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WHEELS

AND

WHEELING

AN INDISPENSABLE HANDBOOK
FOR CYCLISTS

PROFUSELY ILLUSTRATED

PORTER

BOSTON
WHEELMAN COMPANY
12 PEARL STREET

FIRSTS.

From "The Wheel," June, 1889.

The first bicycle rider in this country was Alfred D. Chandler, now an eminent Boston lawyer, July, 1877.

The first bicycle made in this country—1877—cost $313, and weighed anywhere between a hundredweight and a ton.

The first racing wheel owned in the country was an Eclipse racer, twenty-seven pounds, sold by John Keen to C. K. Billings, of New Haven.

The League was organized at Newport, May 31, 1880. The idea of a League was conceived by Charles E. Pratt, and the call for the meeting was issued by C. K. Munroe, then Captain of the New York Bicycle Club.

The first remarkable ride was W. R. Pitman's tour from Boston to Haverhill, 42 2-3 miles, in 5h. 40m.

The first amateur race was run at Lynn, Mass., July 4, 1878, and was won by W. R. Pitman.

A. T. Lane, of Montreal, brought the first bicycle into Canada, 1874.

The first decision on the status of a cycle was given March 25, 1879, in England.

Central Park, New York, was first invaded against the law July 1, 1881, by S. Conant Foster, W. M. Wright, and H. H. Walker.

The League gained its first legal victory, 1880.

The first American decision defining the cycle as a carriage was given May 29, 1877.

The Pope Manufacturing Company's first shipment of wheels was "Duplex Excelsiors," January, 1878.

The first number of an American cycle journal was published December 22, 1877.

The Boston Club was the first wheel organization, February, 1878.

The first bicycle made, a "boneshaker," was exhibited at the Paris Exposition, 1865. Lallement exhibited wheel of same type at New Haven, 1866.

WHEELS AND WHEELING

AN INDISPENSABLE HANDBOOK FOR CYCLISTS

WITH OVER TWO HUNDRED ILLUSTRATIONS

BY

LUTHER H. PORTER

Ex-Representative New Jersey Division, L. A. W., Ex-President Orange Wanderers, Ex-President East Orange Cyclers

AUTHOR OF "CYCLING FOR HEALTH AND PLEASURE"

BOSTON

WHEELMAN COMPANY

12 PEARL STREET

1892.

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PREFACE.

Within the last five years cycling has attained the dignity of being the most popular form of outdoor recreation indulged in by Americans as well as by Englishmen. The phenomenal growth, by means of which this has been attained, has been due to three causes, viz.: (1) Cycling is the most agreeable and exhilarating form of exercise yet discovered; (2) it is a perfectly practicable, very easy, and thoroughly enjoyable method of locomotion; and (3) it is rapidly coming to be recognized by the medical fraternity as far and away the most beneficial form of exercise for the greatest number, including both sexes and all ages.

Upon the last of these causes, too much emphasis can hardly be put, as most people find it simply impossible to believe, without personal experience, or close observation of the experience of others, what remarkable results are accomplished by the use of the wheel. Nevertheless, there now exists abundant evidence to show that its regular employment completely drives away dyspepsia and its allied miseries; entirely banishes all varieties of headache; cures insomnia; removes nervous prostration; improves rheumatism, sciatica, and such difficulties, and often cures them, and imparts a vigorous tone to the whole system. And the medicine which does all this possesses the qualities of being the better liked, and of becoming the more beneficial, the more it is taken. Bearing all these facts in mind, it is only reasonable to predict that the use of "the wheel" is destined to become practically universal.

The growth of the sport has naturally been accompanied by the development of a literature regarding it, in the form of weekly and monthly periodicals, and in volumes treating of its various phases. Poetry, fiction, travel, health and pleasure, practical instruction, touring guides, good roads, and the mechanics of the wheel have all received attention; but, heretofore, there has been no attempt made to collect and record all that has been accomplished in cycling, and this the present volume essays to do.

On such a subject as this, mere verbal explanations and definitions count as little, and statements of facts and results fail to be perfectly intelligible, unless the objects referred to are shown by illustrations. In every cycle there are numerous points which immediately catch the eye, but which even the most elaborate explanations fail to make clear to the reader unless he is trained in the use of mechanical descriptions. Consequently, illustrations, copiously used, are an invaluable feature of a work on this subject, and two hundred and sixteen of them find place in the text of this volume. They have been gathered freely from both foreign and domestic sources, including periodical publications, and nearly all the volumes devoted to the subject which have been issued. The larger part of them have been reproduced especially for this work.

The writer's experience began with the use of the two-wheeled velocipede, or "boneshaker," in 1870, and he commenced to ride the high bicycle in 1880. Since then he has entered into every phase of the sport, and owned, or ridden, nearly every type of machine. The changes that have taken place in this period have been many and great, and old things have very generally passed away. In fact, so obsolete are many of the types that were common only five years ago, that but a very small proportion of those now riding ever heard of them, and much less saw them.

In the "History of the Bicycle," the development of the two-wheeled machine is shown from the earliest times down to the novelties of 1892. In the chapter on Tricycles, early machines are illustrated, and a specimen of each of the later types that ever got a real foothold is given. Specimens of all types of Sociables and Tandem Tricycles are shown, and a very full list of Tandem Bicycles is illustrated.

But beside the machines which naturally find place in a systematic account of the three great families, there have been hosts of others, which have differed from the regular patterns in one or more particulars. In some cases, these points of divergence were slight, and of no great moment, while in others they were radical, and wholly changed the character of the machine. In many instances the cycles produced were practical, and sometimes quite successful, but in other cases the reverse was true. A large number of these machines have been brought together under the title of Peculiar Cycles, this name merely indicating that they do not strictly belong to any regular type.

In cycling, the question of vibration is one of great importance, and has given rise to many inventions designed to protect riders from the jar occasioned in riding. The various designs applicable to this purpose are brought together in the chapter on Anti-Vibration Devices.

Since 1890 the subject of chief importance has been that of tires, and the market has been flooded with new cushions and pneumatics. About seventy varieties of these are described in the chapter on Pneumatic and Cushion Tires, and over sixty of them are illustrated.

In all these chapters the descriptions of machines, anti-vibration designs, and tires, are taken from original sources, as far as it has been possible to get access to them. In most cases the descriptive and explanatory matter is directly from the catalogues or lists of the manufacturers; and in nearly all remaining cases it is from some handbook of the sport, or the notices furnished to the press, for many of the objects described are no longer made, and the only existing descriptions of them are found in such sources. In some instances, manufacturers have supplied explanations that have not appeared elsewhere.

The chapter on Macadam Roads was compiled by the writer in 1887, when he was chairman of the road committee of the Orange Wanderers, and was first printed in the *L. A. W. Bulletin* in August of that year. The information concerning the League has been kindly prepared by Secretary Bassett. Attention is called to it, and wheelmen are requested to consider the advantage to cycling which the League has been, and to join the organization.

It was originally hoped that it would be possible to present a reasonably full account of the trade in this country; but responses to repeated requests for information were so incomplete and unsatisfactory that it became necessary to treat only of the advertisers. They have themselves, for the most part, furnished the matter descriptive of their respective houses.

The Cycle Directory will be found a novel and interesting feature. The list comprises the names of all machines that have ever been sold in this country, so far as it has been possible to secure them, and contains over three hundred and fifty titles, together with the names of the manufacturers and importers.

Tables of American and English Records up to January 1, 1892, are also given.

The work of collecting the facts and illustrations contained in this volume has been extremely interesting, though oftentimes difficult. It was necessary to gather them from many widely separated sources, and considerable difficulty was sometimes experienced in tracing and securing illustrations of some peculiar machines that were known to have existed. In some few cases it proved impossible to obtain them, but these omissions are generally of long forgotten and impracticable machines. No attempt has been made to reproduce the many curious and useless inventions that have been patented, but which have rarely reached the first stages of manufacture. All the wheels and devices here shown (except perhaps some of the new tires) have, it is believed, actually been made and used.

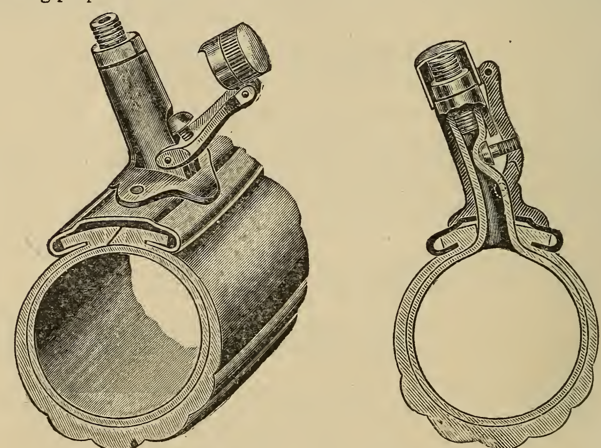
In order to carry out the plan of this volume, and make it complete in all the departments of cycling with which it deals, it has proved necessary to increase its size over that of "Cycling for Health and Pleasure." This book contains two hundred and sixteen illustrations in the text, and nearly double as much matter as the other work. But nothing could well be omitted. The chapter on Tires is the longest one, but it includes only what makers and users of tires need to know as to the construction and care of such as are before the public, and it affords opportunity for a comparison of the different varieties that can be secured in no other way. The other chapters are similarly comprehensive in their scope, and place before the reader the products of the remarkable ingenuity which has been applied to cycling since the inception of the sport.

DON'T BE DECEIVED: See page vi.

When You Buy a Pneumatic, Buy a Pneumatic.

There are so many inflated cushion tires masquerading as pneumatics, that this admonition is not as queer as may seem at first blush. In a true pneumatic, however, there are certain inviolable principles, which simply must be followed, to wit:

It must have a removable air tube.
It must be flexible and yielding.
It must be resilient.
It must be compact and light.
It must be simple and capable of easy and rapid repair.
It must be attached to the rim in a simple and effective manner.
It should be so constructed as to minimize the liability to dangerous side slips.
The sides must be thin and flexible, even the tread portion must be rather thin than otherwise.
It must sit in a flat or nearly flat rim, so that the whole tire will be available for cushioning purposes.



THE G. & J. PNEUMATIC.

We ask you to note how well these principles are followed in the G. &. J. Pneumatic: Note the construction of the rim, the simple and effective manner in which the tire is attached to the rim; note how much of the tire is available for cushioning purposes, likewise the corrugated surface for preventing side-slipping. Bear in mind that no thin rubber tube under high pressure is absolutely proof against puncture and explosion, and that, therefore, facility for repair is an all-important consideration, and note the sublime simplicity of our tire—the entire absence of rag flaps, strings, wires, hooks, bolts, etc., and that in consequence facility for repair is a chief characteristic.

It can be removed, repaired, and replaced within four minutes, and we are in position to fit them to any make of wheel.

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SPRINGFIELD
MASS

WHEELS AND WHEELING.

CYCLING IN THE UNITED STATES.

CYCLING in the United States began its career in 1876 with a small display of foreign bicycles at the Centennial Exhibition, and the riding of two or three men who brought over bicycles from abroad. Nearly eight years had elapsed since the craze over the velocipede had excited interest in man-driven vehicles, and in that interval the old machines had entirely disappeared, save for one here and there in the hands of a boy. There were, however, quite a number of young men who had not forgotten the object of their former interest, and a few of them had heard something of the improvements that had taken place abroad; so, when they saw the first real bicycle, they were ready to welcome it and, when they once had opportunity to try it, their enthusiasm was rekindled by its great superiority over their former mount. In fact many of the earliest of our bicycle riders came from the ranks of the old velocipedists.

In the course of a year there was aroused some little interest in the new vehicle, which, it transpired, was quite popular abroad, and an agency in Baltimore, Timms & Co., imported a number of wheels. Referring to these small beginnings, one of the earliest of American wheelmen, C. E. Pratt, recorded in 1879 what was taking place. Such contemporary evidence is of great interest. He says:

"In the year 1877 an eminent young lawyer of Boston began to seek his lost health on one of the steel and rubber steeds, and became the pioneer rider of the modern bicycle in Massachusetts. In the same year a prominent architect from the same city did likewise, and induced others to join him in the diversion. Other machines were at once wanted. In November, 1877, the new firm of Cunningham, Heath & Co., since changed to Cunningham & Co., commenced to import and sell the best English makes of bicycles, which found a ready market and caused orders to come in faster than they could be filled. This firm thus became the pioneer importing firm, and they soon opened a commodious riding school in connection with their business at 22 Pearl Street, Boston; and by this means, and by liberal advertising and generous enterprise, they gave an immediate and prosperous impetus to the new cause.

"On the 22d of December, 1877, there appeared a sprightly bi-weekly periodical of sixteen quarto pages, *The American Bicycling Journal*, published in Boston, and edited by Frank W. Weston, afterward the genial secretary of the Boston Bicycle Club. This was the pioneer paper devoted to the new interest, and is still [1879] the only one. The club referred to was organized in February, 1878, and is the pioneer club in this country, though it was not long left to be the only one.

"But the gentlemen composing the firm to which I have alluded, though the first actually in the field, were not alone in forecasting and preparing for the new industry here; nor would the incipient demand for the bicycle have utterly failed of a supply had they not stepped forward at that time. For, early in the summer of 1877, a visiting English manufacturer had a bicycle made as well as he could here, rode it some, and interested in the possibilities of it for this country one of Boston's most enterprising merchants, Colonel Albert A. Pope. This gentleman at once took steps toward importing and introducing the new machine. He paid a visit to the leading establishments in London and Coventry, and made himself thoroughly acquainted with the practical construction of the bicycle, and the methods, machinery, and tools used by the best makers. In January, 1878, the Pope Manufacturing Company, of which he is president, opened warerooms for the sale of imported bicycles, and a commodious riding school in connection with them, at 87 Summer Street, Boston, and made this the leading department of their business. So promising was the outlook for the new industry that they soon entered upon the manufacture of the machines, and from their manufactory in Connecticut turned out the Columbia. . . . .

"It is to be said that this latest development of the use of the bipedaliferous wheel in the United States is no 'mania,' and is without any symptoms of a fever. It has been taken up in a quiet and considerate way, mostly by those who needed it for healthful exercise or a practical vehicle. The spread of it in a year and a half to the hands of about five hundred riders has been attended with steadily increasing satisfaction to those who own them, and with a very favorable, though cautious, reception of it by the general public, as one of the permanent acquisitions of the age."

To an enthusiastic wheelman of 1879, the stability and permanence of cycling seemed assured by the fact that some five hundred wheels were in use. The rapid growth of the next ten years could not be foreseen, while the enormous increase after 1888 would have then seemed simply incredible.

Before 1880 there were several parties producing bicycles in this country. In 1878 the Pope Manufacturing Company began to have Columbias built at Hartford. A member of the Gormully & Jeffery Manufacturing Company commenced to build bicycles at Chicago in 1879. R. H. Hodgson, of Newton Upper Falls, Mass., produced a few machines, which he called the Newton Challenge, soon after followed by others called the Velocity; but, in 1880, he sold out to McKee & Harrington, of New York, who soon after brought out a machine called the Union. E. J. Philbrick, of Salem, Mass., also made some machines, and a few others are said to have done the same in a very small way.

During 1879 several foreign professional riders visited this country under the charge of Harry Etherington, afterward editor of *Wheeling*, and engaged in a number of interesting competitions here, making times which were most creditable, and arousing considerable interest in the sport. A number of amateur competitions had also taken place during 1879, and in

February, 1880, came the fifty miles' race in the American Institute building, New York, which was won in good time by L. H. Johnson, of Orange, N. J.

The pastime was now beginning to become popular; it was represented in the press by an active organ, and clubs were being formed in many places. What was next required seemed to be some general organization which would represent the wheelmen of the whole country, and work for their general interests. This was secured, early in 1880, by the formation of the League of American Wheelmen, which is the national organization of the cyclists of America, and is described in another chapter.

From this time on, the cycling interests of this country moved forward with a steady, uniformly accelerated motion. Where good roads existed, especially around Boston, in the Oranges, and at Washington, the number of riders steadily increased. Local racing events were numerous, and a number of good riders appeared. The demand for wheels increased, and early in the eighties the home production was augmented by the formation of the Overman Wheel Company. Foreign made wheels were being imported. Tricycles, as well as bicycles, were coming into use, and about 1884 the first tandem tricycles were imported.

There were, however, some disadvantages under which wheelmen labored. As a rule, the roads in the country were very poor, and those of most towns were not much better. To ride the ordinary, while such conditions obtained, required enthusiasm, pluck, and skill, and largely restricted the riders to the younger men and boys. Moreover, at the outset, some horses showed fear at sight of the new vehicles, and riders were often treated rudely and even roughly by the drivers they met, and compelled to make sudden, and sometimes dangerous, dismounts in order to avoid accidents. Still worse, town and city authorities, in some cases, forbade wheelmen the use of the parks, special roads, and even the public streets, and these restrictions were the source of much annoyance and inconvenience while they lasted.

The bicycle had been early decided by the English courts to be a vehicle, and by our treasury department classed as a carriage, so a good basis for a legal fight had been obtained. The American courts upheld the English view; restrictions were gradually removed; in 1887, the New York Legislature passed the so-called "Liberty Bill," which acknowledged the rights of cycles as vehicles, and it was followed in 1888 by a similar bill in New Jersey. Such events as these, together with the enormous increase in numbers that had taken place, and the constant accession to the ranks of wheelmen of a more mature class of riders, largely removed the features which were once disagreeable.

The roads, too, were showing marked improvement in many places. In 1887 the subject of road improvement was brought to the front by a few men. The *Wheel* in particular published considerable matter bearing on the topic, and a long article on Macadam Roads was compiled by the writer of this book and published in the *L. A. W. Bulletin* in August of that year. It was copied and reprinted in different parts of the country, and issued by the League in a Road Improvement tract. It is reprinted in this volume. This agitation grew to formidable dimensions, and bore fruit in improved methods of road mending, and the construction of many miles of good roads.

Between the years 1883 and 1887 were held the first great American racing tournaments—events which have never been equaled anywhere. Those at Hartford were of two days' duration, and those at Springfield of three days. Both were very successful, but the latter were on the larger scale and attracted wheelmen from all over the country. A number of foreign riders came over to participate in these events, and records were frequently lowered.

The results obtained at Springfield and Hartford led to the establishment of two other first-class tracks—one at Lynn, Mass., and the other at Roseville, N. J. Both of these, however, proved to be financial failures, owing to a variety of unfortunate events. At Roseville, only two meetings out of those held on the track paid expenses. These were the initial meet, given under the auspices of the Orange Wanderers, and the meet of the New Jersey division of the League. An officer of the club mentioned was on the committees having both events in charge, and the policy pursued was to cater for local patronage, rather than for that of outside wheelmen. In those events which failed to pay expenses, a different course had been largely followed. These tracks lasted but a year or two. The Hartford events, however, have been maintained, and the Springfield tournaments were revived in 1891, after an interval of several years.

Between 1887 and 1890 racing interests had somewhat languished, owing largely to the events of 1886, which are related more fully in the chapter on the League. In 1885 pretty much all the fast riders had been in the employ of manufacturers, and constituted racing teams. In 1886 the League declared these men, known as "makers' amateurs," to be professionals. As a result, the American Cyclists' Union was formed, in order to wrest the control of racing from the League, and these men were placed in an intermediate class, and called "promateurs." The result was not satisfactory; the new Union did not long survive; the makers gave up maintaining racing teams, and interest in racing fell to a low ebb. The revival, however, came slowly but surely, and from 1890 on, the number of tracks and meetings have been steadily increasing.

The use of the high bicycle, as already remarked, was necessarily confined principally to the younger and more active men, while the tricycle never came into very great favor, as the roads generally were not suited to the use of light three-wheelers, and very few of them were used in this country. There has been a feeling more or less prevalent among those who rode before 1886 that, under the then existing conditions, the high wheel had nearly reached its zenith. Certainly nothing is plainer than that it had not, and could not have (even in its "geared" form), the very characteristics which have made the Safety so popular. It was in 1885 that the modern Safety got a start in England. In the two following years a few were brought over to this country. In 1888 quite a number were imported; in 1889 it appeared as a serious rival to the ordinary, and in 1890 it began to rapidly displace it. Since then, practically nothing else has been sold.

The advent of the Safety revolutionized cycling. The low machine proved to have none of the faults of the high one, while it possessed practically all its virtues, together with many of its own. Its suitability for all ages, conditions, and sexes, together with the ease with which it could be mastered soon made it immensely popular, and cycling is rapidly becoming more popular than all other out-of-door recreations combined.

LEAGUE OF AMERICAN WHEELMEN.

Items from Its History.

By ABBOT BASSETT, Secretary

THE League of American Wheelmen was organized at Newport, R. I., May 31, 1880. Decoration Day fell on Sunday that year, and the holiday was observed on Monday following. We are thus explicit because some confusion of dates has arisen from the fact that although the League first met on Decoration Day, it was not May 30, but May 31.

When the Cyclists' Touring Club, of England, organized originally under the name of the Bicycle Touring Club, August 5, 1878, became a necessity in England, it was recognized that a similar society would be called for in America when the number of wheelmen should increase. Two clubs were formed in England, the Bicycle Touring Club, to promote touring, and the Bicycle Union (now National Cyclists' Union) to regulate racing. The *pros* and *cons* of the question were discussed here in club and by correspondence, and it was generally conceded that one society combining the ideas of the two English bodies would be better for America.

The bicycle came in under most adverse circumstances. Its forerunner, the velocipede, had made itself objectionable, and the ordinances of nearly every city in the Eastern States contained restrictions against riding the velocipede on the highways. The law knew no difference between a bicycle and a velocipede. The year before the meet at Newport the mayor of that city had issued strict orders to the police to exclude bicycles from the streets, and a special permit to ride wheels in the city had to be obtained before the meet could be held.

Early in 1880 the New York Club, of which C. Kirk Munroe was president, suggested a meet of wheelmen, and after some correspondence with the Boston, Massachusetts, and Essex (N. J.) clubs, an invitation was issued March 20, signed by Mr. Munroe as president of the New York Club, asking all wheelmen in the United States, whether club members or unattached, to meet at Newport on Decoration Day. The ideas of the New York Club did not go beyond a joyful occasion which should include a parade, a banquet, etc., but the *Bicycling World* (Charles E. Pratt, editor), in an editorial published March 20, says: "We wish to suggest now for consideration in season, whether this proposed meet will not offer a suitable occasion for a meeting of delegates from all the clubs, for the organization of a Bicycle League, which may serve to protect and to further the general common rights and interests of wheelmen throughout the United States and Canada, and combine the best points of the Bicycle Union and the Bicycle Touring Club abroad."

In the *Bicycling World* of May 1, Mr. Charles E.

Pratt, as president of the Boston Bicycle Club, issued a call to the wheel clubs of the country, inviting them to send two delegates each to a meeting at Newport, the purpose of which should be the formation of an American League of Cyclists.

On Monday, May 31 (Decoration Day), Newport was alive with wheels. Cyclists from all the cycling centers gathered. Representatives from New York, Boston, Philadelphia, and Chicago were on hand as early as the Friday preceding, and on Saturday there were one hundred visiting wheelmen in the city.

The programme included the convention at 9 A. M., a parade at 2 P. M., and a banquet at 5.30 P. M.

At the convention the delegates from clubs sat on one side of the hall and the unattached members on the other. A constitution was adopted, and officers were elected. Some discussion arose over a name for the organization, and finally a name suggested by Samuel T. Clark, of Baltimore—The League of American Wheelmen—was adopted.

The objects as set forth in the constitution, prepared by Mr. Pratt, were: "To promote the general interests of bicycling, to ascertain, defend, and protect the rights of wheelmen; and to encourage and facilitate touring."

The following officers were elected: President, Charles E. Pratt, Boston; Vice President, Thomas K. Largstreth, Philadelphia; Commander, C. Kirk Munroe, New York; Corresponding Secretary, Albert S. Parsons, Cambridge, Mass.; Recording Secretary, J. Frank Burrill, New York; Treasurer, Hugh L. Willoughby, Saratoga, N. Y. In addition, two directors were chosen from each State in which there was an organized bicycle club. These officers constituted a board of officers for the government of the League.

The parade under command of Edward C. Hodges, captain of the Boston Bicycle Club, had 151 wheels in line. The banquet was an informal affair, and no speeches were made.

In recognition of the valuable services rendered by Mr. Pratt in the interests of the League preliminary to its formation, a subscription was taken up, and a committee was appointed to procure some form of testimonial. At a later date, in Boston, Mr. Pratt was dubbed "Father of the League" and presented with a silver pitcher suitably inscribed.

On September 18, 1880, a meeting of the Board of Officers was held in New York, when a set of by-laws was adopted. The first official discussion on the amateur rule took place at this meeting and was no less animated than later ones have been. Pennsylvania, represented by Joseph Pennell, wanted a strict amateur rule which should exclude all dealers and even cycling editors from the amateur ranks. He did not carry his point. A rule substantially the same as the English rule was adopted. The Board adopted for a League badge, a design made by Joseph Pennell and A. S. Parsons. The badge was of silver, half-dollar size, showing a picture of North America in relief, surrounded by a wheel and the words "League of American Wheelmen," the whole dependent from a handle bar. This badge was called by the designers the "Continent Badge," but it soon came to be known as the "Ham Badge." Five hundred and twenty-seven members were enrolled to this date.

The first case affecting the rights of wheelmen that the League had to deal with was known as the Haddonfield (N. J.) Turnpike case. The Pike Company issued an order instructing its gatekeepers to refuse admission to wheels upon the pike. The League purposed making a test case and fighting the company in court, but the Philadelphia Club employed counsel, and after some correspondence the company was persuaded to revoke its order, and bicycles were not thereafter restrained. The League reimbursed the Philadelphia Club for all the expense it had been to in this matter ($50).

The second meet of the League was held in Boston, May 30, 1881. On the Saturday previous, a race meet was held at Beacon Park. Lewis T. Frye won the quarter (47½ sec.), and half mile (1.42) races, and W. M. Woodside won the one (3.36¾) and two (6.52½) mile races.

The parade was commanded by Commander Munroe, and there were 750 wheels in line.

At the meeting, the membership was reported to be 1654. The following officers were elected: President, Charles E. Pratt, Boston; Vice President, J. M. Fairfield, Chicago; Commander, C. K. Munroe, New York; Corresponding Secretary, Kingman N. Putnam, New York; Recording Secretary, Samuel T. Clark, Baltimore; Treasurer, Dillwyn Wistar, Philadelphia. A dinner at Music Hall, and an exhibition of trick riding concluded the festivities.

The fall meeting of the Board of Officers was held in New York. The "Ham Badge" was given up, and the badge designed by C. H. Lamson, of Portland, Me., was adopted. This badge has been retained to the present day. At this time occurred the first races given under the auspices of the League. The races were held on the Polo Grounds. Lewis T. Frye, of Marlboro, Mass., won the one mile L. A. W. championship in 3.12½. Wm. Smith, of England, won a two mile American championship in 6.35¼. W. M. Woodside won a five mile race in 19.30¼, and two other races of minor importance were contested.

The third annual meeting of the League was held at Chicago, May 30, 1882. The membership was reported to be 2500. A new code of by-laws was adopted, which provided for the election of Chief Consuls in States, and Representatives based upon membership. The office of Commander was abolished. Races were held the day previous to the meeting. The parade was commanded by Commander S. A. Marsden, and 294 wheels were in line. The election for president was hotly contested between William H. Miller, of Ohio, and E. C. Hodges, of Massachusetts. The result of the election was as follows: President, William H. Miller, Columbus, O.; Vice President, Albert S. Parsons, Cambridge, Mass.; Corresponding Secretary, Kingman N. Putnam, New York; Recording Secretary, Angus S. Hibbard, Milwaukee; Treasurer, William V. Gilman, Nashua, N. H. Election of State officers was by mail vote in June of the same year.

In the fall of this year (1882) George M. Hendee won the one mile championship of the League at Boston, defeating Lewis T. Frye.

The fourth annual meet was held in New York City, May 28, 1883. Many of the New York members were interested in the Decoration Day parade of the military, and the first departure from that day for the annual meet was taken, and the custom has never been resumed. The business of importance at the meeting was the matter of a League organ. The *Bicycling World* had been made the organ at Newport, and had continued to hold the position; but it pursued an independent course, and did not fail to condemn League officers and League management when it considered condemnation called for. This displeased those who were criticised, and a ready ear was given to the *Wheel*, of New York, a paper which wanted the organship, and was willing to be altogether an organ. By a large vote the *Wheel* was made organ, and paid for the service. The *World* had never charged anything for publishing the notices, but members were obliged to subscribe for the paper. The League voted a copy of the *Wheel* to every member, and agreed to pay fifty cents for each subscription, be it for one week or fifty-two. This departure cost the League $1950.28 the first year, and emptied the treasury. A popular subscription was called for, and $380 was contributed by members.

There were 723 wheels in line, and by special permission of the park commissioners the parade took place in Central Park. The meet and its parade had a strong influence in changing the opinion held of wheelmen by the commissioners and led to many favors not before obtainable. The membership was reported to be 2131. The following officers were elected: President, N. Malon Beckwith, New York; Vice President, W. H. Miller, Columbus, O.; Corresponding Secretary, Frederic Jenkins, New York; Recording Secretary, A. S. Hibbard, Milwaukee, Wis.; Treasurer, William V. Gilman, Nashua, N. H.

The fifth annual meet was held in Washington, D. C., May 19, 1884. The official-organ experiment had emptied the treasury, and a committee had been appointed to consider the expediency of publishing a paper by the League. The committee reported it inexpedient to publish. Bids had been received from several cycling journals giving figures for furnishing a weekly paper to each league member. A contract was made for one year with the *Amateur Athlete*, whose publisher agreed to furnish the paper to members for five-sixths of a cent a copy. Eugene M. Aaron, of Philadelphia, who was elected Recording Secretary, agreed to act as official editor for one year, without compensation. This venture was more unfortunate than the one that preceded it. The paper was poorly edited, and altogether unsatisfactory, and the officers and members were in a condition of mind to make a decided change at the end of the year.

The membership was reported to be 4250. Six hundred wheels were in the parade. The following officers were elected: President, N. Malon Beckwith, New York; Vice President, W. H. Miller, Columbus, O.; Corresponding Secretary, C. K. Alley, Buffalo; Recording Secretary, Eugene M. Aaron, Philadelphia; Treasurer, Stephen Terry, Hartford, Conn.

The sixth annual meet was held at Buffalo, N. Y., July 2, 1885. The organ had been so unsatisfactory that it was felt that the time had come for the League to publish its own organ. Editor Aaron prepared and published a specimen paper which he exhibited at this meeting, and a vote was carried to continue it as the organ of the L. A. W. This was the birth of the *L. A. W. Bulletin.* The amateur question was hotly discussed. A motion to strike out the word "amateur" from the constitution, and allow professionals to join the League, was voted down by an almost unanimous vote. An amateur rule more strict than any preceding it was adopted. Bicycle makers had just commenced to put teams of racing men on the track to race with amateurs. These men were paid regular salaries, had all expenses paid, and were furnished trainers who attended them. They were called "makers' amateurs," and later they played quite a part in the racing world. The adoption of the new amateur rule at Buffalo was the first step taken to break up the peculiar institution. The officers elected at Buffalo were: President, N. Malon Beckwith, New York; Vice President, Stephen Terry, Hartford, Conn.; Executive Committeeman, T. J. Kirkpatrick, Springfield, O.; Treasurer, Frank P. Kendall, Worcester, Mass.; Secretary-Editor, Eugene M. Aaron, Philadelphia. A new constitution, adopted at the spring meeting, combined the duties of Corresponding and Recording Secretaries and created a new office, that of Secretary-Editor. It also constituted an executive committee, consisting of the president, vice president, and an executive committeeman elected at large. These two new officers were first elected at this time. The total membership December 31, 1885, was 5176.

In the spring of 1886, the chairman of the racing board went before the executive committee and announced that he was ready to enter upon a campaign against the "makers' amateurs" and, if possible, break up the institution. He was given assurance of support and was ordered to go ahead. He immediately set to work from a new position. All previous efforts of the racing board had been directed toward proving that men had violated the amateur rule, but evidence was hard to get, and the board was powerless to convict men of wrong-doing, though it was patent to all. The racing board now made the men prove that they were innocent. Blanks were sent to a number of men and also to manufacturers. These blanks contained questions relative to the relations between man and maker. Makers were asked if they had ever paid this man or that man anything in the way of a salary, and riders were asked if they had ever received money. Thirty days were given for answers. This action came like a thunderclap on the cycling world. It was well known that neither men nor makers could answer the questions without conviction. Indignant letters were published in the press, and law suits were threatened. Neither men nor makers answered the questions, and at the end of thirty days all of the "makers' amateurs" were declared professionals. This took fifty men out of the amateur ranks, and nearly every racing man of note in the United States was on the list. The success of the fall tournaments was threatened, and the promoters of these were, if anything, more indignant than the racing men.

Now came a movement to build up a new organization and take from the League its jurisdiction over racing. It was threatened by the friends of the racing men that, if the acts of the racing board were not disavowed at the annual meeting of the League, a new League would be born and the old League would be killed. But the racing board did not yield to threats, and went on with its work.

The seventh annual meet was held in Boston, May 28, 1886. Great interest centered upon the action of the League on the "makers' amateur" question. The action of the board was fully indorsed at the meeting, by a very large vote, and the racing board was thanked for its brilliant campaign. The election of officers resulted as follows: President, N. Malon Beckwith, New York; Vice President, T. J. Kirkpatrick, Springfield, O.; Executive Committeeman, John C. Gulick, New York; Secretary-Editor, E. M. Aaron, Philadelphia; Treasurer, Sanford Lawton, Springfield, Mass.

As a result of the action of the League in indorsing the racing board, the American Cyclists' Union was formed May 29, 1886. This Union undertook to legislate for amateur, "promateur" and professional racing. The "promateur" class of riders did not race for money nor with professionals. They were allowed to draw salaries for riding. Nearly all the fall tournaments were run under A. C. U. rules. The Union was short-lived. Its antagonism to the L. A. W. was not in its favor, and it went to the wall in 1887. The total membership December 31, 1886, was 10,264.

The spring meeting of the Board of Officers, January 17, 1887, in New York, was one of the most exciting in the history of the League. The official organ had not been a financial success, and the League was bankrupt. The conduct of affairs by the secretary-editor had not been satisfactory, and his resignation was handed in. Though he had resigned, Mr. Aaron wished to elect his successor, and favored the candidacy of John A. Wells of Philadelphia, who was a partner in the Philadelphia printing firm that printed the *Bulletin*. The result of a ballot gave the election to Abbot Bassett, Boston, Mass. Mr. Bassett immediately went to Philadelphia to assume the duties of his office, and two months later removed the headquarters of the League to Boston, Mass.

The eighth annual meet of the League was held in St. Louis, May 20, 1887. The following officers were elected: President, T. J. Kirkpatrick, Springfield, O.; Vice President, H. W. Hayes, Cambridge, Mass.; Executive Committeeman, George R. Bidwell, New York; Treasurer, W. M. Brewster, St. Louis. This year (1887) was passed the New York Liberty Bill which opened Central Park to wheelmen. As far back as 1879 the park commissioners had unanimously voted to exclude bicycles from the Park, and New York wheelmen had had few roads to ride on. Petition after petition was sent to the commissioners, but all in vain. At last it was decided to make a test case in the courts and establish the right of bicycles to go where other vehicles were allowed. Colonel

A. A. Pope generously agreed to pay all the legal expenses in this case ($7000 was expended). At 9 A. M., Saturday, July 2, 1881, three New York wheelmen, William M. Wright, S. Conant Foster, and H. H. Walker rode into the Park and were promptly arrested. The case was carried from court to court, but the wheelmen were defeated at every point. In 1883 the League had met in New York City, and the use of the Park roads for the parade was allowed. The good impression created by the orderly conduct of the wheelmen had led to favors from the commissioners. Very soon after an order was issued, allowing the use of certain drives at all hours and other drives between midnight and 9 A. M. to wheelmen. Later came an order that none but "competent" riders would be allowed, and all such must wear a badge to be issued by the clubs. But riders didn't want privileges, they clamored for rights, and it was determined to go to the Legislature for a bill. George R. Bidwell, then chief consul of New York, aided by Isaac B. Potter, Esq., attorney for the Division, after months of labor and at large expense, carried a bill through the Legislature, and on June 27, 1887, it was signed by Governor Hill. This bill, called "The Liberty Bill," provided that "commissioners, trustees, or other authorities having charge or control of the highways or park driveways, shall have no power or authority to pass, enforce, or maintain any ordinance, rule, or regulation, by which any person using a bicycle or tricycle shall be excluded or prohibited from the free use of any of the park highways or driveways at any time when the same is open to the free use of persons using other pleasure carriages."

The example of New York was followed by other States, and several "liberty bills" were passed. Total membership December 31, 1887, was 11,939.

In 1888 a change was made in the official organ. The paper had been run at a loss, and there seemed to be no hope of making it a paying venture. The proprietors of the *Bicycling World* came forward and offered space for official notices in that paper, agreed to send the paper to each and every member and pay in addition the sum of three hundred dollars yearly. The proposition was accepted, and on March 2, 1888, the *L. A. W. Bulletin* was merged into the *Bicycling World*, and the paper adopted the double title. At the spring meeting of the board at New York, March 5, 1888, a plan of reorganization was presented, and referred to a constitutional convention to be held at Baltimore on the occasion of the annual meet. This plan made the national organization representative and the divisions self-governing and self-supporting. The money paid for dues had been equally divided between the divisions and the national body, but now the national was to be allowed only fifty cents *per capita*. The board of officers was abolished and for it was substituted a national assembly, composed of all chief consuls and vice consuls, and delegates, one for each two hundred members. The new constitution also provided for a first and second vice president, the latter taking the place of the "executive committeeman," and it created a standing committee on the Improvement of Highways. At Baltimore, June 18, 1888, the new constitution was adopted. Officers were elected as follows: President, T. J. Kirkpatrick, Springfield, O.; First Vice President,

H. W. Hayes, Cambridge, Mass.; Second Vice President, W. S. Bull, Buffalo, N. Y.

The spring meeting of 1889 found the national organization heavily in debt to the division. The *Bulletin* had been running behind financially for several years, and the whole burden of this fell upon the national treasury, the divisions bearing no part of it. At the meeting of the National Assembly, February 18, 1889, it was voted to levy an assessment of fifteen cents *per capita* on the divisions. The assessment did not embarrass the divisions in the least, while it put the national organization on a firm financial footing, where it has ever since remained.

The new constitution provided for the election of officers at the annual meeting of the National Assembly, instead of at the annual summer meet of the League. The following officers were elected at the February meeting: President, Charles H. Luscombe, New York; First Vice President, James R. Dunn, Massillon, O.; Second Vice President, William H. Emery, Boston, Mass.; Treasurer, William M. Brewster, St. Louis, Mo. Dr. C. S. Butler, of Buffalo, was made chairman of the new committee on highways. Taking away the business meeting from the annual meet had the effect to destroy much of the interest in that meeting, and 1889 bade fair to go out without an annual gathering. It was decided to hold a meeting in combination with the Hagerstown Bicycle Club on July 4, and accordingly it was so held. No business was transacted. Total membership April 30, 1889, 12,193.

In 1890 the League entered upon its second decade, The list of members was renumbered for the first time since 1880. At the February meeting the following officers were elected: President, James R. Dunn, Massillon, O.; First Vice President, William H. Emery, Boston, Mass.; Second Vice President, George R. Bidwell, New York; Treasurer, W. M. Brewster, St. Louis, Mo. Total membership April 30, 1890, 12,703.

The annual meet was held at Niagara Falls, August 25, 26, 27, 1890. A constitutional convention, held at this time, made several changes in the routine work of the League and extended the presidential term to two years. An amendment to allow non-wheelmen to be enrolled as sympathizers in the road improvement work, and contributors of funds thereto, was also passed. The annual meet of the assembly at Washington, February 16, 1891, found 18,113 members enrolled, a gain of fifty per cent. over the enrollment of the previous year. The following officers were elected: President, James R. Dunn, Massillon, O.; First Vice President, Charles L. Burdett, Hartford, Conn.; Second Vice President, G. Carleton Brown, Elizabeth, N. J.; Treasurer, W. M. Brewster, St. Louis, Mo. Total membership April 30, 1891, 18,504. The annual meet was held at Detroit, July 16, 17, 18. No business meeting was held.

This year was established the Roads Improvement Bureau, under the charge of Isaac B. Potter, Esq. Mr. Potter had given through 1890–91 a good deal of time and attention to the roads improvement work, in his capacity as chairman of the committee on Improvement of Highways. Two pamphlets, "Roads Improvement," and "The Gospel of Good Roads," were issued in editions of 20,000 and distributed to the divisions. In the winter of the year a contract was made with Mr. Potter, to give his entire time to the newly-established bureau under a good salary. The important work of this bureau is the publication of a magazine, *Good Roads*, the first number of which was issued in January, 1892. A legislative committee was also created, in 1891, for the purpose of encouraging and directing legislation for good roads in the several legislatures of the country.

Thus hastily have we sketched a few of the important events in League history.

MACADAM ROADS.

MACADAM'S plan was to thoroughly drain the road bed; properly shape it, sloping it each way from the center, so as to discharge water, and not crowning it by a greater thickness of stone in the middle.

On this bed is placed, on a dry day, a coating of *three* inches of clean broken stone. A roller is then used, no traffic allowed upon it until well packed. If traffic is admitted, men must be on hand to rake in all ruts as soon as formed. The second coating of three inches is added at a wet time, as moisture helps the consolidation. This coating is treated as before, and a third coating is then added, and finally a fourth, if necessary.

The stone is to be clean, nothing being laid on for so-called "binding." Clean, broken stone will combine by its own angles into a solid surface.

A heavy roller will help the consolidation. One made of a hollow cylinder, with several chambers, which can be filled with sand, and so increase its weight as the road becomes packed, is most excellent.

A road just completed requires careful attention for some time, and all ruts and ridges must be removed as soon as formed, until the materials become thoroughly consolidated.

All the stone used must be small enough to pass through a ring two inches in diameter.

Telford's plan differed somewhat from Macadam's and was as follows:

He prepared a level bed, and set in it a layer of medium-sized stones. These rested on their broadest edges, and lay lengthwise across the road. They were to be seven inches high in the center, and to slope off to three inches at the sides. The interstices were to be firmly packed by a light hammer, by hand, with stone chips.

Four inches of small broken stone, like Macadam's, were then to be put on, and be worked in by traffic, care being taken to keep men removing ruts, and to keep the surface smooth. Then, a final coating of two inches of the same stone was to be put on and treated in the same way Care, however, was to be exercised not to make these last coatings as thick at the edges as in the center, so that the final convexity of the road would be six inches. The whole was to be covered with an inch and a half of clean gravel.

Neither one of these systems is literally followed in this country, but the principal features of Telford's are generally adopted.

A road which is kept in proper condition by means of constant little attentions seldom requires elaborate repairs; but this system is almost never followed. The almost universal method is to leave a road alone until the surface is covered with holes and ruts, and then cover it for a long distance with several inches of stone, coated with earth.

To *keep* roads in repair requires a permanent corps of men, working under competent orders. One man can keep in repair from three to four miles of well made and well drained road. The roads once being in good shape, it is the duty of this corps to keep them so. To accomplish this, it is necessary:

I. To have in progress a daily removal of the dust, mud, and other wear and accumulations from the surface. This can be best done by means of wooden hoes and birch brooms.

II. The application of new materials, which must be kept in depots, not far apart, so that they can be conveniently brought to any required spot in wheelbarrows. They will unite most readily when applied after a rain. This division of the subject will now be examined more in detail.

The proper system of repair is this:

I. Put down where wanted, and not elsewhere, hard stones broken as nearly as possible to an even size of *one and a half inches in the largest dimensions.*

II. Mix no earth or sand with them, but let them be worked in by pressure, so that they *fit together by their own angles* into a solid mass like the pieces of a puzzle or mosaic.

Macadam always attached the greatest importance to the small size of stones which he used, and made his surveyors use a two-inch iron ring, with which to try the largest stones in a heap, to see that they would go through the ring in any direction, so that the largest stones in a heap would be less than two inches in their greatest dimensions. He also made the stone-breakers test the size of the stones by putting them into their mouths; any stone that would not go into a man's mouth, or would not go through the two-inch ring every way, was to be broken again. All the authorities agree with Macadam in recommending this small size of stone, and Macadam himself, though he allowed the use of a two-inch ring to save the expense of breaking the stone smaller, yet says, "*Every piece of stone put into a road, which exceeds an inch in any of its dimensions, is mischievous.*" Telford agreed with Macadam as to the size of stones to be used for surface repair, however much he may have differed from him about the foundations of a new road.

The neglect of this principle is the main cause of the badness and costliness of most of the macadamized roads of the present day. Small stones, broken to the proper size, viz., one and a half inches in their largest dimensions, fit much tighter together, work in much quicker, make a much smoother road, and wear much better than the stones such as are usually put down.

It is easy to see that a large stone working in among smaller ones, will project and cause a roughness of the road, and also that the interstices between stones of one and a half inch will be less than between those of three or four inches. Stones of this large size, besides making a rough road and greatly increasing the labor of the horses, are very slow to work in, and either involve the expense of a steam roller, or remain on the surface, to the great annoyance of all who use the road. Moreover, *a cubic yard of stone broken to an inch and a half gauge will cover six or seven times as much surface of road as it would if only broken to four inches;* and as three-quarters of an inch of consolidated road is admitted to be as much as a highway usually loses in thickness in a year, even under heavy traffic, it is evident that to put down a greater thickness of stone is mere waste of material. All the authorities agree that the slight extra cost of breaking the stones to the proper size is repaid many times over by the amount of material saved, and by the superior smoothness and consequent reduction in the wear of the roads. Macadam roads are very frequently "repaired" by covering the surface with about an inch of screenings. This material is completely pulverized by the passing vehicles, and becomes, in a week or two, a fine powder, very disagreeable to ride over, easily removed by wind or rain, and of no value for repairs. The alleged object of "protecting the surface" is, of course, not secured.

Macadam's next point is that the stones are to unite by their own angles into a solid mass, and that no earth, screenings, or other so-called "binding material" should be mixed with them. Cohesion is the first thing to be aimed at in a road. *If the stones unite properly by their own angles*, the result will always be a smooth, economical road, with but little need of repair. The traffic will always provide more mud and dust than will be sufficient to cover the surface of the stones, and to fill up the very small interstices which will be left when they have been properly bound together. Yet there is no point on which greater wastefulness is exhibited in the repair of roads. Large sums are used in providing earth to throw over the newly-laid stones. The authorities seem to think that all this is necessary to "bind the stones together," ignoring the cardinal principle that the stones must unite by their own angles, and being unable to see that if earth is placed on a road it becomes muddy, or if screenings, then dusty; or to understand that the public does not desire to pay for either of these luxuries.

Stones are frequently laid down three or even four thick, and over the whole surface of the roads for hundreds of yards at a time, to the extreme discomfort of all travelers. And this is done where the roads, though full probably of holes, puddles, and ruts, have ample strength and thickness, and only need to have the surface rendered smooth. All that is needed in such a case is simply to fill up the ruts and puddles with properly broken stone, and if this be enough, it will obviously save a great deal of cost in material and labor, to say nothing of the great convenience to the users of the road in having fewer stones to go over. If the middle of the road really requires to be raised, *the puddles and ruts should still be filled up a week or two before the stone is spread over all the middle of the road*, otherwise the new stones will sink more quickly into the ruts and puddles than elsewhere, and the same holes will reappear just where they were before. Stones should never be laid down more than one deep, otherwise, they are much slower about working in, and great waste of material ensues from the grinding of one loose stone against another. Yet it is the rule rather than the exception to put down stones two or three deep. Three-quarters of an inch of wear is quite as much as usually takes place in a year, even on a much-frequented road; the wastefulness, therefore, of putting down two or three inches of stone is self-evident; the annoyance to travelers is also extreme.

The proper drainage of roads is also of the greatest importance for their maintenance in good condition, and a road cannot be properly drained unless it preserves a smooth and slightly convex surface. Water should never be allowed to stand in ruts and puddles, and a road should always be patched up as soon as the puddle appears. "The stone in time saves nine" in road repairing as much as the proverbial stitch; but repairers usually wait till the state of things has become intolerable, and then spread four or five inches of stone over the whole road. Long wide patches of stone should never be put down; vehicles will avoid them, and will go on the path or by a longer road to do so; or, if they cannot be avoided, the ruts will very soon appear in the middle of the road, which will become concave instead of convex. A rake *should be constantly used to fill up ruts and bring scattered stones back to their places.* Patches should seldom be more than from two to four yards long. A patch of stones twenty or thirty yards long on a country road, where there is no steam roller to work it in, is an expensive mistake. Patches should not be square, but should vary according to the shape of the hollow they are intended to fill, *i. e.*, usually round or oval, and should be so arranged that vehicles can go by with only one wheel on the stone.

Mud should always be removed entirely before putting down the stone; it is not wanted on roads, and it means extra labor to horses and increased wear of the road. Yet this is very generally lost sight of, and most repairers actually spread earth on the top of the stones.

The importance of using a good hard material, which will wear well, is very great. Flint, granite, and the igneous rocks generally, and some few of the *harder* sandstones, will make an excellent road, if properly broken and spread; but oölites, limestones, and the softer sandstones will never make a good road, for the simple reason that they are not hard enough, and that they wear quickly into ruts. Besides, they suffer far more from frost than harder stones. Granite will, if properly broken and spread, pay very well in spite of its extra first cost. But flint has no superior except for roads where the traffic is excessive.

To sum up the matter in a few words, the points to be insisted on are these:

I. The stones broken must be small; *i. e., one and a half inch in their largest dimensions.*

II. Hard material, flint where obtainable, or granite, should be employed.

III. No earth, screenings, sand, or so-called "binding material" must be used, but the stones must unite by their own angles into a solid mass.

IV. Economy of material must be promoted by filling up holes at once, and by never putting down stones more than one thick; also by spreading small patches of stones where wanted, instead of large ones whether wanted or not.

V. All mud must be removed.

VI. Attention must be paid to drainage, especially by filling up puddles at once, and keeping them so filled by the use of the rake.

The adoption of this, the only proper system of repair, will diminish the road rates and will conduce to the comfort of everyone. *In short, much less should be spent on material, and rather more on skilled labor and superintendence.*

HISTORY OF THE BICYCLE.

IN tracing the evolution of the cycle from its crude beginning, through the many forms it has assumed in its process of development, up to the various highly organized types of the decade preceding 1890, we find the first primitive efforts made on the Continent, the long period of experiment and trial confined principally to England, and the rapid advances of the last few years shared by England and the United States.

The first attempts to produce anything that can well be styled an ancestor of the modern cycle were made early in the present century, and were continued in different places, and at irregular intervals, for about fifty years. In the latter part of this period, revolving pedals on foot cranks seem to have been applied to three-wheeled velocipedes, and in 1865 they were the feature of the first two-wheeled velocipede built.

From this time on, development became more rapid, and by 1876 the high, or ordinary, bicycle had taken form. While that type was being perfected, there were growing up around it many varieties of tricycles, and these, too, were improved year by year, a number of distinct types being developed. In 1884, as tall bicycles and tricycles reached a high degree of perfection, the forerunner of the modern Safety was invented. By 1886 it had been so improved as to gain a strong foothold in England; two years later it had almost superseded the ordinary there, and in 1890 it had done the same here.

With the pronounced success of the Safety and its universal adoption, cycling has proved to be sufficiently attractive in its pleasurable, health-promoting, and utilitarian aspects to attract annually many thousands of new riders. It may not be uninteresting to them to inspect the long series of antiquated, curious, and more or less practical mounts that have preceded the present Safety; while those who have ridden many of the now almost forgotten types may perchance ponder over the forms of other days with tender emotion and half-regretful longing. He, indeed, appreciates the high-bred, light-roadster Safety of to-day who has ridden every type since old boneshaker days.

Prior to the present century attempts were made to produce vehicles which could be propelled by their riders without extraneous aid, but these carriages can hardly be regarded as predecessors of the cycle. They are interesting, however, as showing that for a considerable period it has been thought that man could, by means of some mechanical contrivance, propel himself quite as well as he could be drawn or carried by other forces or objects. Curiously enough, as it would seem, but commonly enough as experience proves, his first efforts to attain the desired end were most laborious, and the results were complicated and cumbrous vehicles. An example of an early specimen will be found near the beginning of the chapter on the Tricycle.

Other attempts of this sort seem to have been made, but it is not important to trace them here.

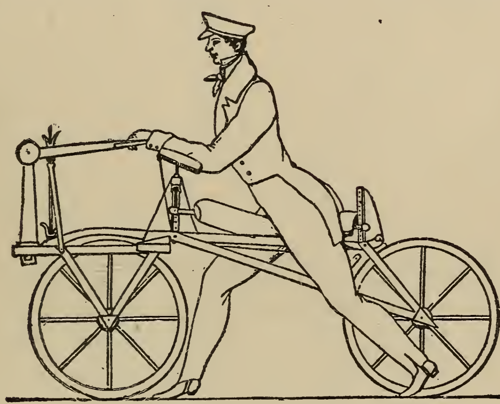
According to some authorities two distinct but very similar vehicles, the Celeripede and the Draisine, were produced almost simultaneously in 1816. The former is said to have appeared in the Luxembourg Gardens in that year, guided by a rider "who managed his

CELERIPEDE—1816.

machine with great skill and showed startling speed." It was composed of two wheels in line, connected by a perch, on which the rider partly sat, propelling it by thrusting with his feet upon the ground and guiding it by means of a vertical bar connected with the steering steel.

The Draisine was the affair said to have been used by one Baron von Drais, while performing his duties as master of forests for the Grand Duke of

Baden. It was likewise exhibited in 1816, and a patent obtained for it in France. Its frame appears to have been a little more elaborate than that of the Celeripede, and a rest for the arms seems to have been used. The rider, as with the other, carried part of his weight upon the perch, and propelled it by striding rapidly along the ground, while on down grades he raised his feet and let it run. The forks of the



DRAISINE—1816.

front wheel were swiveled to the forward part of the perch, so that the bar above enabled the rider to steer it. The wheels were of about equal size, and no brake was used.

An increasing importance has been attached, year by year, to the invention of Baron von Drais, and he has received such titles as "Father of the Draisine," and "Father of the Bicycle." This application of honorable titles seems to have finally culminated in an attempt to preserve his fame in a more permanent way, as may be judged from the following account from the *Court Journal* of May 2, 1891: "On Sunday last, Carlsruhe, the native city of Carl von Drais, Baron of Sauerbronn, discharged her debt of honor to the inventor of the bicycle. Baron von Drais was born in 1785. Originally a forester he devoted most of his time to inventions, which swallowed the whole of his fortune, and procured for him the nickname of 'Professor of Mechanics.' Although to-day the bicycle is in universal use, scarcely anything is known of the inventor, who gave the new locomotor the name 'Draisine.' It has been decided to erect a handsome monument over the grave of the inventor, the expenses of which will be exclusively borne by bicyclists, thereby carrying his name down to the sportsmen of posterity."

The idea of a two-wheeled vehicle of this sort was shortly carried to England, where one Dennis Johnson somewhat improved the Draisine and produced a machine which he called the Pedestrian Curricle and which he patented in 1818. It is represented as being somewhat less cumbrous than the Draisine, with quite elaborate arm rests, and slightly different steering.

This machine quickly came into popular favor with young men, who rode them while the furore lasted, and it is recorded that the method of propelling them proved so hard on foot-wear that special iron-shod shoes were manufactured for the use of riders. The names of Hobby Horse and Dandy Horse were also applied to these machines, and their riders soon became the subject of caricature and ridicule.

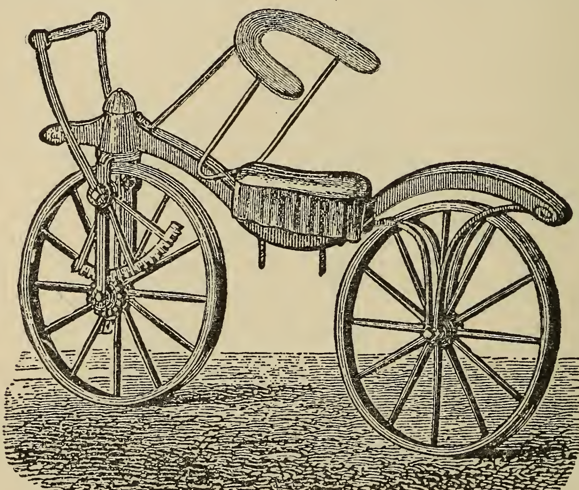
In 1819 the machine was patented in this country, but failed to arouse much interest.

Attention, however, being still paid to the hobby in England, an elaborated design was brought out by one Lewis Gompertz, in 1821. As the leg thrusts upon the ground had evidently proved laborious with the earlier types, an additional means of propulsion

PEDESTRIAN CURRICLE—1818.

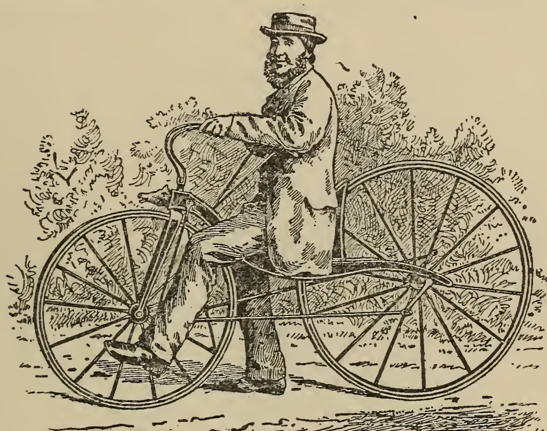
was now added. The rider was still to carry his weight, and to thrust as before, but there was placed in front of the body rest, a lever connected with a segment rack, gearing in a pinion on the front wheel, which could thus be driven by the hands. It is doubtful whether this "improvement" did anything to retard the waning popularity of the Hobby Horse. There seem to be traces of occasional attempts to revive and improve it, both in England and France, but they came to nothing, and the contrivance practically dropped out of sight for about twenty years.

For a long time it was supposed that there had been an interval of over forty years in which nothing of a cycling character was produced, and that after the Hobby Horses of 1821 an interim extended down to



HOBBY-HORSE—1821.

the velocipede of 1866; but, early in 1892, investigation revealed the fact that, about the year 1840, an ingenious Scotchman had applied driving levers to a machine of the Draisine type. This man was Peter, Patrick, or (as most witnesses think) Kirkpatrick McMillan. He is remembered by a number of his old acquaintances, who agree regarding both the fact that he applied a driving gear to his machine, and consequently could travel much faster than those who used the primitive method, and also as to the time at which it was done. An account of the matter was given by Thomas McCall, in a letter to *Bicycling News* in February, 1892. Regarding the application of driving gear to a machine of the Draisine type he says: "This was done by a blacksmith by the name of [Kirkpatrick] Peter McMillan, who wrought at Drum-



McCALL'S COPY OF McMILLAN'S REAR DRIVER—1840.

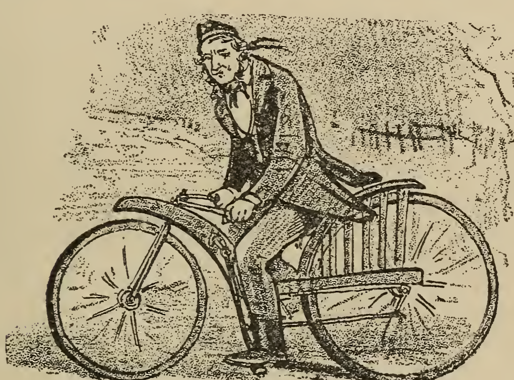
lanarig Castle for some time, and latterly on his own account at Pierpont, Dumfriesshire. This would be about 1845.

"I remember, when a boy, on coming out of school one day, seeing him with his velocipede. I followed him as he led it up a long hill and made a thorough inspection of it. On gaining the top of the hill, the man got on and rode away. I ran for over half a mile, but he outstripped me. It was after his principle that I made velocipedes, years after, of which I will give account.

"When I was an apprentice to the joiner and millwright trade, I commenced to make one in my spare time. On hearing, however, that a smith eight miles off had the remains of an old velocipede, without gearing, I proceeded thither, bought it for 5*s*., and set out for home. On the way, however, the wheels broke down. I made new wheels, put cranks, connecting rods, and pedals on, and for the first time owned a velocipede. A few years after, at New Cumnock, I made an entirely new one without any drawings or reference, and which was in use over twenty years.

"In 1871 I exhibited my machine against some boneshakers, which were in vogue at that time in Kilmarnock. I also rode into Glasgow, and received an order from a house for half a dozen of my sort. I made them, along with some others. A clerk in connection with that firm in Glasgow (who was the best rider in Glasgow at that time) highly approved of my machine. I also made one for a surgeon in England. I was advised to advertise it in an English journal, which I did, and sent a photograph of machine with rider, which was also inserted (*English Mechanic*). Some years afterward I received a letter from a man in England stating that a certain party was copying off my design, which he thought was not fair. Of course I had no claim, or letters patent, and as I was unwell at the time I took no notice of it.

"The present Safety bears a strong relationship to my design, to which many testify. The machines I made were safe and easily balanced, owing to the angle and formation of the shears of the front wheel, and which the Safety has. In this respect the velocipedes which I made were unique from all other boneshakers or high bicycles. The only radical difference between my make and the Safety is this: the power was conveyed to the rear wheel by means of swinging pedals, connecting rods, and cranks, instead of, as in the Safety, a chain. The wheels and backbone were



DALZELL'S REAR DRIVER—1845.

all of wood. On searching among my old papers I have come across one of the photographs which I got done 25 years ago, and which I inclose. There is a breastboard on it, as you will see, but which I afterward abandoned."

The majority of those who remember the McMillan machine place the date between 1838 and 1841; and it is even claimed that Dalzell's machine, which was produced about 1845, was the result of the inventor having seen McMillan's, as it is not impossible that it may have been ridden in his neighborhood. At any rate, another Scotchman, Gavin Dalzell, produced a rear-driving Safety somewhere about 1845. He is reported to have used it extensively, and been able to get ten to twelve miles an hour out of it.

It is described by the *Bicycling News* as "constructed chiefly of wood which, though worm-eaten, is still wonderfully strong, especially in the wheels, these seeming to have stood the ravages of time and rough usage much better than the framework. The rear wheel—the driver—is of wood, shod with iron, about forty inches in diameter, and has twelve spokes, each about an inch in diameter. The front wheel is of similar construction, but only of about thirty inches in diameter. From the front wheel hub, the fork—straight, and with a rake which some of our modern makers could copy with profit—passes up, and is joined together, through the fore part of the wooden framework. A pair of handles are then attached and bent backward into a V-shape to suit the rider, who sits about two feet behind the front wheel hub. These were commonly termed the 'reins.' The main frame is somewhat like that which is now termed the 'dip' pattern, the design of which is applied in an extended form to ladies' Safeties.

"A wooden mud-guard rises from this frame, covering about one-fourth of the circumference of the hind wheel; from this to the back forks, which are horizontal, and of wood, vertical flat stays run down, forming a dress-guard after the manner of those on the latest cycling development—the ladies' Safety.

The action thus obtained is not rotary, being a downward and forward thrust with return, the feet describing a small segment of a circle. That the gearing, which constitutes the chief wonder to the critical and historical reader, was actually on the machine while ridden by Mr. Dalzell, is proved by the receipted accounts of the blacksmith John Leslie, who made all the iron work used in its construction."

A glance at the illustrations of the two machines, together with the descriptions, shows how many of the features of the modern Safety were partially anticipated by McMillan and Dalzell in their inventions. Considering the success they are said to have made of the machines, it seems curious that we do not learn of many others having been made, and almost equally singular that the idea was not taken up and still farther developed. Had that been done, perhaps the modern Safety would have had a much earlier birth, without the slow process of development up to the high ordinary and then down again to the present low type, which more closely resembles the original in outline.

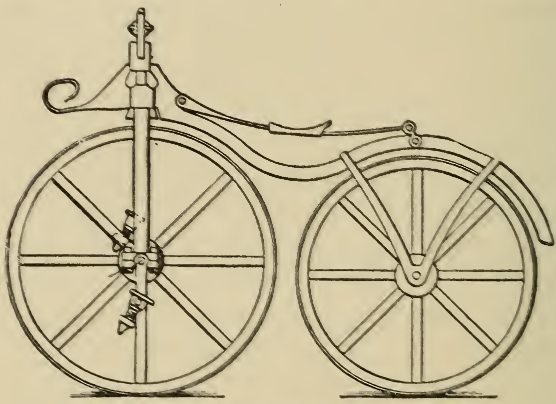
Another blank in cycling history embraces the period succeeding Dalzell's invention. During this time various manumotives, it is true, were in use and they were being improved—the four-wheeled, then the three-wheeled velocipede; double cranked axles arranged for foot propulsion; the front steering wheel made also a driving wheel; and, finally, on a tricycle, foot cranks carrying loose pedals. It is also said that prior to 1860 a tandem tricycle, "nearly all of wood," was built and used, and some other rumors of improvements have been recorded. The most definite of these now seems to have been clarified in a French work, "L'histoire Génerale de la Velocipede," by M. de Saunier, and upon this writer's statements *Wheeling* bases the following description:

"Michaux, a carriage repairer in Paris in 1855, had an old Draisienne or hobby horse brought to him to repair. The Draisienne was at that time nearly extinct, but some few were in use, and it was one of these that was brought to Michaux. It is a common fable that the idea of fitting cranks to the front wheel came to him like a flash, but it is only a fable, for it was only after long thought and sundry experiments that he evolved the crank and pedal, and thus out of the dying hobby horse set the now universal bicycle on its way. His first idea was to fix a pin on to one of the spokes, which pin was passed through the end of a long rod, and the rider, after getting up speed with his feet on the ground '*a la* hobby horse,' had to pump up and down with this rod with one hand while he steered with the other. This, of course, was found to be impracticable, so the inventor fitted a crank to one end of the front wheel axle, but still retained the hand piston rod idea. Then Michaux found that his legs were *in the way*, a rather curious thing in cycling. The sequence of ideas told him that he could not only get one of them out of the way, but make it useful, by setting a long bolt at right angles in the end of the crank and letting the foot assist by working it. From this it was a short step to fit a crank to the other end of the axle, discard the hand lever, and devote the hands to steering, leaving the stronger and hitherto useless legs to do the work of propelling the machine.

The foundation stone of modern cycling was laid. But there is another inventor—one Pierre Lallement—to whom is more commonly attributed the discovery of the pedal motion for velocipedes. Each of these two has his supporters; but it seems a very even thing. Lallement's velocipede was a much more finished article than Michaux's adapted Draisienne, and, save for the wooden wheels and ponderous iron fittings, was a comparatively similar machine in design—though, of course, ungeared—to the front driving Safety of to-day. But, though Lallement's cycle was a better machine than that of Michaux, the first authentic date of its appearance was 1863, eight years after Michaux adapted pedal motion to the hobby horse. Yet it is almost certain that neither of the inventors knew anything of the other's work, and the probability is that both were unconsciously following the same line of reasoning, but too far apart to compare their work."

If this be correct, Lallement was anticipated by some ten years, 1865 being generally accepted as the red letter year in cycling history in which this latter French mechanic built the first two-wheeled velocipede, propelled directly by cranks and loose pedals, and having the front wheel both driver and steerer. The appearance of Lallement's machine is known, however, to have aroused considerable interest; but Lallement, either not appreciating his invention, or being unable to develop it, sold his interests to his employer, and came to this country. Here he soon built another velocipede, and joining one J. Carrol they secured a patent for it in November, 1866.

This machine "consisted of two wooden wheels, with iron tires, of nearly equal size, one before the other, surmounted by a wooden perch, from which projected downward near its rear end two arms on either side the rear wheel, each pair of arms meeting at the end of the hub, and forming a bearing for the end of the axle; one similar wooden bar projected from the fore end of the perch on either side the forward wheel, furnishing bearings for its axle, and



LALLEMENT'S VELOCIPEDE—1866.

arranged with a pivot in the perch near the upper end so that, by means of a hand-bar above, the fore wheel could be turned in either direction. The perch was curved downward in the middle part, and from a joint near the front arms (or fork), backward to a joint over the rear wheel, extended a straight steel spring, bearing a saddle for the rider about midway and over the space between the two wheels. From this position he could place his feet upon the balanced pedals on the cranks connected with the front axle, the latter being a fixed one in the wheel, and thus seated, he started the machine in motion with his feet on the ground as always in the Draisine and then put them on the pedals, and propelled it."

This machine, in which the front wheel was both driver and steerer, and driven by cranks and loose pedals, thus embodied in a crude form some of the principal features of the ordinary bicycle which, in fact, was developed from it some years later. But no one at first appreciated its possibilities, the inventor himself disposing of his interests and returning to France. There he and others continued to build similar machines.

Shortly before this, in August, 1866, an Englishman, Edward Gilman, patented a velocipede, differing somewhat from Lallement's. In it, the front wheel was the steerer, while the rear wheel was the driver, thus following McMillan and Dalzell in employing the principle of the modern Safety. It was to be propelled by treadles, connecting with cranks on the axle of the driver, to be worked by the feet alternately. Of it, nothing more is known.

There was little immediate result from Lallement's patent in this country, but in France interest in the new vehicle did not die out so easily. The velocipede was given more of a trial; attempts were made to improve and lighten it; and, in the course of a year or two, a much better machine was produced by several makers.

In a paper, read by W. F. Adams before the Society of Cyclists in 1892, he is reported to have said that "the fashionable Parisian velocipede was not only very elegant, but highly luxurious. Its wheels were of hickory, and the bearings were excellent. The beautiful long steel springs were delicately adjusted to the rider's exact weight. A twelve stone rider would smash the spring built for a ten stone man, and sometimes a rider broke his own spring. The cost of these springs was £5 each. The finish of the velocipedes was very handsome, and their price ranged from £25 to £30. One maker named Machand turned out 300 machines a week for a long period, and hundreds of these early cycles must still be in existence in Paris. Until the recent advent of the pneumatic tire, no modern cycle equaled the Parisian boneshaker of 1866 for comfort. Its wheels were 40-inch front and 36-inch back. In the winters of 1866 and 1867 bicycling was the height of the Parisian fashion. Everyone who claimed to be anybody possessed a velocipede, from the Prince Imperial downward. There was a perfect rage for the machines, and cycling at the present day is, by comparison with this palmy period, the sport of the vulgar. The Prince Imperial was an excellent rider, and all the fashionable dandies vied with each other in graceful riding. There was no racing—that originated later in England—but fancy riding was much cultivated. Schools existed for the study of the art of riding. The riders were taught to sit erect in their saddles, and stooping forward was a thing unknown. At the Opera House straps were fixed to the walls of the vestibule for holding the machines of fashionable velocipedists; and Mr. Adams has counted a hundred velocipedes so left, while their owners enjoyed the music within. In the

Bois de Boulogne little paths were laid among the trees for the riders. Tiny narrow bridges were erected over the lakes, across which the wheelmen rode on to the islands, and sometimes, after refreshing themselves unwisely at the restaurants, toppled off into the shallow water in effecting their return."

In England, meantime, the matter was eliciting considerable discussion, largely in the columns of the *English Mechanic*, where many crude and curious ideas were broached, at first principally regarding tricycles —their general construction and means of propulsion. Cranks and levers were largely discussed, and as early as April 20, 1866, an endless chain was suggested. The question of change of gear, to aid in overcoming varying conditions of road surface, was raised, and various suggestions were made looking toward what has since been known as a "two speed gear." It was also proposed to do away with wooden wheels with their flat iron tires and build the wheels of metal with "quarter-inch steel rods, screwed into hub and headed into rim" for spokes, and use a half-round iron inch tire. A sociable was also proposed.

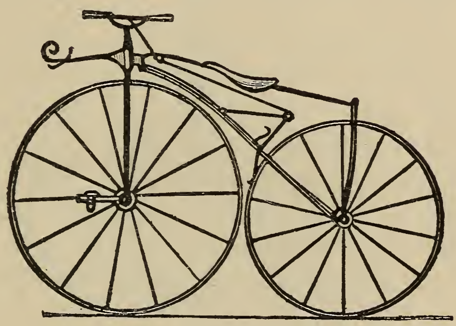
But there was little practical result from all these suggestions, and not much seems to have been accomplished during the following year. In 1868, however, there were three important steps taken. A Frenchman (judging by his name) living in England, Louis Rivière, proposed to make the front wheel larger than the back one; an American, C. K. Bradford, suggested rubber tires; and an Englishman, E. A. Cowper, added the suspension wheel and anti-friction bearings, and these features, when combined, produced a greatly modified velocipede—in fact the first machine worthy to be called a bicycle.

But the time was not yet when so many improvements could be sufficiently comprehended to be incorporated in a single machine, and the velocipede got its first foothold in England, as far as actual use is concerned, from some machines brought over from France and ridden by Charles Spencer, R. B. Turner, and M. J. Maynall. Their riding aroused considerable public interest, and this was farther stimulated by a drawing of the velocipede patented in the United States by the Hanlons. The matter was taken up with renewed vigor, and early in 1869 the word "bicycle" is said to have been used for the first time.

The interest in the velocipede, which flagged so quickly here in 1866, was partially revived two years later, and a patent was taken out by the Hanlon brothers, the famous acrobats, in July, 1868. They improved the frame, increased the size of the front wheel, and used a slotted crank. It was this machine which helped to increase the rising wave of enthusiasm in England.

Here, too, the interest in this improved machine continually strengthened and, in the course of a few months, developed into great enthusiasm. In 1869 it spread, as Mr. Pratt describes it, "with a feverish rapidity and infection, as has been intimated. Rings, halls, and riding-schools were opened in rapid and multiplied succession in all the principal and many of the smaller cities, and the 'velocipede' interest became a craze. Manufacturers in a score of towns had all they could do to supply the demand for them.

Merchants, professional men, mechanics, college students, and even ladies, hurried to its adoption as a pastime and a means of exercise, and also as a hoped-for instrument of practical locomotion. In 1869 the *furore* was at its height. A book ["The Velocipede," etc., by J. T. Goddard] was written about it, and a journal [*The Velocipedist*, edited by W. C. King] was issued devoted exclusively to the new interest; and one of the writers on the subject in that year had confidence like this: 'The machines now in use are so



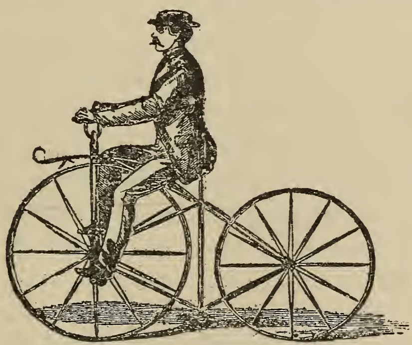
AMERICAN VELOCIPEDE—1869.

radically different from those of fifty years ago, so perfect in propelling power, so easy to ride, so swift of motion, so useful as a means of conveyance, that it seems impossible for history to repeat itself with regard to the present mania.' "

The American velocipede of 1869 was unquestionably a wonderful machine at the time it was produced, and not wholly unworthy of the adulation that was lavished on it; but, when we compare it with its successors, it seems crude, clumsy, and worthless, so great has been the advance in construction since it was produced.

This machine had wheels of about equal size, from thirty-six to forty inches in diameter; was mainly of wood, with a little iron work; the wheels were iron shod; the rider sat midway between them; and a brake, operating on the rear wheel, was connected with the handle bar by means of a light chain, or more usually a cord. The brake was applied by revolving the handle bar forward, and so winding up the cord on it. The rider sat so far behind his work that the action of the pedaling was an awkward as well as ineffective thrust; the machine was heavy and clumsy; power was badly applied; a grade of any account could not be climbed, nor could one be propelled on anything but a hard, smooth surface. As these disadvantages became unpleasantly real to the enthusiastic riders their ardor diminished, and so fast did reaction follow that in a year or two the few velocipedes to be seen were wholly in the hands of boys. While the mania lasted, however, some manufacturers had begun to build a new pattern, with front wheel much increased in size and rear wheel much diminished—a type approaching more in outline to the modern ordinary bicycle; but the fortunes of the velocipede were already on the wane, and this decided improvement in type came just too late to save the two wheeler from dropping wholly out of public view. The writer recalls visiting the works of a large carriage maker, about 1870, and seeing piled up in his storerooms quantities of this later type of velocipede, which had been produced only to fall flat on a disappearing market

For the next six years there was nothing of a cycling nature in this country, and what there was in France was well-nigh extinguished by the Franco-Prussian war, though during this period there was steady growth in England. In fact, about as far back as 1867, Henry Clarke, of Wolverhampton, had begun to build velocipedes and tricycles, and in 1868 the Coventry Machinists Co. went into the business on a considerable scale. By the beginning of 1869



PHANTOM DOUBLE STEERER—1869.

others were also engaged in it, and velocipedes were advertised like other goods and merchandise.

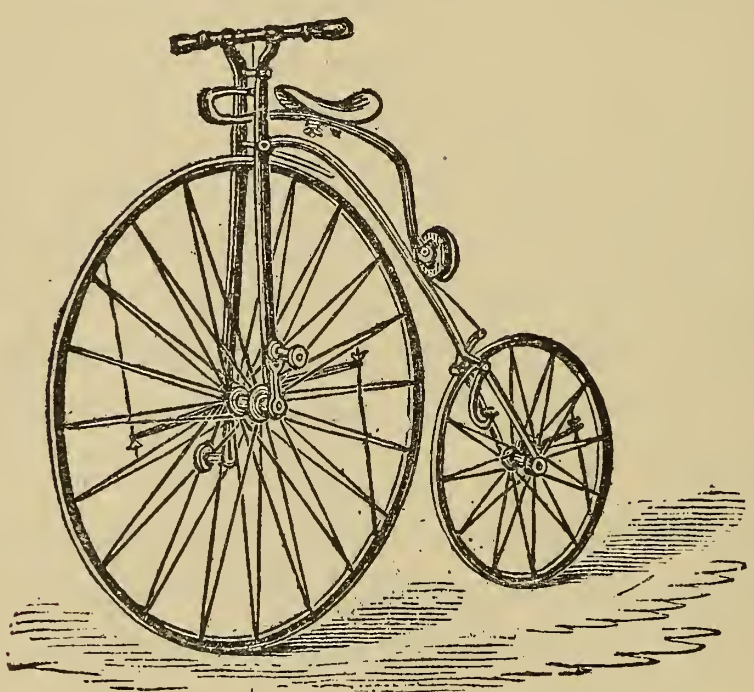
The first marked change from the characteristic velocipede type was in the Phantom, a unique machine in which the two wheels had motion independent of each other. A long pillar divided the diamond shaped frame which connected the two wheels, this pillar serving as a pivot for the rear wheel, and in effect making the steering very difficult, as the wheels thus ran independently. In its construction, the hickory wheels which at first had been used were abandoned, and iron suspension wheels with rubber tires were substituted. The steering, however, prevented this machine from becoming popular, though it was more or less known for four or five years. In tricycles, the hand-driven machine, the Velociman, appeared the same year, and now possesses the distinction of having been built continuously since then.

An entertaining item regarding the condition of the sport at this time is given by H. H. Griffin in his little volume on cycling. He says:

"Owing to the great interest felt in the new-fashioned sport, a grand exhibition and race meeting of 'velocipedes' was arranged and duly held in Studley Royal Park, and within the shade of that famous and most beautiful of all monastic ruins, Fountains Abbey, Yorkshire. There, on the grass close to the high tower, on Saturday, June 26, 1869, was brought together the finest display of cycles ever seen up to that date. One of the most interested spectators, and an eager inquirer into details, was the present writer. Our recollection of that memorable afternoon is clear and vivid as if it only happened twenty weeks instead of over twenty years ago. A prize of £4 was offered for the best bicycle. This was won by J. Richardson, Jr., Parliament Street, Harrogate, who exhibited for Newton, Wilson & Co. The second prize, £1 10*s*., went to Brindle, of Blackburn, who was much disgusted, and poured out a tale of woe that he had lost because he had taken off, or forgotten to attach, his leg-guard. The points by which the judges officially announced the superiority of the Newton-Wilson machine were: 1, Leg-guard; 2, double-bearing spring (it bowed out round the socket-head); 3, self-acting lubricators. The Phantom had not penetrated so far north. Brindle's bicycle was beautifully polished, and being of light wood and bright steel, was really very pretty to the uneducated eye of the period. Another loquacious loser was the venerable J. Crossley, a veteran of fifty, with flowing gray beard, and a wonderful kind of bath-chair-like tricycle, on the merits of which he held forth excitedly. Later on he beat a lot of younger men in the tricycle race. The first prize for three-wheelers was only £2, and was won by W. Younghusband, of Darlington; Pearson and Co., of Leeds, taking the second of £1. Here the points of vantage were: 1, Cyclometer (termed pedometer); 2, adjustable steering-bar. Thus was the Stanley Show anticipated, and a considerable impetus was given to the trade."

In spite, however, of such improvements as had been suggested or introduced, the prospects of cycling were not very bright at the beginning of the seventies. The old velocipede predominated, and its continued supremacy was a menace to the sport. For two or three years improvements came slowly; but they did continue to come, and by 1873 were sufficiently marked not only to save the sport, but to considerably increase it. The velocipede had metal pedals on which the hollow of the foot was placed—a most miserable and disadvantageous method of propulsion. In 1871, W. H. J. Grant proposed the use of rubber pedals "so as to admit of the rider using the front part or toes" in pedaling, and he also vulcanized rubber tires into crescent shaped metal rims. This was followed by a more marked increase in the size of the front wheel, and decrease in size of the back one, so that, instead of having two wheels of about equal size, say thirty-six to forty inches, a machine could now be had with about forty-eight and twenty-four inch wheels and built almost wholly of metal and rubber.

In 1873 there was produced by Starley, "the Father of the Bicycle," about the first machine embodying



ARIEL BICYCLE—1873.

most of the features which are found in the modern ordinary bicycle. In the Ariel were embodied all the good points then known, the machine being on the most approved lines, constructed of metal and rubber, and with new features, such as a step; forks carried up to the handle bar; and the wheels fitted with a lever bar and cross tension spokes designed to take the strain off the spokes and convey it directly from axle to rim. A lady's bicycle "with lever pedals on the left side and forkless backbone" was said to have been also "introduced"; but the acquaintance of the public with it was doubtless limited to the "introduction."

The feature of "cross tension spokes" did not become permanent, but in other respects the Ariel was a good representative of the new type of machine.

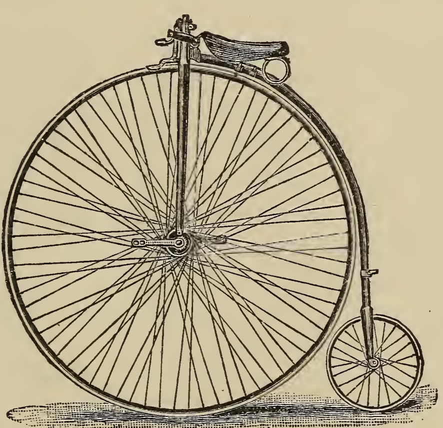
ORDINARY BICYCLE—1876.

Both the velocipede and bicycle had been in use up to about 1874, but about that time the transition to the true bicycle type was pretty well under way and was completed about 1876, when one of the principal houses in the trade showed an illustration like that here given, of what they called their "Perfect" bicycle. The machine was wholly of metal, except the saddle block, brake cord, and tires. It had the high head, short handle bars, and great bowed spring characteristic of the time; and it possessed considerable rake, ample foot rests, and a rear brake. Roughly speaking, its general outline resembled somewhat the principle features of the "Rational" ordinary of 1890.

But few changes were required after this to produce the most highly developed form of the modern ordinary bicycle, and they were soon incorporated in the machine. The front wheel was increased in size, until one could be had of any height up to sixty inches. The rear wheel was correspondingly reduced, until it fell to twenty, eighteen, and even sixteen inches. The old style socket head was replaced by the well-known and, later, universally used Stanley head. The handle bars were lowered and lengthened. The great bow spring was replaced by something smaller and neater, and a front wheel spoon brake took the place of the rear wheel brake.

These features, however, at the start were in a more or less crude form, being clumsy and heavy as compared with themselves a few years later. The effort to produce a practicable machine had been too great to admit of paying much attention to such a question as that of weight, and a 54-inch ordinary, in 1875, is said to have weighed full sixty-five pounds. In fact, nearly ten years later, many a full roadster of the same size weighed fifty pounds, and in 1886, when the ordinary had been practically perfected, many a so-called "light roadster" weighed forty-five pounds, though this was too heavy by several pounds to really deserve the name.

As in weight, so in fittings, finish, and all matters of detail connected with the machine, modifications and improvements were slight but constant up to about 1886, when the final form was reached. Plain and roller bearings had been superseded by balls, and in 1879 by adjustable ball bearings. These were applied first to the front wheel, then to the rear; later

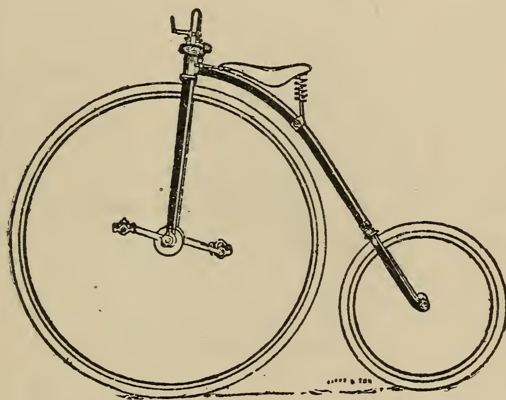


ORDINARY BICYCLE—1886.

to the pedals; and last (by some makers only), to the head. The early nippled and nutted spokes were replaced by the "direct" and the various forms of "tangent." The tubing used for backbone, forks, and bar was changed in shape, gauge, and diameter. Twenty-inch straight handle bars yielded to 28-inch curved ones; small, uncomfortable, grips to delightful T and spade handles, and hard little "pig skins'' to easy hammock saddles. While the machines of 1876 and 1886 were of one kind, those of 1886 were of a far finer breed than their predecessors.

Almost contemporaneously with the perfecting of the ordinary came the successful advent of the rear-driving chain safety, and the newcomer soon supplanted the but recently perfected high wheel. In the course of two or three years, the ordinary almost disappeared, though attempts were made to preserve its popularity by building it in a safer and, so-called, ''rational'' form. The ''rational ordinary'' differed from the regular type merely in having an inch or two more of rake to the forks; a rear wheel some four inches larger, plenty of clearance for the driving wheel, and the saddle a little farther back. A man would thus ride a machine a size or two smaller than had been his custom, and would have a safer position. These machines were fairly well received, but had little appreciable effect in arresting the well-nigh universal rush for the Safety.

Late in 1891, however, there was introduced a machine whose career excites much interest, particularly among old ordinary riders. It is an ordinary bicycle, built on ''rational'' lines, with the addition of the front wheel being geared, the gearing being small and compact, and completely concealed in the front hub. ''In appearance it scarcely differs from a rational ordinary of the prevailing type, but on the crank axle on geared side of hub there is a flange which carries four pinions. These revolve round the pinion, which forms one piece with the bearing, and is therefore stationary, and serves as fulcrum for the four pinions mentioned above. On the inside of hub are cut internal teeth, into which the four pinions also gear. In action the crank actuates the axle, and therefore the four pinions, which again drive the hub by means of the internal teeth. The degree of gearing is determined by the proportion of the number of teeth on bearing pinion and in hub, which in the present case are 14 and 38 respectively. The gear so far as regards sizes of teeth, etc., is the same as has been



GEARED ORDINARY BICYCLE—1891.

used for many years in the Crypto two-speed gear, in which it is subjected to even greater strain, so that the makers have every confidence in its standing any strain that it may be put to, and also wearing well. This gear adds to the weight about two pounds in all, and thus compares favorably with the weight of pulley wheels and chain in the ordinary R. D. Safety, apart from any other considerations, as the whole can be neatly boxed in; it is free from much of that friction from the accumulation of dust, which made the Carter gear case so distinct an advantage to road riders during the past year; and a small groove cut in the hub will hold a considerable amount of oil, so that the gear will run to a great extent in oil, and the combined advantages will materially add to the sweetness of the running." It will be built in small sizes, forty to fifty inch, and an adjustable handle bar will adapt it to any size of rider.

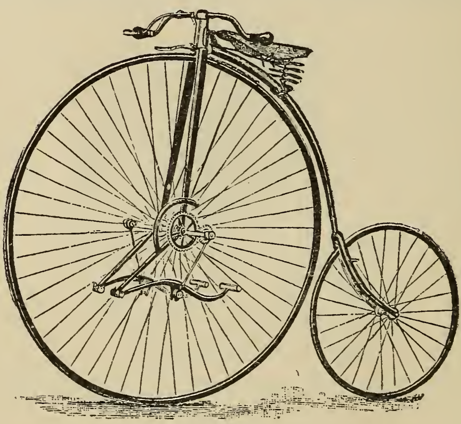
Turning now to the Safety in order to trace it from its beginning, it is necessary to revert to an earlier date. Cycling was growing steadily in 1883, though the difficulties and dangers of the high wheel tended to confine it to comparatively young men, and even among these to such as were willing to take some risk, for on the high wheel it was the sport in which carelessness and inefficiency were surest to bring their own speedy punishment. Its delightful and valuable features, however,—its exhilaration, and its remarkable ability to promote and restore health, were just securing more general recognition, and it only required a type of wheel as easy as the ordinary to propel, while wholly free from danger, to make it the most popular sport in the world. Precisely this soon came.

The first attempts to produce a bicycle that would be more safe than the ordinary had been made some years before. In 1878 there had been built two Safety bicycles, having driving wheels somewhat smaller than that of an average ordinary, the early pattern of the Xtraordinary being furnished in sizes from 48 to 54 inches, and the Facile from 36 to 52 inches, though the larger sizes of the latter were never much used. The "Xtra," as the former was called, got its safety qualities, from the great rake of the forks, about nine inches, which made it necessary to carry the saddle far back. To secure steadiness of steering the forks were bent just above the wheel, so that a line drawn lengthwise through the head would, if extended, touch the ground at the wheel's point of contact. Instead of rotary action, it had bent levers connected with the

XTRAORDINARY CHALLENGE BICYCLE—1878.

cranks, and attached at their upper ends to short arms, working on universal joints at the sides of the forks. This gave quite a different pedal motion. The machine was somewhat peculiar as well as rather heavy in appearance; but it was safe, and fast, especially on rough roads. It soon got a hold on the market and has never been entirely out of it in England, though comparatively few have ever been used here.

The Facile bicycle, also produced in 1878, was a somewhat smaller form of Safety. The driving wheel was usually 40 inches, and the rear wheel, which was 22 inches, was carried well back in order to reduce the tendency to headers. The front forks were extended below the bearings and curved forward, and to their ends were jointed pedal levers to which secondary cranks were attached. The pedal action consequently was not exactly rotary. Within a few years a system of gearing-up has been adopted, thus making

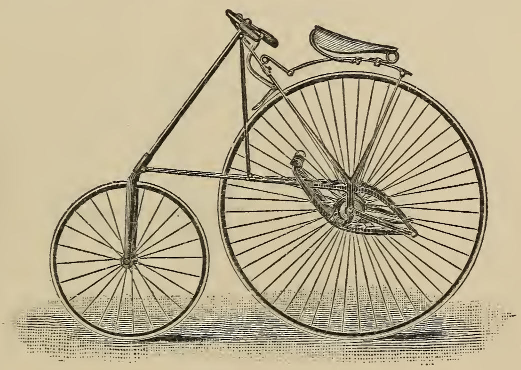


FACILE BICYCLE—1878.

the machine faster. The illustration represents one of these. The Facile soon made a place for itself, and has always held, and still holds, a good position in England.

These two machines were unlike each other, and unlike all other bicycles; yet, with their individuality was enough of merit to bring them into prominence, and to carry them through a longer life than has thus far been possessed by any other type of bicycle.

Soon after the appearance of the Xtra and Facile there was produced in this country a bicycle resembling them in several particulars, though at first glance quite a different looking machine. This was the American Star. It had the novel feature of a large rear driving wheel and small front steering wheel, and was driven by levers and clutches, with a spring to recover the lever at each stroke. It had a direct, long, sloping steering-post and vertical front forks. The rider sat



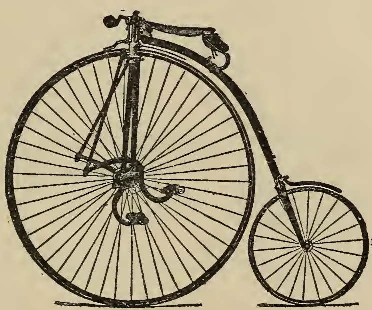
AMERICAN STAR—1881.

almost directly over the center of the driving wheel, which was built usually as 48, 51, or 54 inches, and the steering wheel was 22 inches. In later patterns the sizes of the wheels were altered, until finally 39 and 24 respectively became the favorite sizes, the levers being comparatively straight, instead of being bent up as at first, so that the machine could be ridden with a straight leg. Safety from headers was obtained by means of the front steering wheel, but a careful fore-and-aft balance had to be maintained, as the small steerer was easily lifted off the ground, and a backward fall could be thus taken. The steering was a little peculiar, but easily mastered. The machine was a good hill climber, and successful on both road and path for a number of years.

Another American-made machine was produced a little later. It had a large front wheel, which was both driver and steerer, made in sizes from 42 to 46 inches. "The safety principle consists in placing the weight of the rider much nearer the ground than in the ordinary machine, and further back; to do this the front wheels are made smaller and the spring longer. The upright position of the rider, and the direct downward thrust of the feet, are secured by placing the ordinary bicycle pedals on levers that are hung below, and extend to the rear of the crank a suitable distance to effect this result. By connecting the front end of the levers to a swinging tubular rod, the pedals move in an almost perfect oval curve, and avoid the jerky movement caused by the rapidly descending and slowly ascending pedal movement of similar Safety machines that do not have the swinging rod. The joints on the levers are constructed on the ball-and-socket principle, so that an accident that bends either the levers or the cranks will not cause the machine to turn hard in consequence."

The Xtra, the Facile, the American Star, and the American Safety constitute, in a manner, a class by themselves, though each has its own perfectly distinctive features. They all depart from the type of ordinary bicycle, which prevailed when they were invented, and in seeking to secure increased safety and greater ease of propulsion, all adopted a lever action. In its day, each was known as a Safety; but since 1885 that term has come to be restricted so entirely to the equal wheeled, rear driving, single chain Safety, that it is seldom used in connection with other types.

The introduction to the cycling public of these new types, and the success which each one achieved, opened the way, in a measure, for still more radical departures, and still more strenuous efforts to produce an ideal Safety. But the inventors had not waited

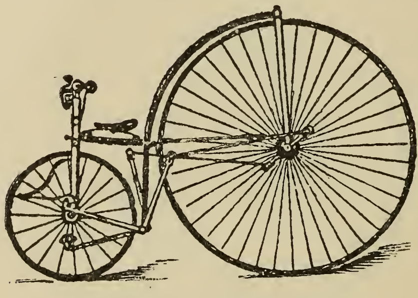


American Safety Bicycle—1885.

until this time to make their initital efforts. Though these machines may be regarded as constituting a link between the ordinary and the modern Safety, the inventors had been at work for some time, and while their efforts were not conspicuously successful until 1884, it is necessary to go back as far as 1876 in order to find what seems to be the real beginning of the Safety.

It was about 1876 that H. T. Lawson, an Englishman, invented a rear driving Safety which was manufactured by Singer & Co. for a short time. It had a large rear wheel driven by levers, and a very small steering wheel, with a vertical fork and cross handles at the top of it. The rider sat nearly over the steering wheel, where he was within reach of the handle bar, with the driving wheel behind him. Altogether, it must have been a clumsy and slow affair, and one not likely to meet with much popular favor.

About three years later Lawson produced another Safety. This machine had the steerer larger than the

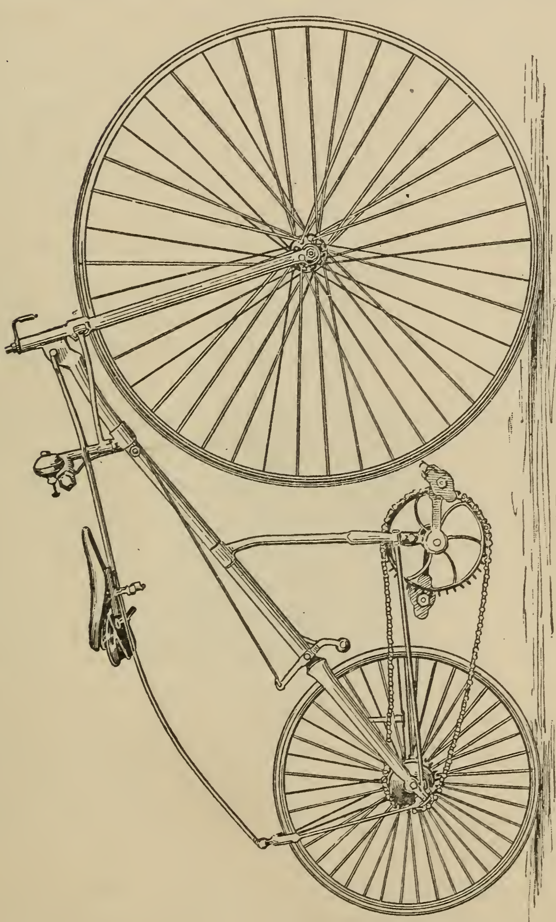


LAWSON'S SAFETY—1876.

driver; it was driven by a chain and cog wheels; it was geared up, and was steered by means of a nearly vertical fork connected by rods with a secondary steering post and handle bar.

This machine struck popular taste no more favorably than its predecessor. It was called the Bicyclette, but it was locally known as the "Crocodile," and is said to have been regarded with considerable derision. It was built by Rudge.

A third large house, the Coventry Machinists' Co., tried their hands about this time, at a "Pony" Safety invented by W. H. Blood. It seems to have been only "a small bicycle, with hanging links to the cranks, on



BICYCLETTE—1880.

the ends of which the pedals were." It did not prove successful.

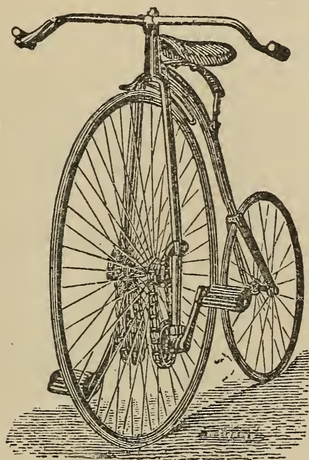
During the next few years no striking departures from old lines appear to have been made, but in 1883 Hillman, Herbert & Cooper brought out the Kangaroo Safety. It was a front driving and steering machine, like the ordinary bicycle, of which it was a dwarf pattern rather than a true Safety. The forks were continued below the center of the driving wheel, which had two cog wheels on each side,—one at the axle, and one at the end of each fork,—so that two chains were used, and the machine was geared up. There was a tolerably large back wheel, and the saddle was fairly back; but, though the machine was undoubtedly safer than the ordinary, it was by no means an ideal Safety.

The Kangaroo, by establishing a new record in a hundred mile road race, speedily became famous and then jumped at once into popular favor. Nearly every maker in England copied it more or less closely, and in this country one firm brought out a pattern. The Kangaroo was novel, and was successful—at least, temporarily; but it was never entirely satisfactory either in the working of the chains or in its general qualities. Moreover, it happened, that while it was achieving success, inventors were busy developing quite another type, which was destined, in the course of a year or two, to supplant it in public favor, and, not much later, to drive the older ordinary almost wholly out of the field.

In 1890 the *Scottish Cyclist* brought to light the fact that a peculiar rear driving Safety had been built in 1884, and described it as follows:

"The machine was built in May, 1884, at the Howe

Machine Co's. Works, Bridgeton, under the superintendence of Mr. Rudling, an Englishman, who endeavored to induce the firm to place the machine on the market. Two of these machines were actually built, but the Howe Co. could not come to terms as to royalty with the inventors and designers, and they took their machine elsewhere, though what ultimately became of it we are unable to say. One is at present to



KANGAROO SAFETY—1883.

be seen at the Bridgeton works. It will be seen the machine has many things in common with the modern Safety. It is rear driven, as in the present type, except that the chain is outside the frame in the Marvel; it has ball bearings on all friction parts; tubing was used in its construction, and the frame has something of the diamond in its appearance, while it has center steering—the steering being direct. Both seat and steering pillars are adjustable. The tread was rather wide, but this was to allow the front wheel to clear the cranks when steering. Mr. Macfarlane tells us it steered very easily, and he obtained a good speed out of it, though, of course, owing to the small size of the wheels, there was considerable vibration. We have seen reference made to the Marvel in a contemporary, but, apparently, its construction seems to be altogether unknown.

"We give below an extract from the *Scottish Athletic Journal*, of July 18, 1884, which gave a description of the machine, which will be read now with interest:

"'Bicycle novelties are being daily introduced. Some are said to be improvements, but on trial they have generally been found not to answer the expectations of their sanguine inventors. Very few of the so-called improvements ever come to anything. I think, however, I have lighted upon one which presents many points which will commend it to the cycling public, and which has, I firmly believe, a brilliant future before it. In response to a note from Mr. W. Macfarlane, who informed me he had a novelty to show me, I hied me out to the works of the Howe Machine Co., at Bridgeton, where I found the genial Mac installed in a position of some responsibility. I asked him to produce his novelty, and I am prepared to admit honestly the novelty rather took me aback. I confess I felt somewhat skeptical at first as Mac detailed the excellences of a machine which I at first thought was a toy bicycle. After a thorough examination of the machine, and seeing it tested, I believe there is a great future before the Marvel Safety Bicycle.

"'The Marvel is a Safety bicycle on an altogether new plan. It is neither an imitation of the Facile nor of the Kangaroo. The only similarity between the latter and the Marvel is that both are driven by chain gear, but here the similarity ends. The driving wheel, which, by the way, is the rear wheel, is only 25 inches in diameter, and the steering wheel 18 inches. The machine is geared up to 50 inches, or double.

MARVEL SAFETY—1884.

The large wheel of the gearing is fixed to the frame between the two wheels, and the small one to the axle of the driving wheel, the chain acting horizontally. The rider is seated directly over his work, and it is claimed, and with some show of reason, that more work and better pace can be got out of the Marvel than out of any ordinary 50-inch roadster. The standard pattern will, I believe, be 30-inch driving and 18-inch steering wheels, the machine being geared up to 65 inches.

"'The saddle is adjustable with cradle spring. The Marvel can be ridden with ease by the smallest boy as well as the tallest man. All that is required is to raise or lower the seat and handles. The cranks are of the usual character, with a 5-inch throw. The steering is done direct from the head, in the new type of machine, and, what is more, steering is quite easy. It is fitted with ball-bearings, on all friction parts, and the frame-work is made of hollow metal. It weighs slightly over thirty pounds.'"

The Marvel Safety appears to have been, like the "Bicyclette" of 1880, one of those things that seem to have in them nearly all the elements of success, but still somehow just fail to achieve it. Looking back at the year 1884, and comparing the Marvel with the original Rover, produced at almost the same time, it would seem that the Marvel ought to have become the prototype of the modern Safety; but it vanished from sight, and soon from mind, while the persistent attention given the Rover by its inventor soon resulted in the development of a practical machine.

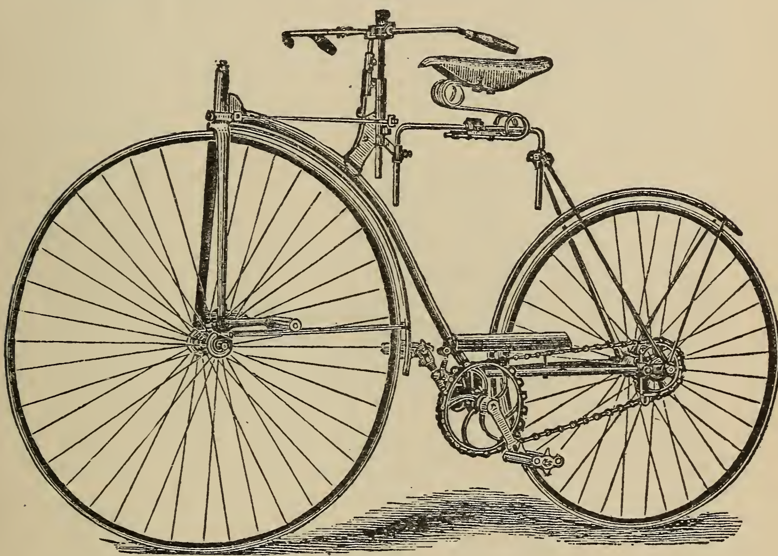
The Marvel seems to have been so completely forgotten that even the veteran Henry Sturmey, in his sketch of the "History of the Safety Biccyle," in the *Cyclist* early in 1890, makes no allusion to it; but, on the other hand, A. J. Wilson mentions it in his little book, "The Pleasures, Objects, and Advantages of Cycling," published in 1887. Though Mr. Wilson speaks of it as "made for experiment by Rucker & Co.," his description of it makes it identical with the Marvel already described and illustrated, and he calls it by the same name. He learned to ride the machine with considerable difficulty, as he found that the short wheel base made it exceedingly sensitive, and very difficult to control. What became of the experimental machine he does not say.

At about the same time that the Marvel was produced, the earliest pattern of the Rover was under way. Mr. Sturmey, the editor of the *Cyclist*, had personal knowledge of the genesis of this machine; consequently, his relation of his experience with its development is of peculiar interest. In his sketch in the *Cyclist* he said, speaking of 1884:

"About this time, or a little before, Messrs. Starley & Sutton introduced a tricycle in which the rider was placed behind his driving axle, and his seat placed rather in front of than behind the crank axle, as was done in the majority of other tricycles. The success of this machine as a hill-climber induced the inventor —J. K. Starley—to work out the principle as applied to a bicycle, and the result was a machine with nearly equal wheels, driven from the back as now, but steered like Lawson's original Bicyclette or 'Crocodile,' with a vertical fork, secondary handles, and connecting links. This machine went easily enough, but its steering was neither firm nor direct, and the long frame and connecting bars gave it a heavy and complicated appearance, which militated against its commercial success, and, although the inventor stuck to it, with the firm conviction that its principle was right, it would doubtless have fallen into obscurity but for the alteration in the steering method which was shortly afterward made.

"And here we are introduced once again to the inventor Lawson, who about the same time produced at the works of the National Cycle Company, of which he was then manager, a machine, the ostensible object of which was to permit of the use of the bicycle by a lady. This was a rear driver, driven by a chain. The frame was constructed of a single tube bent into a large curve, carrying the saddle at one end, the driving-wheel bearings in the middle, the crank bearings lower down, and terminating in the connection with the steering wheel. In this machine a very small steering wheel was used, and the steering was effected by a sloping fork and the cross handles, the steering being direct as now, and the forks, owing to the small size of the steerer, almost vertical. This machine was likewise doomed to commercial failure. Its frame was insufficiently rigid, and the small size of the steering wheel prevented its getting a fair trial.

"We rode both this and Starley's original Rover at the time, and a member of our staff—Mr. Golder—used Lawson's machine a good deal for 'pottering about' upon, with the result that he became fairly *au fait* with it, and was able to manage it pretty well. In a conversation with Mr. Starley the question of wheel principles was entered into, and upon our suggesting the alteration of the Rover to direct steering, he admitted he had not tried it, as he was under the impression that the vertical fork was necessary to secure proper steering. We referred to the Lawson machine as a proof that with practice a slightly sloping fork could be manipulated successfully, and referring him to Mr. Golder for a proof of its practicability. The result of that conversation was that Mr. Starley built a machine as a trial, in which he substituted the sloping direct fork for the arm-and-link arrangement

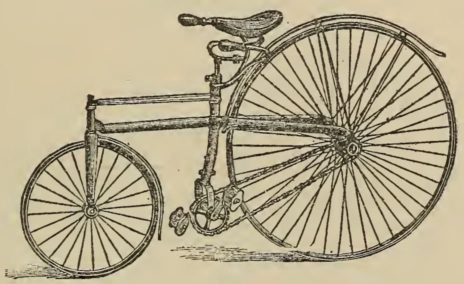


ORIGINAL ROVER SAFETY—1884.

as hitherto adopted, retaining the large steering wheel and other structural features of the original Rover, and placed it at Mr. Golder's disposal to see if he could ride it. For the first few days it took him all his time to keep upright upon it, but its intricacies being once mastered the capabilities of the new machine were quickly proved in his runs with the club, for whereas several members had been able to hold him when he was riding his ordinary, with the new mount he was able to show the whole club his back wheel, especially up-hill.

"This practical proof of the value of the machine decided Messrs. Starley & Sutton to go ahead, and within a month or two the example of Messrs. Hillman, Herbert & Cooper, who had introduced the Kangaroo with a big road race, was followed, and a hundred miles contest was arranged. Upon that test practically hung the future of the machine. Had the times accomplished fallen short of those made in the Kangaroo ride of the previous year, there is little doubt but that it would have taken much longer to make its way in public opinion than it did. But, as the result showed, the Kangaroo times were beaten considerably by George Smith, the same rider who had won the Kangaroo ride, while Mr. Golder himself lowered the fifty miles' road record, which had previously stood for many years, by nearly a quarter of an hour. Taking due advantage of this success, the firm energetically placed the machine upon the market, and from that day the success of the Rover was assured. The next two seasons saw a rapid decline of the Kangaroo-type mounts, and a steady, yet certain, replacement of it in the makers' pattern books by machines on Rover lines."

The word Safety had been pretty closely associated with the Kangaroo type for a year or two; and this fact led at first to the use of the word Rover as a general name for all Safeties of the new pattern—those with wheels of nearly equal size, the front wheel steering and the rear one driving by means of a single chain. But the Kangaroo was soon driven from the field; all makers brought out Rover pattern machines; the word Rover gradually lost its meaning as the designation of the type, and the word Safety replaced it. Not long after—perhaps two or three years—the ordinary bicycle was so nearly driven from the field that its manufacture practically ceased, and the Safety took its place. It thus gradually came about that the word Safety was

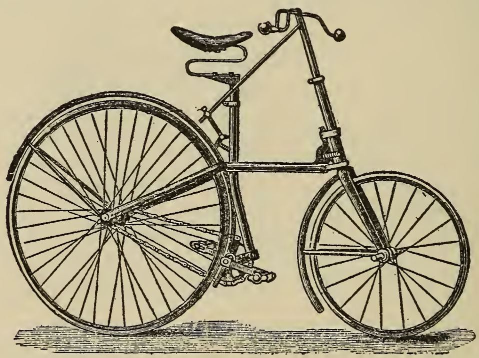


ANTELOPE SAFETY—1885.

hardly necessary any longer as the designation of a class or type, for its class preponderated so greatly as to become almost universal, and the general term "bicycle" was applied to it. If the high wheel was mentioned, it was spoken of as the ordinary or high bicycle.

The "Indispensable Handbook to the Safety Bicycle" was issued in 1885, and was devoted almost entirely to machines of the Kangaroo pattern, there being then but few of the new Rover type in the market. There were, however, illustrations of three or four of the new type, including the Original Rover, previously given.

Another was the Antelope, which claimed to be "the only Safety in the market giving a perfect open front to the rider." Its wheels were 36 and 20 inches; the steering automatic; and the handles, which curved around, were actuated on a swivel, and connected with the steering wheel by means of two parallel rods. A very similar machine, the "B. S. A."



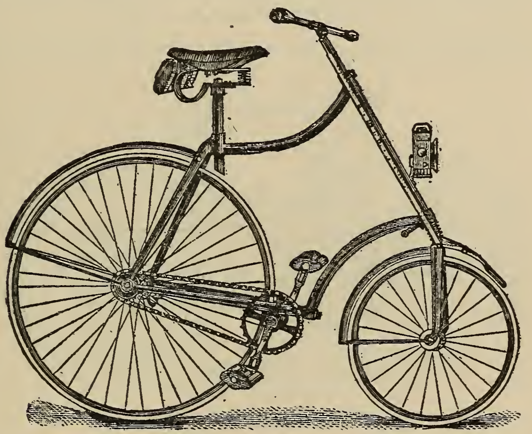
PIONEER SAFETY—1885.

(Birmingham Small Arms) had 32- and 20-inch wheels, and a vertical steering post directly in front of the saddle. This post carried a cross handle bar at the top, and at the bottom was connected with parallel rods which ran to the steering head.

The Pioneer was of a somewhat more advanced type. It had 30- and 20-inch wheels, a cross frame, direct steering, and a long sloping steering post nearly in line with the front forks.

The Humber approached somewhat nearer to some varieties of the diamond frame of later days. Its wheels were 30 and 18 inches; its steering was automatic; there was direct steering with a long sloping steering post, and the front forks were vertical.

With the exception of the original Rover, nearly every one of these early machines had a steering wheel very much smaller than its driving wheel, while the forks either sloped at bad angles, or were vertical with

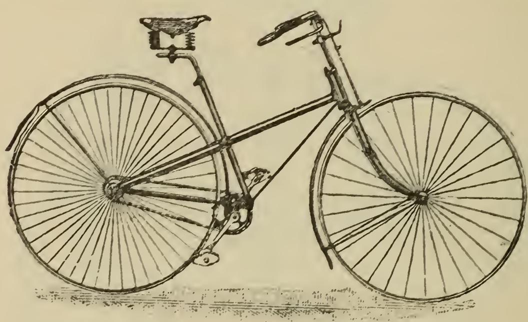


HUMBER SAFETY—1885.

some awkward device designed to bring the handles within the rider's reach. Such combinations resulted in giving very peculiar or sensitive steering, to remedy which some automatic device was generally adopted, and was at that time considered very important. Even as late as 1887, A. J. Wilson refers in his book to this sensitiveness of steering, and remarks that on the Humber "this defect is remedied, and the cam-and-spring controller aid in steadying the steering."

The next two years, however, were destined to see a general settling down to the Rover type, and the steady disappearance of the Kangaroo type. So strong indeed was the movement that but few Kangaroo machines were left to be described when the "Indispensable Handbook" again appeared in 1887.

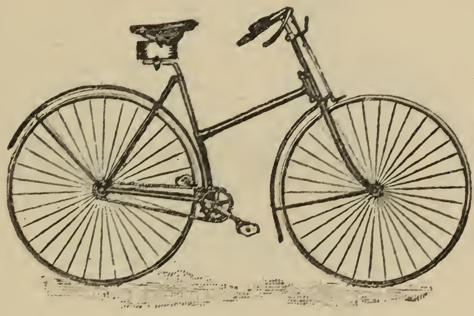
The general outline of the Rover Safety, as it now assumed definite shape, is found in most of the 1887 machines. It consisted of a simple cross frame —the backbone connecting the rear forks in a straight



CROSS FRAME SAFETY.

line with the steering head, which was of the hinged variety working in lugs behind the steering post; a pillar crossing the backbone nearly at right angles, immediately in front of the driving wheel, carrying the saddle post at its upper and the crank axle at its lower end; sloping steering post and front forks; stay rods between the crank axle and driving-wheel axle, and sometimes additional stays, one being shown in the cut, between the crank axle and forward part of the backbone. This was the prevailing type in 1887, though several makers showed more originality in producing frames which gave promise of the diamond variety afterward so popular.

The cross frame, if stayed to both the crank axle and the top of the seat pillar, gave a sort of triangle at the rear, and led to an early modification in frames called the semi-diamond. This, however, never superseded the cross frame, but a few makers have continued to use it in slightly modified forms, the most marked change being, in some cases, the forking of the

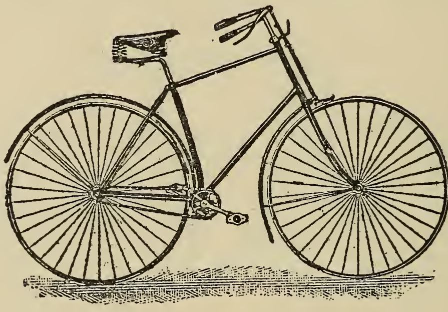


SEMI-DIAMOND FRAME SAFETY.

lower end of the upright pillar so that the ends of the crank axle are carried by arms.

The type of frame known as the diamond, however, soon supplanted all others in popular favor. It was, at first, nearly a true diamond in shape, the upper and lower tubes coming together within an inch or two at the head; and it was of the "open" variety —that is, there was no cross tube to stay it. But this was soon improved in two particulars; a cross tube was added, either curved, to follow the line of the driving wheel, or straight; and the forward part of the frame was made more open, the tubes being carried to join the steering post at the ends of a long steering head. This gave the "divided" or "double" diamond which, while not quite a true diamond in shape, is technically given that name.

The other principal modification in the frame of the Safety is the use of a curved, or "drop" frame, by means of which the machine is perfectly adapted to a



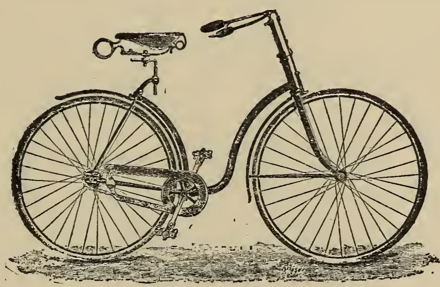
DIAMOND FRAME SAFETY.

woman's use, there being nothing whatever in the way of her skirts.

After the success of the equal-wheeled Safety bicycles, a Star Safety, with nearly equal wheels driven by levers, and a sort of semi-diamond frame, was brought out; and in 1891, another pattern, called the Rover Star, which had a frame almost like the earlier American Star, but wheels of about 30 and 36 inches, appeared.

According to generally accepted notions, one of the most striking things among Safety bicycles is the machine known as the Hickory, its name being taken from the material of which its wheels and frame are made. It was at first made only as a drop frame, though a diamond frame has since been built. It is well made and finely finished, and has many good features. Metal is used only where necessary, as in handle bar, front forks, and cranks. The hub is rock elm, and spokes and rear forks hickory. It is light and strong.

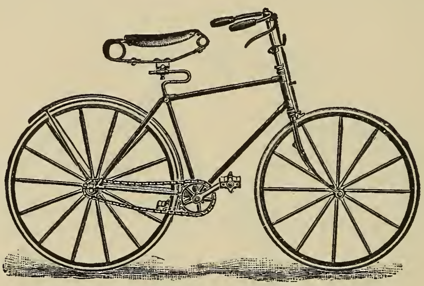
In an earlier part of this chapter, the latest design



Drop Frame Safety.

in high wheels—the geared ordinary—was described. The company which introduced it have also produced a chainless Safety, in which essentially the same gear is used, and applied to the front wheel. This gives a practically equal-wheeled machine which is both front driver and steerer, and consequently one which must be characterized by many features of its own, not a few of which will be found very different from those possessed by the chain-driven rear driver.

"The new chainless Safety," says *Bicycling News*, "will be an equal-wheeled ordinary with a 30-inch driver and a 28-inch trailer. This will be driven direct from the front forks like the ordinary, the gear fitted being rather more elaborate, the pinion wheels having ball bearings all around. The rider, to obtain the favorite behind-the-work position, will get well back from the head, the back of the saddle being 15, 16, or 17 inches away therefrom, the work being practically under the head at the end of the short, and consequently very rigid, front forks; the handles will

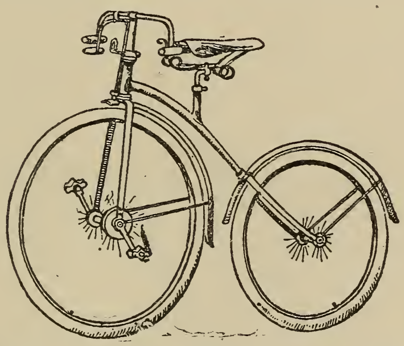


HICKORY SAFETY BICYCLE.

be adjustable, and the rider's position practically the same with regard to his work as on the Safety.

"From the head will come an ordinary backbone, which, if it possesses a certain amount of spring, will be none the worse, and a hind fork, in which will run a simple trailing wheel, which, we venture to predict, will decrease in size as the advantage of the inflated tire becomes more apparent. This trailing wheel will have but one function, and will only carry its share of the rider's weight and nothing more. Now, if any one of our readers will take the trouble to sketch a bone-shaker in outline, that will represent the outline of the new Safety, if he imagines the wheels to be 30 inches x 28 inches with the necessary space between them, and a slight rake on the front forks, and then measures back 15 or 16 inches from the head, he will find that the rider will be placed equidistant from the center of either wheel, and in the very best position as regards running and vibration, while, at the same time, his work is suitably placed as regards the saddle.

"Thus all the points aimed at by the long wheel base will be attained without the necessity of adding



CRYPTO GEARED SAFETY BICYCLE—1891.

inches to the length of frame; the work and material used in trying to secure the rigidity of the bottom bracket will be unnecessary, and the bottom bracket itself will disappear; the front wheel instead of the rear one will be driven, the feet can assist the steering, and the rear wheel, though carrying its share of the weight, can be made lighter. No undue strain will be thrown on either wheel, and the apostles of vibration will see the ideal they so often talked about fully carried out."

The inventor of the machine, an experienced wheelman, discusses its merits in a letter to the *Cyclist*, and compares it with the chain-driven Safety as follows:

"But now that it is generally admitted that a rider must sit well back in order to do good work, the whole situation is changed as by a magician's wand. The best relative positions for saddle and crank bracket are still matters of discussion, but I think it will be generally admitted that the center of saddle *must* be 12 inches, and *may* be 16 inches behind crank axle. I may mention here that Mr. R. C. Nesbitt and Mr. A. Webb and other riders pronounce the rider's position on our new Geared Ordinary as perfect, and the center of saddle, as they are riding it, is 16½ inches behind axle. With center of saddle even 10 inches behind axle, a front driver is for all practical purposes as safe as a rear driver, while with saddle 15 inches behind, a "header" can only be caused by an obstacle if encountered even on a rear driver.

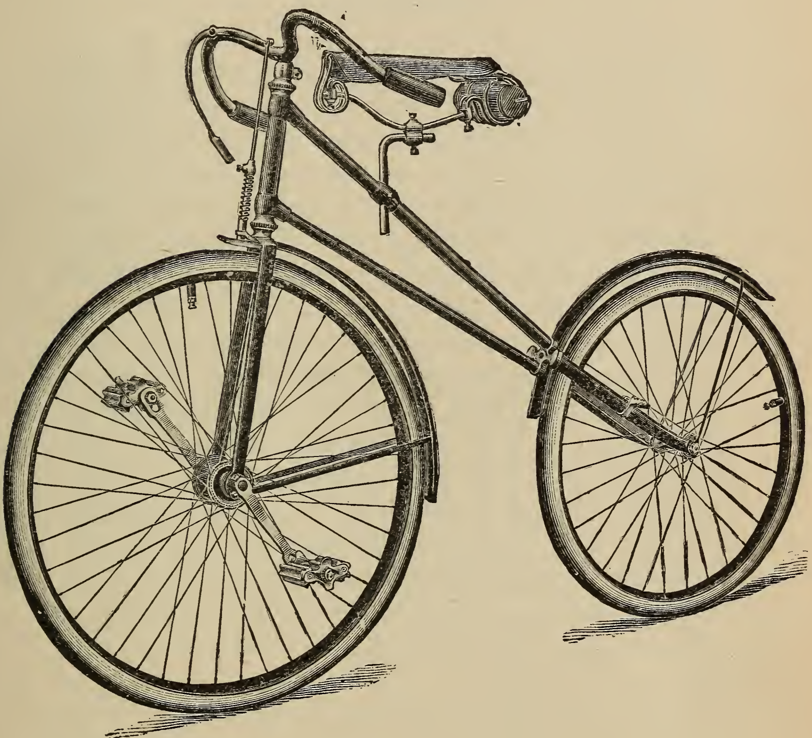
"Now, if the above be admitted, let us see what follows, and first let us consider what are the defects of the present chain Safety. These are, in my opinion: (1) The chain itself. As a means of transmitting power on a cycle it is unmechanical, dirty, difficult to protect from mud, and full of friction when muddy. Its best friends would gladly be rid of it, and the constant cry is to be delivered from it. (2) Owing to the driving not being done directly upon the driving wheel the frame is complicated, and there is a great amount of torsional strain, the two chain wheels being sprung more or less out of line at every stroke, even on the best constructed machines. (3) The rider's weight is badly distributed. Instead of being seated midway between the two equal-sized wheels, almost all his weight is on the back wheel, and he therefore gets the whole shock of every obstacle. An attempt is being made in the latest pattern frames to place the rider more midway between his wheels, and no doubt the long frame is an improvement in this respect. If the rider and crank bracket could be brought forward without throwing the front wheel also further forward, the ideal position would soon be attained, but unfortunately this cannot be done, and the gain in distribution of weight in the long frame, is therefore, only slight, and got at the expense of neatness and of lightness or rigidity.

"Now let us take the same wheels, say 30 inches and 28 inches, and drive on the front wheel, and what do we get? (1) A neat, light, dust-proof gearing concealed in hub, and weighing, with cranks and bearings complete, about 6 pounds. And to set off against this, we save the chain bracket and chain wheel complete, the back hub and chain wheel complete, the chain, the chain adjustment, and the chain guard; or for 1892 Harrison Carter's chain case, which, I am sure, will be a *sine qua non* on all the best machines. And let it be understood that I am not assuming that the Crypto is the only gear that can be used, though I naturally think it will be hard to beat. (2) The frame is the simplest that can possibly be conceived, viz., the ordinary type as against the complicated frame of the chain Safety. (3) The rider is at once placed in the very ideal position, viz., midway between the wheels, and as a consequence he gets only half the shock from each. (4) The machine is much more compact. Instead of being six feet or more in length it is only five feet. (5) The steering and driving being on the same wheel, there is a feeling of unity between man and machine which is impossible with the rear driver. There will also be far less tendency to slip on greasy roads. Against all these advantages the only drawback I can discover is the tendency (common to all front drivers) for the front wheel to slip round in going up a very stiff incline. This so rarely occurs as to be hardly worth a moment's consideration."

Right in line with this invention is an American chainless Safety of yet more original character. "Its entire weight, stripped of mud guards, for heavy road use, suitable for a two hundred pound rider, is twenty-seven pounds, it being possible to make the weight of this machine fully ten pounds less than the rear driver by doing away with sprocket wheels, chain, crank hanger, etc., etc. The machine has 30-inch driving wheel, geared to 60 inches, and a 26-inch rear wheel. It is fitted with either cushion or pneumatic tires. The position of the rider is identically the same as on the improved model of English Safeties, the saddle being in the exact position relative to the pedals as on the Humber.

"The Chainless Telegram is bound to develop a great deal of speed. The fine construction of the front hub will be readily appreciated, as there are 172 balls used in it alone. The gear used was constructed and planned entirely by Mr. F. H. Bolte. The frame and other details are also his own design. It is easily steered with the feet on the pedals without making any use whatever of the handles, the same as on the

G. O. O. It is unquestionably superior to all other styles of geared ordinaries from the fact that the front wheel is only 30 inches, whereas the driving wheels of the English machines of this class are from 40 to



CHAINLESS TELEGRAM SAFETY—1892.

46 inches in diameter. By thus reducing the size of the front wheel perfect safety is insured to the rider, and the makers are prepared to furnish these machines with 28-, 30-, or 32-inch front wheels."

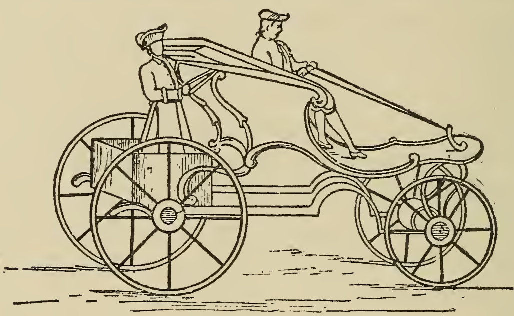
TRICYCLES.

TO the great majority of wheelmen of these latter days, there is but one type of cycle, and that cycle is the Safety; but under the general term "cycle" are likewise to be included both tricycle and quadricycle, and of these the tricycle has, in its day, played a most important part. In England its day is not entirely past, and it still appears there, though in a restricted sphere; but in this country it has almost entirely vanished from sight. This rapid disappearance of the tricycle is probably due chiefly to three causes, (1) the general wretchedness of our roads, nearly all of them being almost impassable for a three wheeler; (2) the comparatively small proportion of the population who have yet learned to use a cycle, those who have thus far learned being such as have felt sufficiently strong and ambitious to master a Safety; and (3) absence of such light tricycles as would compare at all favorably with Safeties, and be an inducement for anyone to use them.

These difficulties in the way of the growth of tricycling here do not exist in England, and tricycles keep a hold there. With the growth of the sport here, with an ever increasing number of elderly riders, and with the slow improvement of our roads, there will be a growing field for a really light tricycle built on modern lines, and one will be welcomed when its good points are once learned. Those who have never ridden a tricycle, and those who have never ridden any but some heavy machine of antiquated pattern, have no conception of its possibilities, or how nearly, *on good roads*, it is able to approach the bicycle. Its possibilities are shown by the facts that at both fifty and one hundred miles the tricycle records are faster than those of any ordinary bicycle, and for a twenty-four hours' ride it is but half a mile behind the ordinary. See tables of records, at the end of this volume. At the present, however, interest in the tricycle is chiefly historical, or perhaps antiquarian some would have it; but even here it lacks the interest of the bicycle, for it does not show the same course of comparatively steady development, and though it was designed (at least in a four-wheel form) long before the Celeripede and Draisine, it was not till about 1877 that any great effort was made to develop it. The term "tricycle" seems to have been first used in 1828, and applied to some three-wheeled machine.

Probably the first vehicle designed to be driven by its rider of which we have record is one described in the English periodicals of 1769. A writer in the *Gentleman's Magazine*, who signed himself "Hibernicus," then referred to it as having been mentioned by a professor in Trinity College, Dublin, three years before. Concerning it, the "Tricyclists' Vade Mecum" of 1885 says:

The machine described was a cumbrous affair, being merely a heavily constructed four-wheel chaise, the two front wheels of which were steered by means of a handle coming up through the flooring, and the two back wheels being driven by means of a pair of clumsy ratchet wheels on their axle. After explaining this, by the assistance of diagrams, "Hibernicus" continues: "The method of putting this chaise in motion is this: a person being seated in the body of a common chaise (which is placed in the usual manner on the springs) takes hold of the handle to direct it, while another person gets into the box, and, treading alternately on the planks behind, turns the pulley, which makes the plates of iron catch hold of the notches in the little wheels, and consequently sets them and the great wheels in motion, and forces the machine



QUADRICYCLE—1766.

along, quicker or slower, according to the rapidity of the motion of the person's feet who stands on the planks."

In the same month, August, 1769, an illustrated article appeared in the *London Magazine*, commencing, "the conversation of the public having been so greatly taken up with a machine to move without horses, we are persuaded the preceding plate, with the following explanation, will be not a little agreeable to our readers." Then follows the description of the machine referred to in the *Gentleman's Magazine*, concluding: "Thus you will readily apprehend that the footman putting his feet alternately upon either plank, one of the plates will turn one of the notched wheels. *For example!* If he leans with his foot upon the plank T, it descends and raises the plank S, which cannot rise, but at the same time the plate of iron that enters the notches of the wheel must needs make it turn on its axle-tree, and, consequently, the great wheels.

Then the footman leaning upon the plank S, the weight of his body will make it descend and raise the other plank T, which turns the wheel again ; and so the motion will be continued. You may easily imagine that, while the two hind wheels advance, the fore wheels must likewise advance, and that these will always advance straight, if the person that sits in the chaise manages them with reins made fast to the fore-beam."

As the driving wheels of this machine were fully sixty inches in diameter, and the footman who did the driving had to propel himself, the heavy "common chaise," and the man in front who steered, it will be easily understood that the "chaise to go without horses" would not be a practical success. The ratchet wheels being about eighteen inches in diameter as compared to the sixty inches diameter of the driving wheels, afford a remarkable instance of the ignorance which people in those days must have been subject to on the principles of mechanical power, the proportions mentioned exhibiting a very decided instance of "gearing up." Therefore, when these considerations are borne in mind, the concluding remarks of the writer in the *London Magazine* will be fully appreciated : "N. B.—The velocity of these carriages depends upon the activity of the manager."

The next record of early experiment is contained in the *English Magazine* for October, 1777, where, under date October 16, the following appears : "An ingenious Smith, at Newcastle, we hear, has invented a machine to go without horses, similar to a four-wheeled chase, wherein a person may travel at the rate of six miles an hour. It has been tried on the Moor, near Newcastle, and in the streets of that town, greatly to the satisfaction of the inventor ; and though it should meet with any obstructions in stony ground, it gets over these difficulties very readily. It has a saddle for a person to sit on who puts the spring in motion, stirrups to keep his feet from the ground, with a proper seat behind for a person to sit on, wherein the greater the weight is, the safety to the person is proportionable." From this it is open to doubt whether the machine was fitted with a coiled spring-motor, or whether manual levers were used.

Le Journal de Paris contained, on the 27th July, 1779, a description of a four-wheeled pedomotive, invented by MM. Blanchard and Masurier ; but this, like its forerunners, was a clumsy contrivance,and was never regarded as anything but a toy. A similar result appears to have attended upon ensuing experiments, and even as late as a year or two ago, mechanics have employed their leisure time in devising four-wheeled velocipedes, of more or less faulty construction, without success.

No mention is made, in any known book, of a *three-wheeled* velocipede until 1839, but in 1819 the introduction of the two-wheeled " hobby-horse "—the progenitor of the modern bicycle—appears to have led to three-wheelers being made on a similar principle, the rider sitting astride a crudely formed bar, which rested in front at the top of a fork containing a wooden wheel, and at the rear on similar forks holding two wheels abreast. This is exemplified in a caricature by T. R. Cruikshank, "published by Sidebotham, 287 Strand, 1819." In this there appears no arrangement of cranks, the motion being obtained by the rider striding along the ground, partly seated on the bar, which thus served merely to enable him to take long strides.

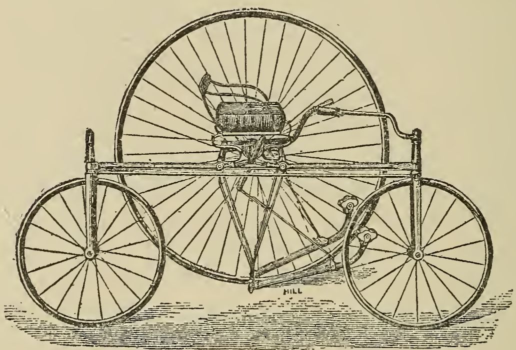
Another print, "published May 21, 1819, by J. Hudson, 85, Cheapside," is the earliest record we possess of a genuine pedomotive tricycle ; the note at the foot saying : " The principle of this machine consists in two boards acting on cranks on the axle of the fore wheel, in a similar manner to those used for the purpose of turnery, and is accelerated by the use of handles, as represented in the plate ; the direction is managed by a center handle, which may be fixed so as to perform any given circle." The front (driving) wheel of this machine is represented as of about three feet diameter, and the rider is a lady. That this machine was actually made and ridden seems confirmed by another print, "published May 22, 1819, by T. Tugg, 111 Cheapside," which is practically of identical design with the one published in the same street only one day earlier.

A great many other prints published in 1819 caricature the same kind of machine, so that it appears conclusive that this was the year in which crank-action tricycles originally appeared. Various magazines, too, noticed the invention of similar machines ;

one published in 1839, gravely portraying a lad driving (?) a tricycle, whose wheels were about eight or nine feet in diameter, the cranks here being attached to foot-boards, similar to those used upon the tinker's grinding-trucks to this day. *The Great Western Magazine*, in June, 1863, published an article on "Velocipedes," from which we extract the following: "Toward the close of last summer, two gentlemen of Bristol, declining for the time the facilities afforded by the Great Western Railway, journeyed up to the Great International Exhibition, from that ancient city, on those machines popularly known as velocipedes.". This would appear to have been the first velocipede tour on record, but whether the machine under notice was a three or four wheeler does not transpire.

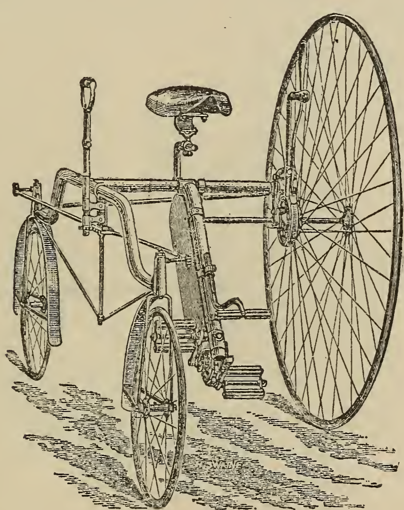
But the actual origin of the tricycle of to-day must be traced to the bicycle. The original two-wheeled velocipede, introduced into this country from Paris in 1869, of the pattern which is now denominated a "boneshaker," had been gradually and steadily improved to such an extent that the pastime of bicycle riding had established itself on a footing in the front rank of British sports, and the great advantages of this method of locomotion came to be so widely recognized that a want grew up for some vehicle which, while possessing the locomotive powers of the bicycle, should be free from the peril attaching to the riding of a machine of that nature. The element of danger which was, and still is, to a certain extent, inseparable from riding the bicycle, might possess a charm for young men with few responsibilities, but among middle-aged men there were considerations which made the possibility of meeting with accidents a contingency to be avoided; beside which, the necessity of acrobatically mounting and balancing a bicycle made it unsuitable for those who had passed their youthful days, as well as for even young men who did not care to run the risks and endure the inconveniences of bicycling. In addition, there was the fair sex to be provided for, and although a few very daring young ladies were found willing to learn to ride a sidesaddle bicycle, the position thereon, and the restriction to one foot for working the machine, made such a performance more of the nature of a circus-trick than of practical bicycling for utility and pleasure.

Therefore, it was not long before mechanical inventors turned their attention to producing a machine which should possess all the good and none of the bad qualities of the bicycle. The invention of spider-wheels, and iron and steel frameworks, replacing the cumbrous and fragile wood and iron "boneshakers," gave inventors of tricycles a vastly better groundwork upon which to build up their ideas ; and after several unsuccessful efforts had been made to produce a three-wheeled velocipede worthy of notice, the machine which can be said to have been the forerunner of modern tricycles appeared in 1877. [It has, however, been recently claimed that



COVENTRY LEVER TRICYCLE.

"a ball-bearing tricycle, with wooden wheels and iron tires, was constructed and ridden continuously in 1867. The inventor's native place is known, but his name remains in obscurity, though a direct photograph of the machine and rider prove it to be genuine."] This was called The Coventry Tricycle, [designed by Starley] and was made by Haynes & Jefferis, of the Ariel Works, Coventry. Its general outline was, and is to this day unique, the large driving wheel being placed on the left side of the rider, while two steering wheels, of equal diameter, were hung in forks placed at the extremities of a horizontal bar, which ran from front to back on the right side, the steering being effected by an arrangement of levers, which caused these small wheels to turn with their forks simultaneously in opposite directions. The power was applied to the driving wheel by means of levers, and so successful was this machine that the original pattern is still made, with merely a few alterations in details, although modern developments have induced the present proprietors of the machine to bring out an alternative pattern [the Coventry Rotary], in which a rotary motion of the pedals is substituted for the reciprocating motion of the levers.

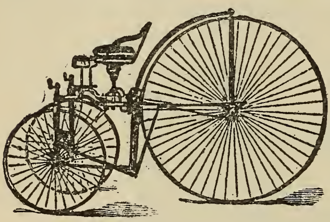


COVENTRY ROTARY TRICYCLE.

Still, in all the patterns the original design of the general outline of the machine has been adhered to, and to this day [1885] it is the best single-driving, two-track machine known, and one of the fastest tricycles in the market.

The Dublin was one of the earliest introductions, but was very little known, being made in Ireland, and not pushed in other countries. Its general plan was peculiar, two small wheels running abreast in front, and the large driving wheel, centrally, behind the rider. Levers for both hands and feet were provided, the steering being effected by means of a small winch gearing on one of the manual levers. This pattern was also adopted by Messrs. Singer and Co., of Coventry, who introduced the Challenge tricycle, worked by foot levers only, and steered by handles which surmounted the forks of the two front wheels.

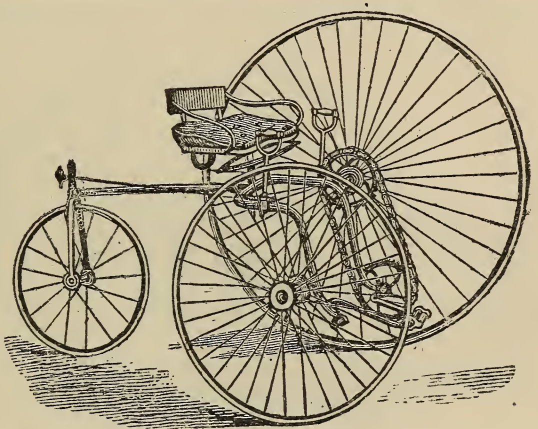
Several attempts were also made to revive the old style of boy's tricycle, of the type resembling a bicycle, but having two back wheels. It was thought that the elimination of wood in favor of wire and rubber for the wheels would make this a useful pattern ; but in practice it was found that, although the two back wheels would, by their great width apart, give a certain amount of stability to the machine, the tipping up of the outer wheel in turning corners was a fruitful source of danger, and the style has never been popular except for very small children's toy tricycles.



CHALLENGE TRICYCLE.

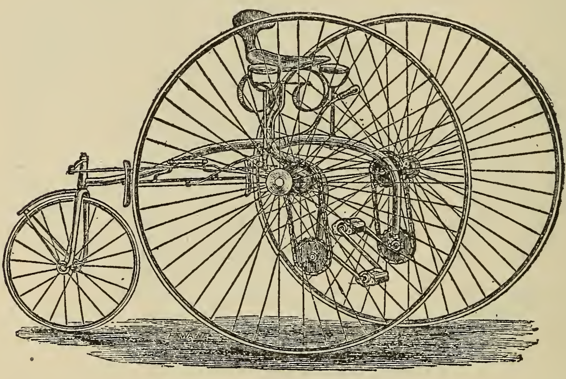
A peculiar type of machine, produced about 1879, had three wheels of different sizes, the driver being large, and the other wheels smaller, in order to reduce weight, and was known as the "one, two, three" tricycle, and is seen in the Excelsior. In it "one large driving wheel at the left side faced, on the rider's right hand, a wheel about two-thirds of the diameter of the driving wheel, a small steering wheel being attached by the ordinary fork to the extremity of an arm running backward from the center of the main framework ; thus the steering was done behind the rider, and the front left open." This type of frame was known as the "hayfork." The machine was said to weigh only eighty pounds, but certainly was heavy running for that weight, though in its day it was a noted and successful mount.

A similar frame of the "hayfork" variety is found in the machines of the pattern sometimes called the "reversed bath chair." These were open-front, rear-steering machines, and were extremely popular about 1881. At first, nearly all were single driving; but later double driving was introduced, and is found in



Excelsior Tricycle.

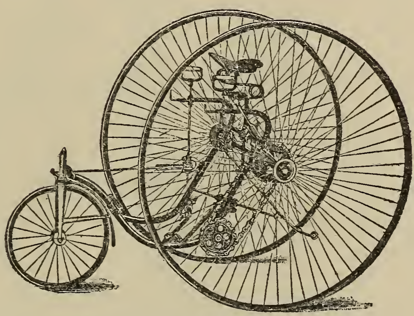
the Cheylesmore, which is an excellent type of this class, as well as one of its most popular varieties. The Cheylesmore tricycle was "an open-fronted double driver, being driven by means of clutches incased in neat boxes on the crank shafts. These are connected to the axle by means of two chains. At each end of the pedal shafts the clutches are keyed on to the axle, and each clutch has four teeth, *vide* illustration, which jamb four small rollers against the chain wheels, and thus the power is transmitted to the driving wheels. The pedals act as foot-rests, resting in any position the rider desires while the machine continues to travel. A powerful double-lever spoon brake is supplied, called the patent spring lever, which, when gently applied, acts from the center of the double spoon; and the harder it is applied, the firmer it grips, until, when it is full on, there is a bite on the wheels of fully four inches, which is sufficient to stop the machine dead on



CHEYLESMORE TRICYCLE.

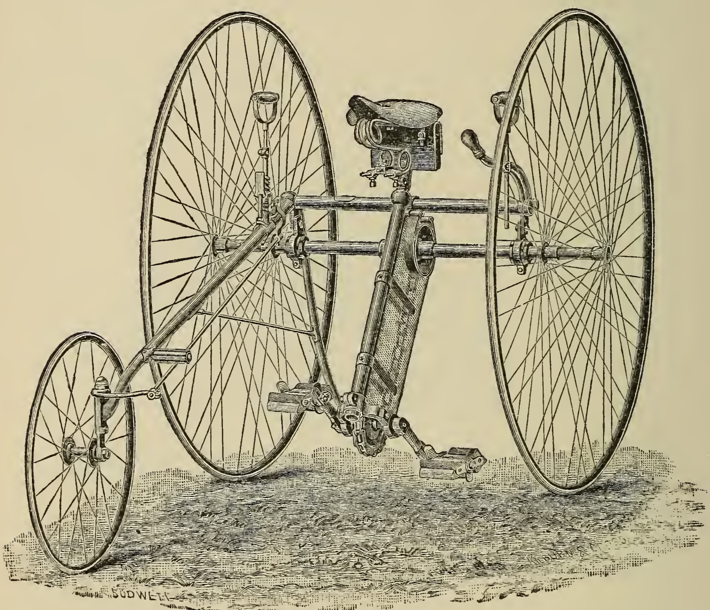
the steepest decline. The steering is improved rack and pinion, while patent adjustable ball bearings are fitted to all wheels. The frame of the Cheylesmore has been altered and the backbone lengthened and tubing used. The forks are bent more inward, the crank shaft bearings being fitted to the bottom of the forks and rendered self-adjustable. This end is obtained by means of allowing the neck of the chain wheels to protrude up the forks, and these are held in place by a screw, thus making the action more vertical; adjustable handles, and a patent sliding saddle are supplied, so that a rider, while traveling, can shift his position, forward when going up hill, and backward when descending—this latter helping to keep the steering wheel steady, in fact, making it almost as safe as a front steerer."

The front steering tricycle of what was sometimes called the "bath chair" pattern soon became a popular style, the "name being given to the class of machine



LOOP-FRAME TRICYCLE.

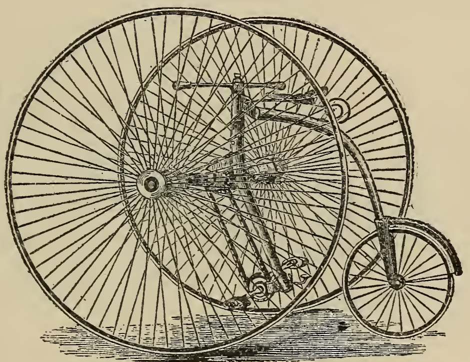
whose general outline resembles that of a bath chair, two equal-sized wheels running one on each side of the rider, with a steering handle, exactly similar to that of an invalid's bath chair, actuating the small guiding wheel in front. Several variations of this style of machine were introduced with indifferent success, notably the Centaur, Premier, and Coventry Express, but the machine which made the first sensation in this direction was the Salvo, invented by Starley Brothers, of St. John's Works, Coventry. Originally it was introduced under the title of The Salvo Quadricycle, it having in fact four wheels; but it was essentially a tricycle, the fourth wheel being carried clear of the ground, and only serving as a preventive of the rider tipping over backward; literally, therefore, 'quadri-



TWO-TRACK TRICYCLE.

cycle' was the correct name for it; but as there were never more than three wheels on the ground at once, it was, and is, rightly classed as a tricycle; and since, among other recent improvements which the machine has undergone, the size of the rear safety wheel has been materially reduced, the long name has been abbreviated, and the machine is now known as the Salvo Tricycle."

This type of tricycle had large driving wheels—48 or 50 inches, a front steering wheel of about 18 inches, a side steering handle; the chain was placed at one side; they were double driving, and the frame was of the "loop" variety. Several machines of this type were built in this country, such as the Victor, Columbia, and Otto. At a little later date, the frame

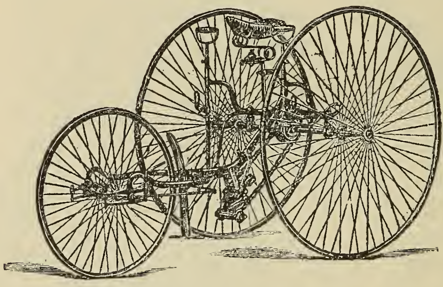


HUMBER TRICYCLE.

of this type was somewhat modified, and instead of the large "loop," a single tube was brought down and forward from the center of the axle, under which the chain was carried, so that the machine was "central geared," and the frame was T shape.

A modification of the usual pattern of front-steering machines placed the steering wheel in front of the right-hand driver, so that the machine had but two tracks instead of three; had a good open front, and could be built lighter This variety has also been popular, and was built in this country by Messrs. Gormully & Jeffery and the Pope Manufacturing Company.

Another type of machine which acquired great popularity, and was very successful in its day, was the Humber. This has been described as "a bicycle with two front wheels, and driven by a chain, so that the center of gravity is kept low. Both the large wheels, which are placed in front, drive, and both steer, the latter being done by means of a cross handle as with

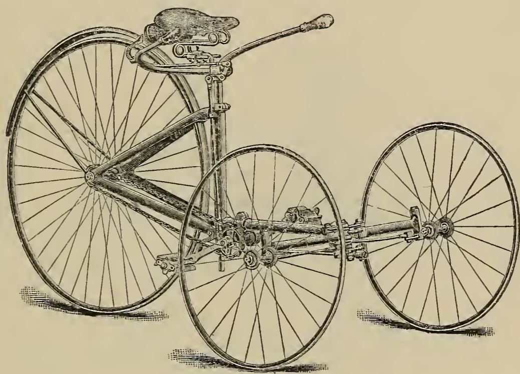


QUADRANT TRICYCLE.

the bicycle. The main features of the machine are that the position when riding and the action of the muscles are almost identical with those of the bicycle, while, when thoroughly mastered, it is as obedient to the will of the rider as the bicycle itself, and is simple in construction and easy in running, the main points against the variety being the time necessary to master its peculiarities, and its erratic and dangerous behavior when descending hills, unless in very careful or experienced hands."

This variety of tricycle, though very popular for a time in England, was not extensively used in this country in its single form; but in its double form, as a tandem, it was considerably used, and is described in another chapter.

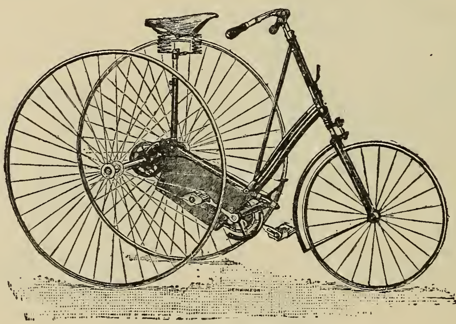
In front-steering tricycles, as shown in the illustrations, the steering wheel was small and the wheel base very short. In the Quadrant, some change was made in both these particulars, the steering wheel being increased from 18 to 26 inches, and the wheel base



SURPRISE TRICYCLE.

somewhat lengthened. The chief peculiarity, however, was in its steering, which gave the name to the machine. The central tube of the frame runs forward, carrying wide horizontal forks which "converge until they reach the center of the steering wheel. Here they end in oblong slides curved toward each other so as to form quadrants or quarter circles. The wheel axle is long, and runs in bearings which work in these slides. Below the center of the straight cross tube of the frame a long bar pivots, the ends of which are connected by hinged rods to the extremities of the steering axle. A rack and pinion steering rod actuates one end of the pivoted bar, and thus, drawing one end forward and forcing the other back, causes the wheel to turn as desired."

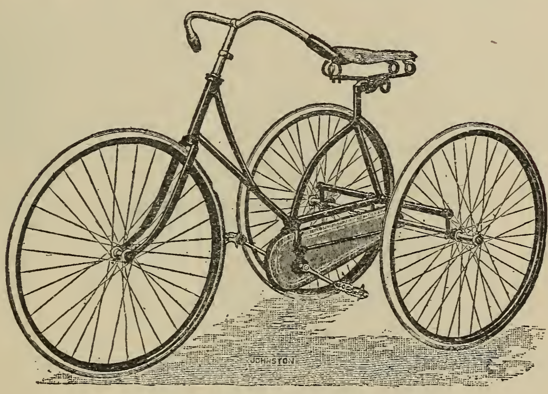
A type of tricycle suggested by the success of the rear-driving Safety is shown in the Surprise, which has a fairly large rear driving wheel, and two small front steering wheels. The type generally known as the



CRIPPER TRICYCLE.

Cripper is one of the later and most successful patterns of tricycles. It had 36- to 40-inch drivers, and 18- to 20-inch steering wheel, and a sloping steering post carrying handles at its top, so that bicycle steering was secured. It had a drop frame, suitable for ladies' use, as shown in the illustration, or a high frame with a tube running straight across from the seat pillar to the steering post. A strong spring held the steering post firmly, so that the steering wheel ran in a straight line, except when deflected by the rider for steering purposes, and always returned again to its position when pressure on the handles ceased. The chain was in the center, and the driving gear at one side.

The last change in tricycles must be regarded more as a modification of the Cripper type than as a new introduction. It consisted in equalizing in size the three wheels, and discarding the spring which partially controlled the steering. As to wheels, the change even went so far as to make the drivers smaller than the



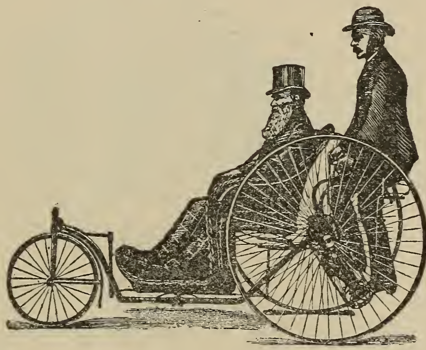
DIRECT-STEERER TRICYCLE.

steerer; the wheel base was also lengthened, so that the rider sat somewhat in front of the axle, which was now bridged, and had three or four bearings; and the frame was altered and simplified, in some cases following very closely that of the diamond frame Safety. So far as tricycles are now built, they are of the direct-steering pattern.

Beside these distinct patterns of tricycles, every one of which, except perhaps the old Challenge, has had a longer or shorter but a decidedly successful career, there are three patterns, adapted to special uses, which have become standard in their respective spheres. The Velociman was first built in 1869, and is still

VELOCIMAN.

manufactured. It is for the use of cripples. The driving wheels "are connected by means of a main axle, and these are again connected by means of a small chain to a double-cranked shaft to which the propellers or hand levers are attached, and to which also the foot lever is connected, all working together. The machine can thus be driven by a combination of hands and feet, or by the hands without the feet, or *vice versa*. The handles are worked backward and forward, and the steering is done by means of a pad at the back of the seat," the machine being a rear steerer, and the steering rod being attached to the semicircular

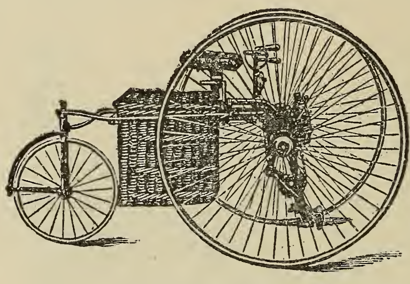


COVENTRY CHAIR.

back-rest. In order to steer, the rider simply inclines his body in the direction he wishes to go.

The second pattern is that of a chair in which an invalid sits, and is propelled by a rider who is seated behind him, tandem fashion. The chair is of easy shape, and fitted with springs which render it very comfortable. In this machine, and in the following one, some of the more intensely practical possibilities of cycling are shown. The introduction and maintenance of such features are valuable aids in establishing the sport upon a permanent basis, and demonstrating its utility as well as its pleasure.

The third pattern of tricycle having a peculiar sphere of its own is the Carrier. It may be a tricycle of almost any type, with the frame so extended or shaped as to enable it to carry a basket for the transportation of merchandise of any sort, such as the mails, newspapers, parcels, or such light articles as are commonly



CARRIER TRICYCLE.

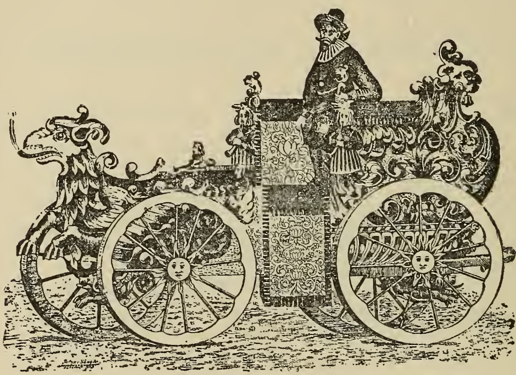
delivered by wagon. For these purposes the carrier tricycle has considerable use in England.

In addition to the standard types of tricycles shown in this chapter there have been produced, at one time or another, many machines containing slight variations of all sorts, but generally of minor importance, and others containing radical departures from accepted lines. Pretty much all that was good in design, however, found its way into some of these standard types; but some of the more "original" productions are interesting, and find appropriate place in the chapter on Peculiar Cycles.

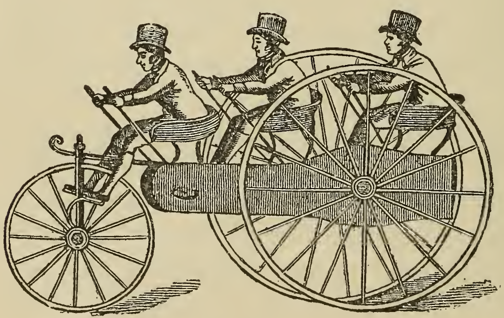
SOCIABLES AND TANDEMS.

THE pleasures incident to cycling, like those attendant upon almost all forms of recreation, are much enhanced by securing agreeable company, especially if the riders are equally well mounted and accustomed to travel at about the same speed. In the early days of wheeling the average tricycle was heavy and cumbrous, and when one's companion was a lady, having a heavy mount, the rate of progression was necessarily slow. There was, therefore, much to be gained if there could be built a double machine which would be but little heavier than a single, and, at the same time, give the stronger rider a chance to do half (or more) of the work of propulsion. So, soon after the tricycle assumed definite character, attempts were made to add a second seat, and so secure a double machine.

But even at much earlier dates, when there were in vogue all sorts of odd contrivances, built on unmechanical principles, three and four wheeled vehicles, intended to carry several riders, were designed. These machines carried different numbers, up to nearly a dozen persons, in some cases. "The Beaconsfield, for five," says H. H. Griffin, "had the front man riding the pilot-wheel, as on a bicycle; behind him, in a conveyance of ample proportions, supported by two large wheels, sat four men, who were working, by hand power, a swinging bar. The result was akin to trying to eat a bantam's egg with a soup ladle. There was a vast waste of power; the bar did not



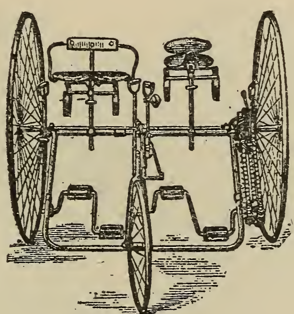
require five per cent. of the force applied, and the pace was painfully slow. In a trial against time, five of us working, we occupied over seven minutes in rid-



ing a mile on a cinder path. Had the machine been geared up highly, a good pace could have been got out of it."

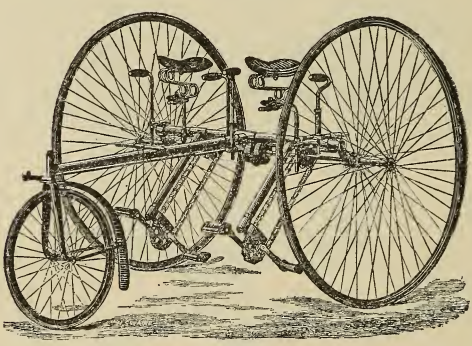
There were, it would appear, many other machines of unique character, fantastic design, and peculiar construction, of which we have little definite information either in the way of illustration or description; but, as new facts concerning these curiosities are continually coming to light, it is probable that additional information will ultimately be obtained. Illustrations of two of these curiosities are here given.

Coming down now to the modern tricycle, we find that nearly every one of the principal types was



Loop Frame Sociable.

brought out in a double form, while some were built so as to carry three or four riders. The loop frame sociable here shown has 44-inch driving wheels and a 22-inch steering wheel. The riders sat side by side; both pedaled, and the left-hand rider steered. Such machines were usually geared low, and weighed about 150 pounds. It will be seen that this particular machine has the unusual feature of two chains, by the use of which two distinct gears could be used, a high one for level roads, and a lower one for hills—a great advantage on so heavy a machine. The change of gear was effected "by working a small lever, acting in connection with the box on the axle. This box is in three parts. The two outer portions have each teeth notched internally, while the middle one is plain. By moving the small lever downward it forces a pawl into action, which catches the teeth on the disk nearest the driving wheel, and then the machine is driving the full height of the driving wheel. By moving the lever upward, the same pawl operates on the toothed wheel

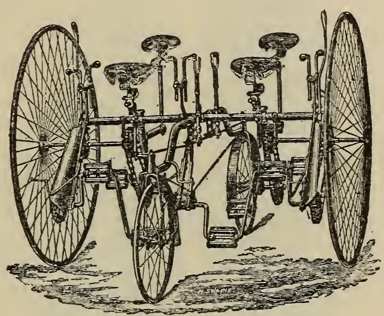


T-FRAME SOCIABLE.

nearest the rider, and the machine is then driving equal to a 38-inch wheel. The lever can then be moved to the center, which position leaves the pawl in the center of the middle portion of the box, so that the wheels run free, neither side driving, and the pedals act as foot-rests. The whole arrangement is extremely simple, and it is impossible for any of the parts to become disarranged."

A central geared sociable with a T-shaped frame was another principal type. It had 46-inch driving wheels; a 22-inch steering wheel; a horizontal T frame, and a central gear for each rider. This made a lighter, and a rather neater-looking machine than the loop-frame pattern.

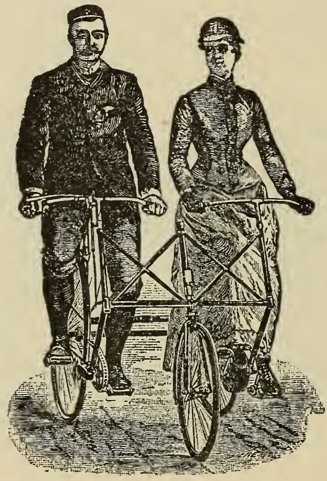
The Coventry Rotary, already shown in its single form, also figures as a sociable, a four-in-hand, and a tandem. As a sociable, the cross tube of the frame is merely doubled in length, so as to carry another driving wheel at its other end, with an additional



COVENTRY CONVERTIBLE FOUR-IN-HAND.

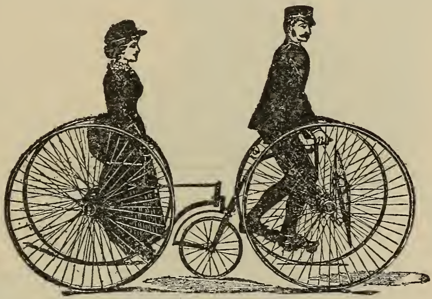
saddle, chain, and pedals. Instead of illustrating that, the Four-in-Hand pattern is shown, as it is really the sociable, with an additional tube behind each saddle, so that two more saddles can be added, together with the chains and pedals necessary for the third and fourth riders. The Four-in-Hand also presents almost exactly the appearance of two Coventry Rotary Tandems placed side by side.

About 1885, the sociable, with its heavy weight, clumsy action, and slow speed, gave way to the much lighter, more convenient, and faster tandem, and in a few years became a creature of memory only. In 1889, however, old riders were brought face to face with recollections of earlier days by the production, by two or three houses, of sociables built on new and much improved lines. The great feature of these new patterns was that each rider sat over a small driving



NOTTINGHAM SOCIABLE.

wheel, instead of both sitting *between* two large wheels. The new machine had thus a track of but 30 inches, instead of 51 inches as formerly, and was also much lighter, more manageable, and faster, small geared-up wheels taking the place of the large geared-down drivers which were used on the early patterns. "The rear part of the machine is, practically, two Safeties with 30-inch wheels, joined by a long axle and bridge, which is joined to the axle by two bearings, near the wheels. Nearly the whole of the weight resting on this part, the bridge is very strong, having in the center a third tubular seat-pillar—only used when the machine has to be ridden by one rider as a single tricycle. Both wheels have upper and lower forks, joined by an arched tube, which also answers as a mudguard. Following the curve of the wheel, the saddle-stems are slightly cranked, so as to permit of adjustment and centralize the weight; but the saddle



CONVERTIBLE SAFETY TANDEM.

is over the wheel, in order not to interfere with the pedal action. Over the left wheel is placed a large wire guard, in order to render it suitable for a lady."

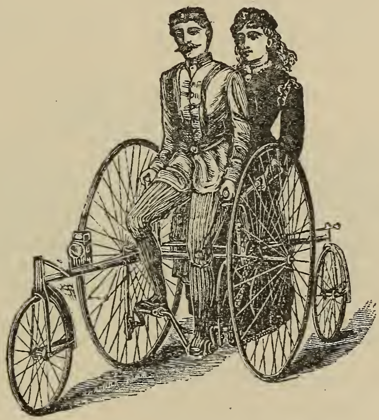
The sociable, excepting perhaps the type last described, had been a slow, heavy, clumsy affair, and one that riders could not but weary of; so the introduction of the tandem was a great boon, though there were some people who objected to it on the strange ground that the riders sat too near to one another. This was scarcely true, however, of those early attempts at tandem-making which consisted in joining together two single tricycles by means of a coupling or connecting bar. But this system was merely a makeshift, designed chiefly for those who already owned two tricycles.

In this tandem, the front part shows a Humber tricycle, and the rear part a central geared, front

CLUB CONVERTIBLE TANDEM.

steerer. In the Club tandem, also convertible, there is a compact frame, the front portion being on the lines of the usual central geared front steerer, and the rear portion being a part of a Humber frame attached to it. This machine was made so as to remove the rear part and leave an ordinary front steerer, or so as to remove the front part and leave a Humber pattern tricycle. The other tandem had five running wheels; this had four.

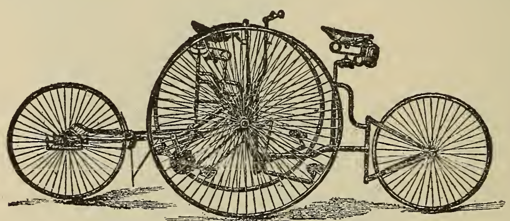
Another convertible tandem of the kind using superfluous wheels, like the two already described, was the Royal Mail. It was essentially a simple two-track tricycle, with a horizontal tube running to the rear on



Royal Mail Convertible Tandem.

the left side, similar to that running to the front on the right. The small steering wheels were connected, so that the front rider controlled the steering. One chain connected the two-crank shaft and axle; the second seat arm and resting handles projected from the rail. It was two-track in both double as well as single form.

Still another four-wheeled tandem was an early pattern of the Quadrant. The later Quadrant tandem tricycle was a front steerer, built on the lines of their single tricycle, already illustrated; but the No. 9 was something of quite a different sort; having a unique combination of lever and rotary action. It was a "front steerer provided with two lugs on the seat rail, and to these lugs is attached by knuckle-joints (hinged horizontally) a small cross bar, having in its center a long curved tube, to which a trailing wheel is attached; bicycle handle bar for rear rider, and the rear pedals are connected by long levers to the front pedals, attaching themselves by a small knuckle-joint and



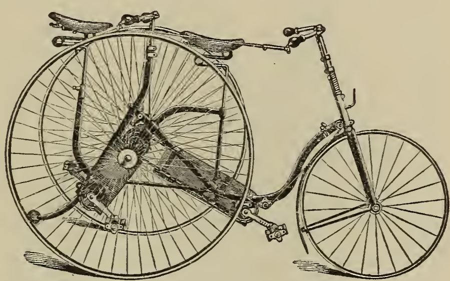
Quadrant No. 9 Tandem.

thumbscrew to a roller bearing on pedal pins—thus no second chains are required."

These four-wheeled tandems differed from one another about as much as they did from their three-wheeled relatives; but they constituted, to some extent, a class of their own, but one which never was remarkable for its success or popularity.

As the Coventry Rotary has been shown twice already (in its single and four-in-hand patterns) it is not necessary to illustrate it as a tandem. In this form there is, in fact, less change of appearance than takes place in any other machine when a tandem is made of it, for its frame lends itself easily to the doubling process. Two short tubes, running to the rear, carry the second saddle post and chain, and add little to the weight, while they also detract little from the appearance.

Among the first tandem tricycles a number had appeared built on the lines of the ordinary front-steering tricycle of the day, the frame being extended sufficiently to make room for the necessary additional parts. They were rather clumsy at first, but became more handy and convenient as the type on which they

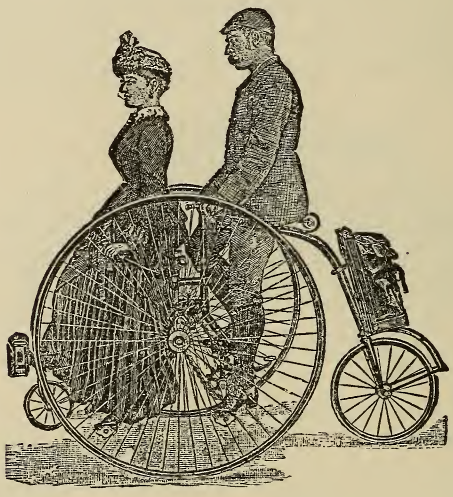


Cripper Type Tandem.

were based was improved. Those which were in effect an elongated Cripper tricycle were among the best.

The Humber pattern tricycle also lends itself very readily to the tandem form, as the additional tubing, chain, pedals, and saddle can be readily arranged for in front of the axle. In fact, as a tandem the machine runs much more steadily and pleasantly than as a single. It is the most easily propelled of tandems, and has a very delightful bowling motion closely akin to that of the ordinary bicycle. Its only drawback is that there is required a great deal of practice and experience with it in order to master it, and that it is so delicately balanced on the axle that the brake cannot be applied suddenly, and great care has to be exercised in descending steep hills.

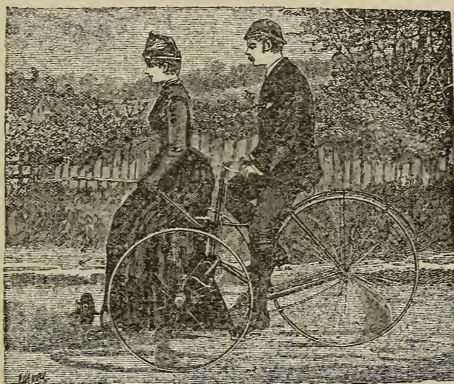
About the last type of tandem tricycle was one built on lines somewhat resembling those of the Surprise



Humber Tandem.

single tricycle. It had a single driving wheel in the rear; two smaller front steering wheels, controlled by the rear rider, and the weight of the riders was carried far enough back to make it a steadier and safer machine than the Humber type. It proved itself easy running, and very fast.

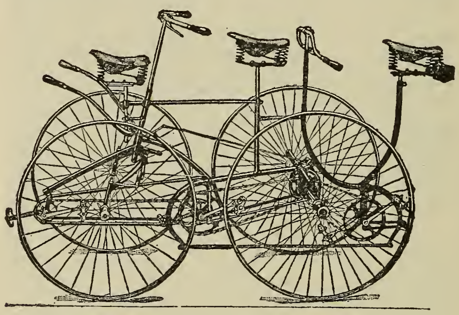
But the final invention in tandems having more than two wheels was the Triplet Quadricycle, which, as its name indicates, was a four-wheeled machine to carry three riders. "This machine," said H. H. Griffin in 1889, "is, without doubt, the fastest and safest tandem ever built, and in the latter part of 1888 several sensationally fast performances were accomplished on the road on it. In the standard the wheels are 30-inch rear and 28-inch front, the distance between the wheel tracks being 31¼ inches; total width, 37¼ inches; be-



Olympia Tandem.

tween wheel centers, 32 inches; the front saddle is 23 inches before the central, the back being 20 inches in rear thereof; between the pillars, 20½ inches. This placing balances the machine admirably. The foremost rider, who may be a lady, has regular Whatton handles. The pilot wheel axle pillars are held by a very strong tube, which curves forward and downward. In the center, a strong tube from the lower part of the steering pillar slants forward, and carries, at the extremity, the bracket of the chain pulley. From the upper part a stout tube runs rearward, and from the bottom of the bracket two stays run to the central tube, which curves over the central chain pulley.

"The secret of success of the machine lies in the way it adjusts itself to the inequalities of the road, and its self-balancing. If it were not so, the machine would not only be easily upset, but it would be 'pulled to pieces' on an uneven road. As it is, however, it is



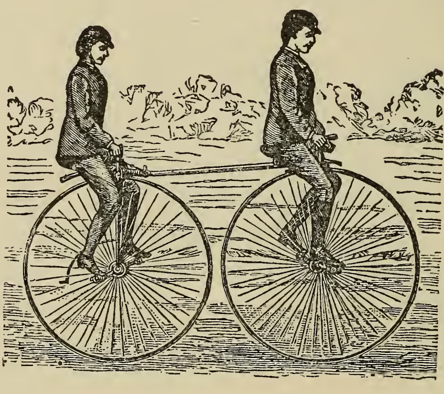
RUDGE TRIPLET QUADRICYCLE.

simply the safest cycle extant, and the front half may be almost turned on its side without in the slightest affecting the equilibrium of the rear portion. This is managed by hinging the middle of the arched tube carrying the front wheels to the center of the frame. The frame is well stayed in all directions by strong tubes between the pillars and stay rods below the frame, so that the whole is very rigid. The rear seat is supported by a tube curving backward, with a clear space between it and the steering pillar, so that it can be used by a lady.

"Steering is entirely under the control of the central rider, and the machine is very obedient, and can be guided with great exactness and ease. There is a powerful band brake—applied by No. 2 rider—or an auxiliary can be added for application by the occupier of the rear saddle. The main axle has a four-bearing bridge, extra strong, to stand the weight and strain of three riders. All three drive the one gear; from No. 1 there is a chain running round a smaller chain pulley—attached to the larger—on the central crank-axle bracket; a second chain communicates the combined power from these to the gear box, on which there is a second pulley, driven by No. 3 rider."

Before leaving the subject of tandem tricycles, the Victoria should be mentioned. It was formed by a system of joining together any number of Humber tandems which, when connected, formed one long serpentine machine, the steering of the whole being controlled by the front rider. With the passing away of the single tricycle before the resistless advance of the Safety, there seemed little hope for the continued existence of the tandem tricycle; but it held its own for a brief space longer, catering as it did to the needs of a special class, and then slowly disappeared. But there always existed interest in double machines, and some demand for them, especially while single machines were as heavy as the old tricycles. With tricycles, as has already been shown, it had been easy enough to produce a double mount, by simply widening the machine to place two seats, side by side, as on the sociable; or, by lengthening the frame, to place one seat before the other, as on the tandem. But the ordinary bicycle had presented a far more difficult problem. It was necessary to place one rider before the other, and that necessitated a long frame, and made both the balance and steering more difficult than on the single machine.

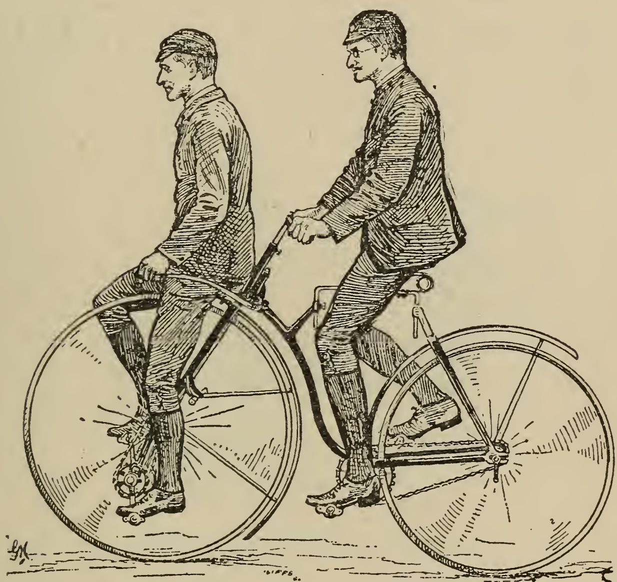
The form of tandem bicycle developed from the ordinary was a somewhat curious mount, and a not very practicable road machine. As shown in the illustration, the backbones and rear wheels of two ordi-



RUCKER TANDEM BICYCLE.

naries were removed, and their driving wheels were then connected by a bar. Both riders drove; but they steered independently, and the rear rider, in addition to preserving his own balance, was obliged to track with the leader. This was not always an easy task, and side falls could easily occur. In fact, there were so few advantages in this form of tandem, that it never became very popular, and has long since disappeared.

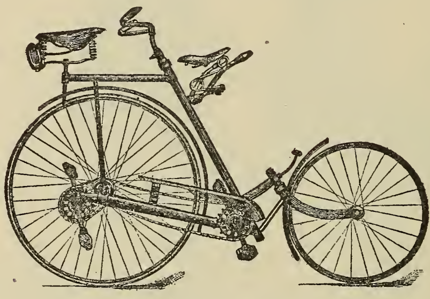
The success of the Kangaroo type, and its rapid rise into popular favor, caused attention to be turned to the possible development of a tandem from it, and experiments were made with this in view. They were not successful, however, and soon ceased, as the Rover



WILSON'S SAFETY TANDEM.

type quickly began to crowd the Kangaroo from the field.

With the assured success of the Rover, the tandem idea once more appeared. At first the simplest and most direct method of carrying it out seemed to be Wilson's plan of placing the second seat immediately in front of the handle bar, carrying curved handles around for the front rider and lengthening the front forks to carry chain wheels and chain in Kangaroo style. But this plan did not prove successful in operation, for, as Mr. Wilson himself says, "owing to the great rake of the front fork, the front rider's weight tends to turn the steering wheel violently out of a straight line and the rear rider is therefore compelled to use tremendous arm force in steering." Another tandem on rather exceptional lines was the Dart. It had a 32-inch driver and 24-inch steerer. The rear

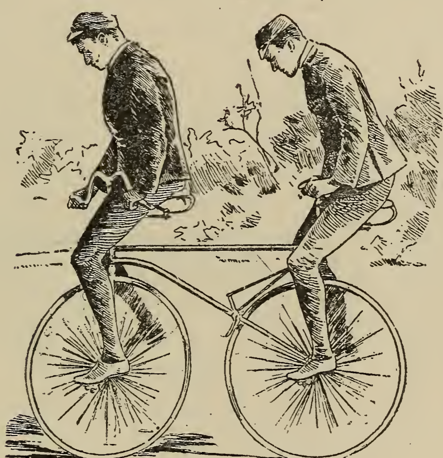


DART TANDEM BICYCLE.

rider sat over the driving wheel, a little back of its center, while the front rider sat just before it and on a few inches lower level. The rear rider had a short chain running back of the driving-wheel axles, something after the manner of the chains on the Kangaroo, while a longer chain for the front rider followed the lower part of the frame to the crank axle, which was situated midway between the wheels. A long, sloping steering post was connected by rods with the front forks.

Another pattern, in which two wheels of equal size are used, was described as follows in the *Bicycling World*, January 9, 1891:

"From the accompanying engraving one can get a good idea of the great compactness attained, and the small number of pieces employed, both of which have a tendency to reduce weight. To give an idea of its simplicity I have compared it with single wheels of several well-known makes, and I find it *several inches*



MULLER TANDEM BICYCLE.

shorter, and lighter than these singles. The tandem roadster of the Muller pattern has been given a thorough trial by many different riders in and about New York, and in spite of its 64-inch gear with only 5½-inch cranks, it climbed in good time all the hills ridden by the ordinaries and safeties, and went ahead of everything encountered on the road.

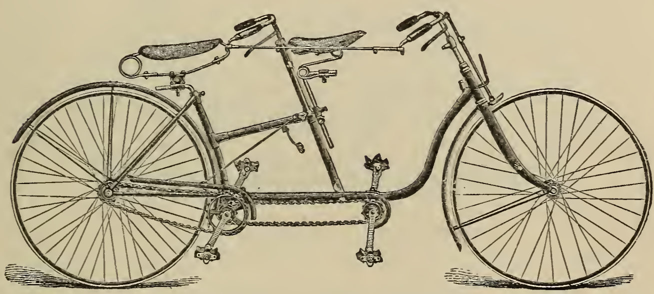
"The frame (on which Mr. Muller holds his patent) can be applied to any size wheel, and made its appearance about three seasons ago, when, fitted with two 56 Expert wheels, Mr. V. H. Muller and his brother rode it, defeating all tandem teams of prominence. Last spring they gave the frame a thorough trial on a pair of 50-inch Springfield Roadster driving wheels, and on it made a tour of Europe, where its novel lines attracted much attention among the cycle manufacturers. The Humber Co. made a heavy bid for the patent right in England, but the offer was refused.

"This season, the last and by far the most successful experiment was made in connection with a couple of regular Broncho driving wheels, and the machine as shown above is readily acknowledged to be the fastest, neatest, and most perfect tandem cycle ever produced. This opinion, as expressed by all who have seen or ridden the machine, is amply backed by the offer of a prominent manufacturer to pay seven thousand five hundred dollars cash for the patent, while another firm has gone even higher than this.

"The specifications are: Two 32-inch driving wheels geared to 64, with Broncho hubs; cranks 5 to 6 inch throw; tangent spokes; ⅝-inch solid tires; ball head; weldless, cold-drawn steel tubings, fitted throughout; cow-horn bars and spade handles. There are no chains, 'middle axles,' ratchet wheels, chain guards, mud guards, guard-supporting rods or handle-bar connecting rods. Nickel everywhere except spokes and rims.

"The machine has been ridden up and down curbstones and submitted to every practical test that could be suggested. Its appearance on the track will be made early next spring, and it is expected to prove as much faster than the chain tandem as the pneumatic is than the solid tire. Several photographs have been taken with Messrs. Muller sitting still on the machine without supports. Nearly all of the tricks that can be accomplished on the ordinary are as easily done on this, which is certainly a new departure in the tandem line."

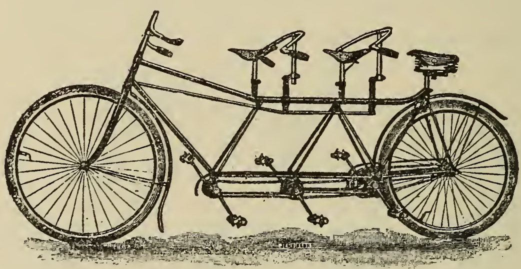
The development of the Rover type of Safety, however, soon showed the manufacturer a way in which



TANDEM SAFETY BICYCLE.

to design a tandem without departing materially from the usual Safety lines. This was done by simply lengthening the frame, so as to place both riders between the wheels of the machine. The rear portion of the frame was usually braced by a cross tube, or made diamond shape, while the front part was generally open in the style of the drop frame Safety in order to adapt it to ladies' use. These machines have had a fair demand, being very easy running and fast. A drawback to them has been that the steering generally proved very tiresome, particularly where roads were not good; and two single Safeties seem generally to be preferred to one tandem.

The last, and perhaps the most striking production in Safety tandems is the triplet safety—a machine claimed to be faster than the triplet quadricycle of the same house. On account of the length of the frame it is made on a sort of divided diamond pattern and can be ridden only by the racing sex. It is claimed that "it



RUDGE TRIPLET TANDEM SAFETY.

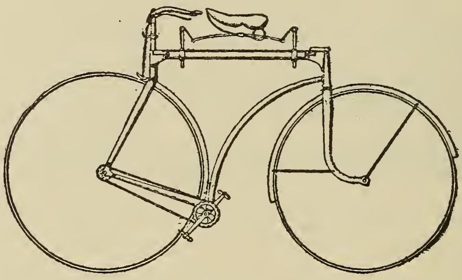
possesses great improvement in the steering apparatus. Instead of the usual bar being attached to each right-hand handle it is attached to the right-hand side of the fork of the steering pillar and conveyed under the backbone of the machine. It permits each rider to steer. The danger apprehended from a fall off a tandem or triplet through being caged in is thus done away with."

PECULIAR CYCLES.

IN treating of the development of the bicycle every change of type was described and depicted, and in describing tricycles and double machines the same course was pursued, so that each chapter shows, in connected form, the manner in which the latest types have been evolved. But there have been produced many machines differing from the standard types in some special features, or which were so original as to form special varieties by themselves. To have introduced all these into the preceding chapters would have overloaded them with matter not required to illustrate the development of the three great classes. They are, nevertheless, an interesting and important part of cycling history, and deserve careful attention, as they exhibit many features that have been regarded as important at different times, some of which, perchance, may appear at some future time as "original" inventions.

Some of the peculiar features of these machines are of marked value, while others possess only a fantastic importance. It is not difficult to distinguish between them. Some of the machines were successful and popular in their day, and some are still in practical use. Others, of more recent introduction, are in the market and have ready sale. Still others never were extensively manufactured, and have long since disappeared. They are arranged alphabetically.

The Acme Safety "consists of a 32-inch front driving wheel, a rigid fore-frame, a 30-inch rear steering wheel, and the rear fork hinged to the perch as shown in cut. The driving wheel being held firmly in line with the framing, it is claimed that the push of the rider does not throw it out of its course. The rear wheel is used as the steerer with the rear fork hinged to the perch far enough forward of the center of the rear wheel as to voluntarily follow in line with the front one when the machine is in motion. The



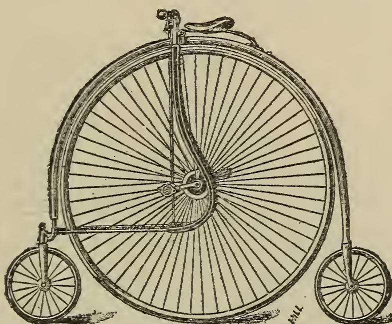
ACME SAFETY BICYCLE.

steering is effected by connecting the steering bar and rear fork by means of rods and links, the rods passing through the hollow perch. The links consist of two toothed wheels, one fixed firmly on the top end of rear fork and the other hinged on the rear end of the perch, both inclosed in a neat sheet metal case.

"In addition to the usual lever and spoon brake there can be placed on the crank shaft a drum and band brake operated by the foot. The saddle is placed on an elastic seat-spring which is suspended between two oscillating springs, absorbing vibration.

Ample means are provided for adjustment to suit riders of different leg measure. It is claimed that a bicycle constructed as above will run steady, and that a rider need not be an expert to ride with hands off the handle bar."

The Atlantic Special "is really a tricycle, as it has three wheels; but this is the only point of resemblance to the three-wheeler, as its action and management are almost identical with that of the bicycle proper, and

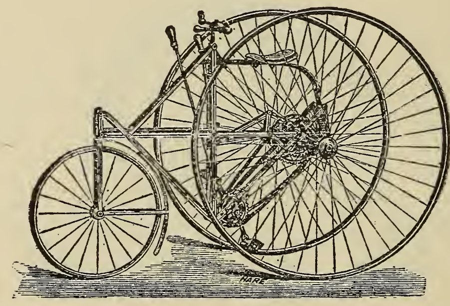


Atlantic Special.

indeed the makers consider it to be a Safety bicycle rather than a tricycle.

"Its outline and peculiar features can best be seen by reference to the above illustration. The front forks are raked slightly forward, and curve back around the bearings, below which they run forward horizontally till they clear the large wheel, when they end in a neck and centers, on which a small Stanley head and forks work. A second 'backbone' runs down in front over the large wheel, and is affixed to the steering connection by a stout spring which enables the front wheel to take the inequalities of the road. A rod depends perpendicularly from the steering handles to the horizontal forks, where it ends with a pinion wheel working a rack on a rod, and by that means turns the small front wheel as desired, the handles being kept fairly rigid by means of a stout spring."

The advantages claimed for this machine were immunity from headers; position directly over pedals; ability to stand still on it; and great brake power.



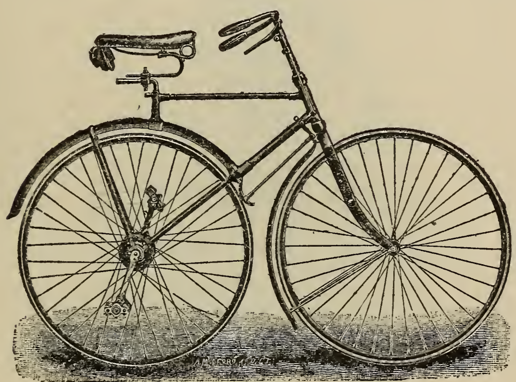
BERKSHIRE TRICYCLE.

Its steering was said to be somewhat peculiar, but easily acquired.

The Berkshire tricycle differs from all others in several features. "Both wheels are rigidly driven, both backward and forward, and in turning corners one is freed by moving a handle in connection with a sliding clutch. It has two speeds. The chain and driving gear are in the center, and the necessary two speeds are obtained by using two chains and two sizes of chain wheels on both crank and axle, throwing one or the other out of gear with a lever handle as desired."

An American safety bicycle of peculiar character was the Broncho. It was a chainless machine, the cranks being attached directly to the rear axle, in which was concealed the driving gear, which was the most curious feature of the machine.

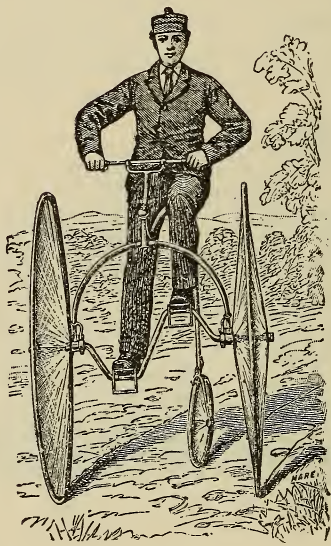
"The axle is in the form of a cross. There are four miter gears (good ones, as anyone can determine by putting one under a drop hammer). One of these gears is forced on and keyed to the left-hand ball case,



Broncho Safety Bicycle.

and of course is immovable. Another is forced on and keyed to the right-hand hub end and turns with the wheel, of which it is a part. On the arms of the cross of the axle are the other two gears, which are on ball bearings. When the axle is made to revolve these gears are carried around with it, and being in mesh with both the immovable gear and the one keyed to the hub, transmit one revolution to the hub by their motion with the axle, and also one revolution from the fixed gear in which they run, thus giving two complete revolutions to the wheel to one revolution of the crank and about five rods of air line to your opponent's four.''

To preserve the balance of the machine, it was necessary to place the saddle a little forward of the axle,

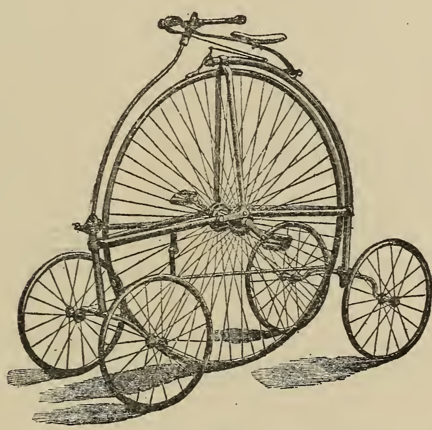


CELER-ET-AUDAX.

the result being that the rider was actually obliged to pedal somewhat in a backward direction.

The Celer-et-Audax was a direct-driven tricycle. It had 54-inch front wheels and an 18-inch rear wheel.

''The frame is simple yet peculiar. The large wheels face each other, and are connected by a double cranked axle and pedals. A tube forms an arch resting on the bearings at the axle ends. At the top of this the head is fixed pointing forward, while at right angles to it a backbone departs rearward, first rising high into an arch, and then dropping away to the rear wheel and fork as in a bicycle. The saddle is on the top of the arch. The rider sits on the backbone, and drives direct upon the axle. To steer he leans to whichever side he wishes to turn; this throws the



CENTER CYCLE.

backbone over, and pushes the outer wheel round. The rider steers by the inclination of his body only. It is also simple in construction, but requires more learning than the majority of other tricycles. When thoroughly mastered it runs well, and is a good hill climber."

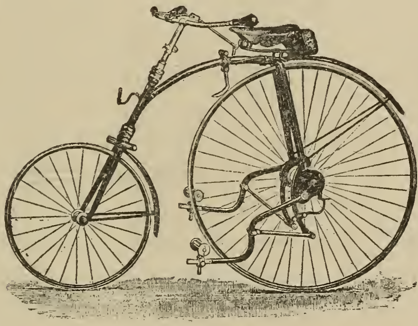
A very odd machine which was called the Center Cycle or Ideal, was commonly known as the "Octopus" or "Hen and Chickens." The term Center

Cycle obviously came from the central position of its large driving wheel.

"This machine is a curiosity, and something out of the common. The Center Cycle has four small steering wheels and a large central driving wheel, driving direct as on a bicycle, and the steering is actuated by a handle bar. The frame consists of three forks running right and left, and upward from the hub of the driving wheel; and these are connected on the one side to a curved backbone, and on the other to a short tube, to which a steering handle is affixed. A bow spring for saddle connects backbone and steering arm, and on this the rider sits. The lower part of the frame is jointed, so that a gymnast or equilibrist could jerk up the small wheels and travel on the central one, the small wheels tracking in a similar manner as the users of roller skates do, when adopting a leaning position."

Several types of bicycles were at one time built by the Claviger Cycle Co., some form of the Claviger driving gear being used on each. They possessed many original features. The driving gear was a combination of levers and gear wheels, the general principle being that of a lever with a movable fulcrum.

In the Hanger Claviger driving gear "the arrangement consists of a bracket brazed at one end into the lower end of the fork side, and carrying at the other end a stud, which is the fixed axis of the Hanger Claviger. The latter consists of a rod called the clavis rod, and a rod or link called the restraining arm. The two rods are attached to each other by a pivot. The joints are coned, and though the oscillation on these joints is very slight the cones allow of adjustment for wear and prevent rattle. The clavis rod is slotted at the end in order to allow the pedal to be adjusted to vary the length of stroke; the other end terminates in a boss, in which is cut a rectangular slot. There is also a small spur pinion, provided with a boss or projection on one side, which fits into the slot in the end of the clavis rod. A spur wheel is also rigidly fixed to the axle of the driving wheel by coned screws, so that it may be easily taken off for cleaning the parts



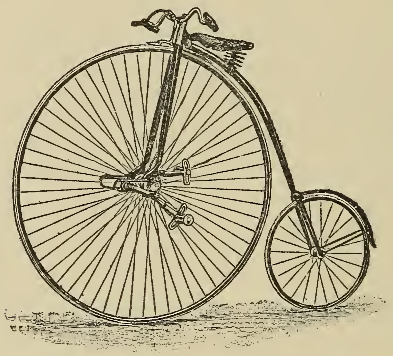
CLAVIGER MODEL B BICYCLE.

behind. The bracket is recessed and drilled, and forms a knuckle-joint for the bearing case. Between the spur wheel and the bearing case is a slotted radius arm, which is mounted loosely on a hardened steel bush or sleeve attached to the spur wheel, and to the axle of the driving wheel. A spindle having a fixed collar is clamped in position in the slot of the radius arm. The spur pinion is mounted upon the spindle, and is free to revolve upon it. The boss or projection of the spur pinion is passed through the slot in the end of the clavis rod, and secured in position by a washer and nut. The spur pinion is thus tied to the axle, and is held in gear with the spur wheel, while it is prevented from turning upon its own axis. When the pedals are operated the spur pinion makes half a revolution round the spur wheel for each stroke, and supposing the same tooth in the pinion remained engaged between the same two teeth in the wheel during the movement the driving wheel would be moved through half a revolution. But the pinion is locked to the clavis rod, and at the end of the stroke half the teeth in the pinion have been engaged with the teeth in the wheel, and the latter has been advanced to that extent more than half a revolution. Hence, if the spur wheel and pinion have each the same number of teeth, the driving wheel will make one revolution instead of half at each stroke of the pedal.

"It will be seen from the foregoing description that by loosening the nuts by which they are secured, the spur pinion or planet wheel can be readily taken out, and another with more or fewer teeth substituted, a supply of planet wheels of different diameters being conveniently carried in the tool bag. If the movement were to be directly connected with a crank so as to make even gearing, the return stroke would be inconveniently more rapid than the down stroke, as the latter would then turn the crank more than half a revolution. The effect of the sun and planet gear in connection with it is exactly the reverse, the result being that the up and down movement of the pedals is equalized. The larger the planet wheel, the more nearly equal they are brought. The nearer the fixed axis is brought to the axis of the driving wheel, the greater the ratio between the velocity of the down and up strokes. In this way a nice adjustment of the movement may be obtained to suit any size of driving wheel, and an average of four or five different-sized planet wheels; and by arranging for the return to be slightly quicker than the down stroke the two dead points may be thrown into the return stroke. The variation of force in this movement is less than with a rotary pedal. At the commencement of the stroke the power is transmitted for an indefinitely short distance by leverage alone, the clavis rod acting as lever, and turning slightly upon the fulcrum. As the stroke proceeds the leverage gradually diminishes, while the force transmitted by direct thrust gradually increases until at mid-stroke these two operations of the force are exactly equal. The process is reversed for the remaining half, and at the end for an indefinitely short distance the power is transmitted by direct thrust alone. For the thrust part of the stroke the pivot acts as guide, and is moved along the proper position for this function by the rod turning upon the fixed axis."

Another model of the Claviger, having a different driving gear, is built with a large front driving wheel. In it, "the pedal orbit is elliptical, without dead points, and within the wheel base. The main part of the stroke is in a straight line, almost vertically under the rider, but allowing for all the ankle action that can be put on at ordinary speed. The velocity of the pedal is so much less than that of the ordinary rotary as to give the impression that the machine is geared up."

In the Roller Claviger driving gear "there is a fixed bracket springing outward, forward, and downward from the lower end of the fork side (into which it is firmly pinned and brazed). The lower end of the part which forms a continuation of the fork side terminates in a knuckle-joint, and carries the bearings for the driving-wheel axle. Slightly forward of this the bracket has a projection or fork at each side, each terminating in a knuckle-joint, and carrying bearings which support the ends of a short spindle, to which the



CLAVIGER MODEL F BICYCLE.

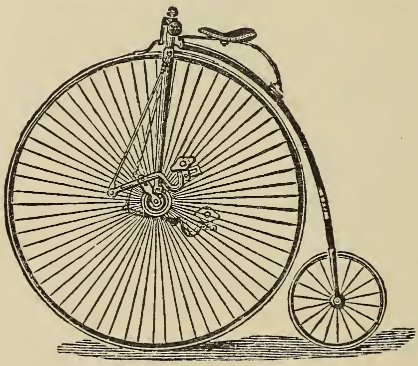
crank is rigidly attached. The backward face of the bracket, for about half the length at the lower part, is broader, and is finished with a flat surface. This forms a guide for the roller which bears against it. The crank spindle and the axle of the driving wheel have each a spur wheel rigidly fixed to them, and the centers are arranged so that these two spur wheels gear together. The clavis rod is bent, and carries a roller on a stud near the center. The movement represented is the normal form of this kind of Claviger—

that is, a line drawn from the center of the pedal to the center of the roller is equal to a line drawn from the center of the roller to the center of the crank pin, and both lines, being in the same plane, make a right angle at the center of the roller; also the center of the roller moves in a straight line, which, if produced, would pass through the projection of the center of the crank spindle. The length of the stroke is exactly equal to two sides of a square inscribed within the crank pin circle, so that with a crank of 5 inches in length the stroke is a little over 14 inches.

"During a complete revolution of the crank the roller moves up and down the guide a distance each way equal to the diameter of the crank pin circle. The directions of the motion of the roller and of the pedal do not coincide as to time, the roller being a quarter of a stroke behind the pedal. The stress of the pressure is against the bracket, in a direction perpendicular to its bearing face throughout the movement, both up and down. Unlike the Hanger Claviger, previously described, the two operations of the force (by leverage and by direct thrust) are not combined throughout the stroke. During the center of the stroke these two methods, by which the force is transmitted, are blended in the exact proportions required. The crank pin is adjustable, so as to allow of a stroke from 9 to 13 inches. It has very deep double ball bearings (3 inches from center to center) in a boss at the end of the clavis rod. The pedal is also adjustable vertically. The roller has double ball bearings. It is covered by a ½-inch round rubber tire. The roller is prevented from jolting about by a wire fastened into the bracket and passed over a groove in the roller, and just clear of touching it.''

The Devon bicycle much resembled an ordinary with peculiar driving gear, but it was called a Safety, probably because the power was applied at a point to the rear of the driving wheel axle—a feature which has been incorporated in other machines, and generally with the result of calling them Safety bicycles.

''To the sides of each fork a straight rod is attached, working at its top end upon a joint. In length, each



Devon Bicycle.

rod about reaches the bearings, and at its lower extremity a second rod is jointed. This second rod has attached to it, at about one-third of its length from the first, a socket and pin, the latter of which is provided with a nut, wherewith it is fastened to the crank end in the same way as an ordinary pedal; passing this point, the rod curves, dropping so as to form a U, the rearmost end of which carries a pedal. The side rods swing to and fro, and upon pressure being applied to the pedals they act somewhat on the lines of a piston and crank, and so work the machine. The advantage of this method of driving is that the rider can sit very much farther from the head and so obtain safety in riding, and at the same time have his pedals well beneath him with a nearly vertical tread. In point of manufacture it is a very well constructed machine, and is certainly considerably safer than the ordinary. The manufacturers also apply to this machine, if desired, a very neat and ingenious contrivance, by which the steering is effected by both wheels simultaneously, by which means the rider can take much sharper turns, and need only lean inward in turning one-half as much as with the ordinary machine."

The patent Disc wheel is an arrangement which has heretofore been discussed, but which the year 1892 promises to see for the first time in practical use. "The patent consists of making a wheel out of two sheets of thin steel, stamped out and brazed together with a hub in the center, the rim and sides being in one. In this manner a light and exceedingly strong wheel is made. The following are the acknowledged advantages of this wheel:

"1. The wheel being made of thin sheet metal, is very light, in fact, lighter than the majority of wheels at present in use; and anything to reduce weight in cycle construction is an immense advantage.

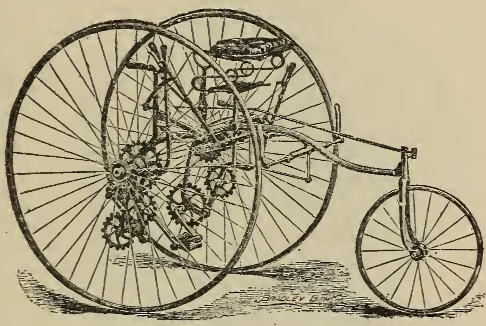
"2. Being without spokes, there is none of the trouble and cost arising from broken spokes. Any rider has had ample experience of the trouble and annoyance, not to mention expense, caused in this way.

"3. They are much faster than a spoke wheel, and for the following reason: A wheel with spokes meets with great resistance when traveling fast, since each spoke has to be driven against the wind; and although, perhaps, one spoke has no great resisting surface, yet, when one considers the great number of spokes in the two wheels of a bicycle, it will at once be self-evident that this resistance must be much greater than a casual observer could imagine. In Hide's patent Disc wheel this resistance is absolutely done away with, hence the increase of speed, and any device, however ugly, which can increase the speed of a cycle, even only a few seconds in a mile, is bound to be a tremendous success. One need simply refer to the pneumatic tires to bear out this assertion.

"4. The cost of manufacture will be considerably less than that of the present wheels. This speaks for itself, and no comment is necessary as to the advantage on this point. That this statement is correct is self-evident to anyone with only the slightest mechanical knowledge, after reading the process of manufacture described above.

"5. The wheels can be easily cleaned, and in a short space of time. At first sight this seems a doubtful advantage, but any rider who is not fortunate enough to possess the means to employ someone to clean his machine (and how many are?) will hail with joy a wheel in which no spokes have to be cleaned. To go over each spoke, and carefully wipe off the mud, and to fiddle about inside a wheel, cleaning the hub—is a task which very few, and then only the veriest novices, relish.

"6. There is no possibility of accidents through a stick or a stone catching in the spokes. Anyone at all conversant with cycling will be able to recollect how many accidents, and, unfortunately, in many cases, with a fatal termination, have occurred through 'something catching in the spokes,' and resulting in the accidents alluded to. Sticks on a country road, birds, dogs, even rabbits have to bear their share of guilt in accidents of this description; and it is claimed that this advantage will appeal more strongly than any



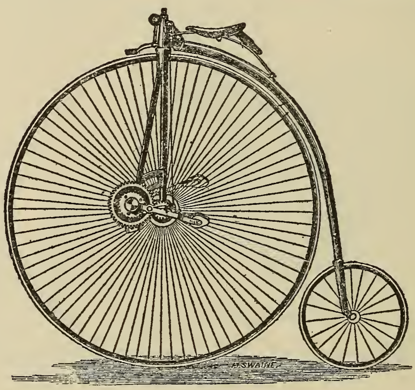
DUAL TRICYCLE.

other to the greater bulk of the cycle riding community."

The Dual tricycle possesses a peculiar double gear, one wheel driving for power and the other two for speed. In this driving gear intermediate wheels are used. "These are affixed at the ends of levers placed on each side and connected by a swiveling beam. Each lever has a catch which holds it in the position required, and by pulling this up with the finger, and moving the lever backward or forward, as the case may be, either wheel is put into gear, the other being at the same time thrown out of gear."

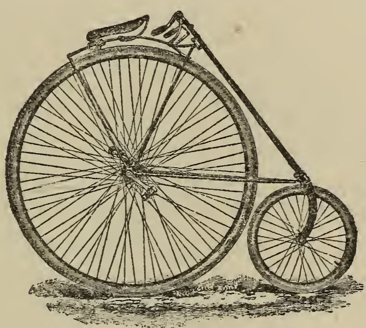
A machine somewhat of the ordinary type, but fitted with a peculiar driving gear, was the Dutton. It possessed the advantage of machines similarly driven that coasting could be enjoyed with the feet on the pedal, but its gear was of a complicated order.

"The peculiarity of the machine consists of 'Dutton's patent driving gear,' which may be described as



Dutton Bicycle.

follows: A stay rod runs from each fork head to a point some 6 inches or 8 inches in front of the axle, where it unites with the end of a second shorter and stouter rod, which curves out from a few inches above the bearings. At the junction of these two rods a wheel, some 6 inches in diameter, is fitted, the circumference of which is cut into teeth, which gear into similar ones on a 2½-inch (or thereabouts) wheel affixed to the axle of the machine. On the outer side of the first wheel a smaller one, some 2 inches to 3 inches in diameter, is affixed by means of screws, which said wheel is fitted with a set of ratchet teeth on its circumference. Outside this again, and on the same bearing, is pivoted one end of a 12-inch crank, or rather lever, having a pedal at its other end, and a pawl near the fulcrum so arranged as to engage the teeth on the ratchet wheel on a downward stroke. A small pulley is fixed at the top of the neck, and over this a cord passes, connecting the two driving levers, so that the



EAGLE BICYCLE

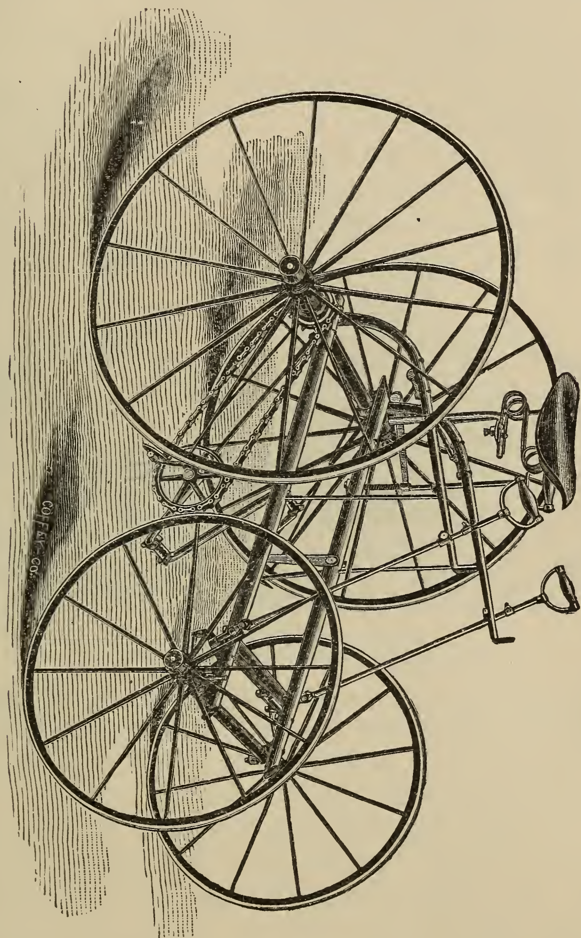
down stroke of one draws the other up. The effect of this arrangement is to place the pedals almost immediately beneath the rider, while the action is a powerful one, and the feet can be kept still at pleasure, the wheel being free to revolve independently of the pedals. Of course one cannot back-pedal with it, and a stoppage must be effected by the brake. It is neatly and strongly made. The above sketch will give a good idea of its appearance."

The Eagle is a well-known American bicycle built somewhat on the lines of the American Star. It is said to have the safety of a Safety, together with the advantages of an ordinary. It presents a certain combination of the features of the Star and the ordinary. It has a large rear driving wheel, propelled direct by cranks, and a small front steering wheel, with a long sloping steering bar.

The Elliott quadricycle is "a light, two-track, steady running, safe and easy, open front machine, at a moderate price. The wheels are constructed in the same general manner as are carriage wheels, but instead of being inferior to the cheapest carriage wheels, as were those used in the old velocipedes, our wheels are superior to the finest carriage wheels ever built. This statement may sound strong, but we are always ready to back it up. The wheels used on the Elliott quadricycle weigh much less than wire wheels of same size. We have wheels which have already withstood hard work during the life of an ordinary wire wheel, and are still, practically, as good as when made. They cannot rust, and the spokes don't get loose.

"We claim the safest and steadiest steering ever made. It is done by either or both hands, and the handles can be placed where you want them, being adjustable forward and backward, as well as up and down. The advantages of being able to sit erect in a comfortable position, and at the same time have the hands in a line with the feet for hill climbing, will be appreciated by all riders. The brake is applied to the rims of driving wheels, and is so balanced as to press equally on both wheels. Brake handle is adjustable for different riders, as are all other parts of machine.

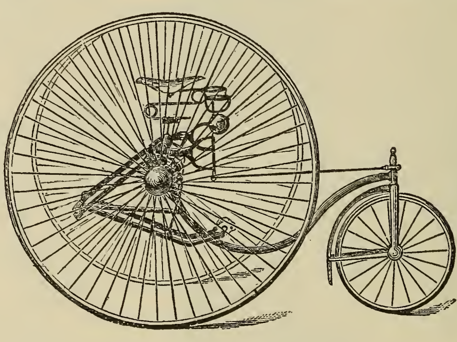
Brake may be securely locked by a simple turn of the handle. The bearings are made on a new plan, which



Elliott Quadricycle.

is original in this machine. They are hung in such a manner as to remain perfectly free, regardless of load on machine, or any twisting of frame due to unevenness of the road."

The Englefield tricycle is a machine having lever action, in which the throw can be altered, while it is in motion, so as to cause it to run at any relative power from equal to 36-inch to 52-inch. "The adjusting racks are carried within the levers, which are tubular, to allow the connecting joint to pass up and down in a slot, while the revolving pinions are turned by an extra handle placed some way behind the rider, and pro-

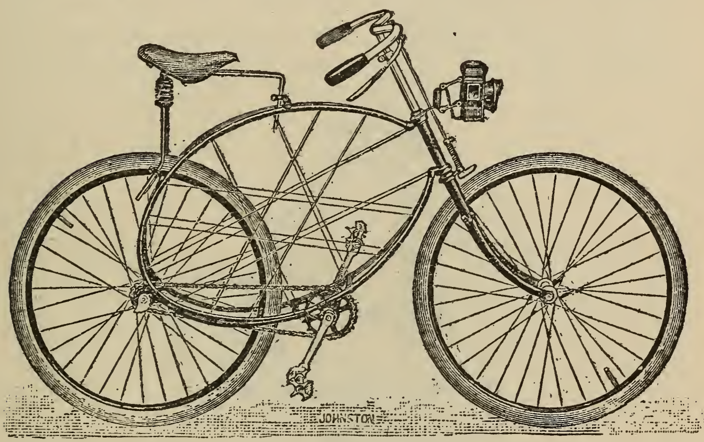


ENGLEFIELD TRICYCLE.

vided with a bevel or crown wheel at the bottom, gearing with a similar one on the end of the pinion rod. The levers, too, are drawn up and down by a cord or strap passing over a pulley fixed on the frame."

A peculiar tensioned wheel frame is used on the Euclidia Safety. It consists of "two half-tubes forming a sort of oval, running from the two extremities of the ball head, and carrying on their way the bearings and seat grip. These are braced together by a number of light spokes passing right across the frame, the hub being no longer used. It makes a wonderfully strong and exceedingly light frame."

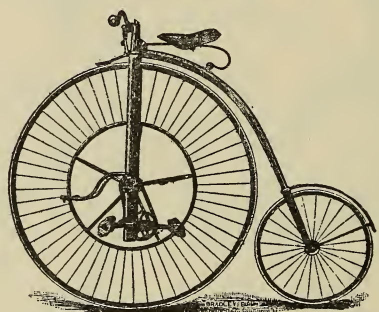
An objection to the Kangaroo type of Safety, with its two chains, having been the very wide tread—the horizontal distance between the centers of the pedals, or rather between the planes in which the pedals



EUCLIDIA TENSION WHEEL FRAME SAFETY.

moved, an attempt was made to produce a Narrow Tread Wheel which would overcome this objection.

"The Excelsior Narrow Tread Wheel is especially designed for dwarf bicycles. The usual hub, with its flanges, is absent, and from the center of the axle five stout tubes depart for about a foot, when their ends are crossed by short T pieces projecting about an inch on either side. These T pieces support two inverted felloes or rings of rim steel, having their convex surfaces on the outside instead of, as when used for their legitimate purpose, inside. From these rims spokes depart in the usual way to the rims of the wheel proper, which hold the rubbers. This makes an exceedingly strong wheel, though possibly a pound or so heavier than usual; the gain is in the width of tread, for the chain wheels and bearings, both upper and lower, are carried within the recess thus formed in the wheel, and the width of tread therefore is no more, if, indeed, nearly so much, as on an ordinary, which is a

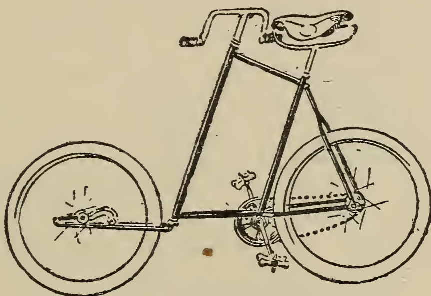


EXCELSIOR NARROW TREAD BICYCLE.

distinct gain with the front wheel driving type of Safety upon which this wheel is used."

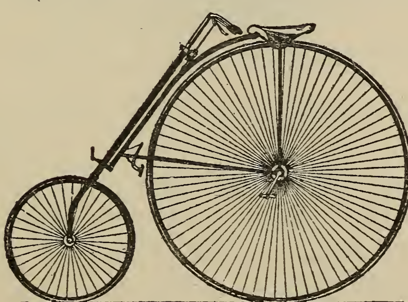
The Fearnhead is a chainless Safety on which the power is not applied at either hub, as in the case of the Broncho and Crypto gears. It is driven by a bevel gear "in which the shaft is carried within one of the compression tubes, and the whole is shut in by a very neat casing. The idea of using bevel gear for driving a cycle is by no means new, but this is by far the neatest application of the principle yet seen, and in its present form may possibly prove successful, while those which went before failed."

To the American public the machine called the Jupiter Gearless Safety will not perhaps seem strange, as they will instantly detect in it a close resemblance



GRAVITATION SAFETY.

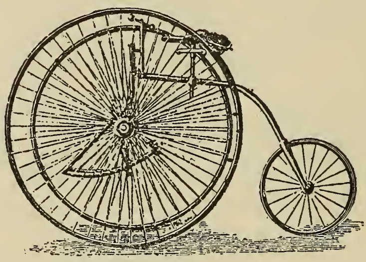
to a domestic wheel—the Eagle—of which it appears to be a fairly close copy. It has the same large rear driving wheel, driven direct by cranks; small front steering wheel, and long, sloping, steering post.



JUPITER GEARLESS BICYCLE.

"This machine will be found to embody all the good points of the ordinary bicycle, which are: Lightness of running, direct power, simplicity, elevation, and length of life, together with the best points claimed for the dwarf Safety, viz.: Perfect safety, great brake power, good position for 'feet up,' luggage and lamp-carrying facilities, and a higher gear. (A four-inch higher wheel can be taken than on an ordinary.)"

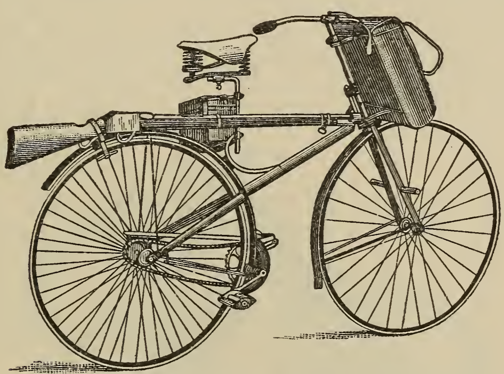
The Merlin is built in several patterns, but its peculiar features are its lever steering and driving gear. The driving levers are hinged to the fore part of the frame, and the driving cord is attached some 4 inches from the end, where a pedal is fixed. It has also lever steering in which "the handle bar is fastened to a rod



MERLIN SPECIAL BRIXTON TRICYCLE.

placed some 3 inches behind the top of the tube which, in the ordinary Humber pattern, carries them. Both this rod and the top of the tube are fitted with short arms or levers projecting at right angles to them. Their ends are united by a link, through which power is transmitted from the handles to the top of the steering gear."

Soon after the Safety bicycle attained its present high state of efficiency, and proved its capabilities in the hands of a trained rider, many speculations were indulged in as to the possibility of excelling horsemen in such departments of practical usefulness as messenger and scouting service. Tests of various sorts were accordingly arranged, and in every instance, both in this country and England, the cyclist was able to far excel the horseman in speed, and in security from

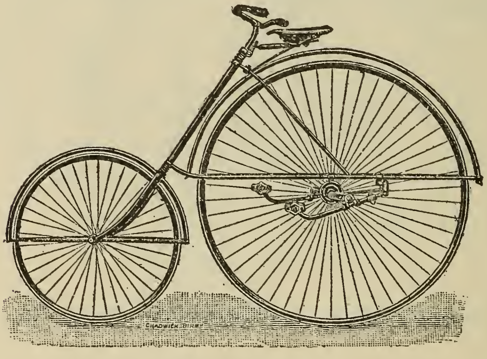


MILITARY BICYCLE.

observation. As a result, cycle corps are being formed.

A lever action, rear driving machine of the large-wheel type, called the Mona Safety, was produced as late as 1890.

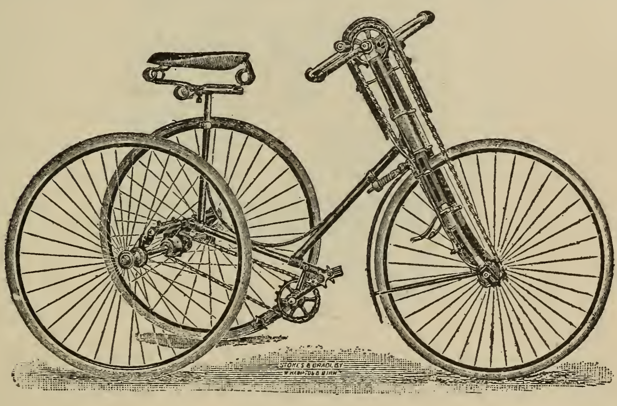
"In general appearance it bears more a resemblance to the American Star than to any English pattern. The front wheel is about half the size of the back, which is the driving one. The steering is done by a sloping steering post, very much indeed like the American Star, and while the rider sits just forward of the axle, he has his work immediately beneath him, the driving being done by levers, as shown in the sketch. A horizontal frame running on each side of the machine serves to carry the fulcra of these levers, and the driving mechanism is an adaptation of the principle which was introduced some years since on the Rob Roy tricycle, though its application in a neat, light, and compact form to the bicycle has been done in an exceedingly ingenious manner. The levers work short cranks attached to a through axle, which lies freely within the hub. Upon one side, attached to this axle, or rather to the crank, is a small internally



MONA BICYCLE.

toothed wheel, which works eccentrically with the axle proper of the driving wheel, which has a small spur wheel fastened to the outer hub, this being snugly held within the before-mentioned internally-toothed wheel, and the wheel thus geared up by the motions of the levers. Another special feature is the spring arrangement of the saddle. This consists in attaching the saddle to the end of a lever, hinged to the frame in front, and supporting it in a high position by a strong coiled spring. The weight on the saddle tends to continually expand this spring, and virtually the weight of the rider is sustained by it. Mr. Edwards claims as one point in favor of the machine that by turning the handles round the machine can be driven in the opposite direction, and its type thus entirely altered; but as to do this steering would have to be done with the back wheel, and as that system of steering has never yet proved satisfactory, we dismiss this point altogether from our minds. The machine is strongly built and nicely made, and the working out of the idea is certainly extremely ingenious."

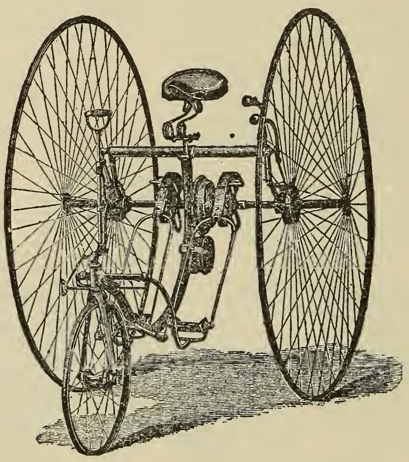
The Mumford tricycle is a machine fitted with an arrangement permitting the use of the arms to aid in



MUMFORD TRICYCLE.

propelling the machine. It is said that it "is a marvel for power and ease. As a hill climber, and for general purposes, it defies the world. It can be worked with a combination of hand and foot power, or with the hands only or the feet only. On level roads the

Mumford will be a great boon, as the feet and hands can be used alternately, thus giving rest to one set of muscles while another set is brought into action, and strengthening the arms and chest as effectually as rowing. It can be thrown in and out of gear instantly, and there is no extra weight. This is a splendid machine for people with varicose veins, weak legs, weak backs, or those who are unable to use one or



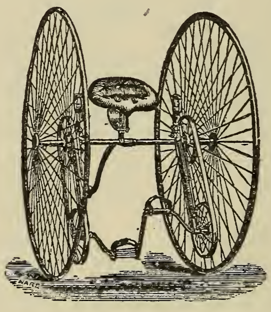
OMNICYCLE.

both legs; also for riders of advanced age who are seeking a machine for pleasure and ease, because they are tired of being machine-slaves. It is a blessing to the tourist."

The Omnicycle, here shown, "differs from any of the ordinary patterns of machines, being driven by means of expanding segments. The two driving wheels are connected by means of a main axle, while about eight inches above this, supported on two bearings, is the seat rail, on which adjustable handles and seat rod are fixed. From the center of this rail descends the central tube, to which steering wheel is attached. About four inches from the steering head of the small wheel, on central tube, is a cross bar, and to this are attached two (one each side of tube) curved levers, with pedals at their ends. To these pedals are connected two deep U-shaped steel forks, being fastened at the top to stout leather straps. On the axle, at either side, are two expanding segments, while in the hubs of the driving wheels are the clutches (consisting of ratchets and pawls), and in the center is the double chain pulley. Lower down the central tube is a fork in which the lower chain pulley is adjusted. Fine steel chains connect these pulleys. The lower chain pulley is perfectly hollow, but in the interior of the upper are arranged three ball-jambing clutches. Each segment drives a wheel, and the chains simply act as pulleys, and the segments are attached to the afore-mentioned leather straps, and so connected to pedals. The motion is an up and down lever motion, and the segments expand to three positions by pulling small levers, so that hills of almost any gradient can be overcome."

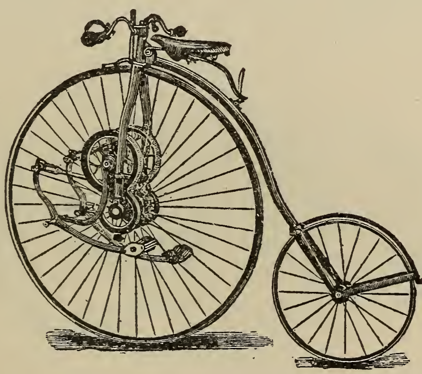
A two-wheeled machine, sometimes known as a "dicycle," was the Otto. Its peculiar construction lay in the two wheels being placed side by side, at the ends of an axle, as on a tricycle. It was said to run well, climb hills easily, and be safe and steady when once mastered; but it often required considerable patience to get the knack of it, and much practice to become expert in its use.

"In point of construction the wheels are usually 50 inches or 54 inches in diameter, and built with very large gun metal hubs, direct spokes, crescent rims, and red rubbers. Upon the inner side of each wheel a smooth band wheel, about a foot in diameter, is securely attached and connected with a second band wheel, by an endless flat steel band, of great strength and pliancy. The second pair of band wheels are of the same size as the first, and are attached to the ends of a double-cranked pedal shaft, such as is used with



Otto Dicycle.

the majority of tricycles. The connection of this shaft and wheels with the main frame is one of the most ingenious parts in the construction of the whole machine, and shows to good advantage the admirable and really exquisite fitting and workmanship. Stout rods project downward and forward from the axle to the pedal shaft, passing through cylindrical sockets, and thus supporting it. At the upper ends of the rods 'spade' handles are attached, and by turning either of these the end of the pedal-shaft in connection with it is raised, which action consequently causes the band upon that side to become slack, when, of course, the other wheel, remaining in gear, drives round its companion, and thus the machine may be turned in either direction as required. This action is facilitated much by the simultaneous application of the brake to whichever wheel is thrown out of gear, this operation being performed automatically. The seat is placed on springs supported on adjustable rods in the center of

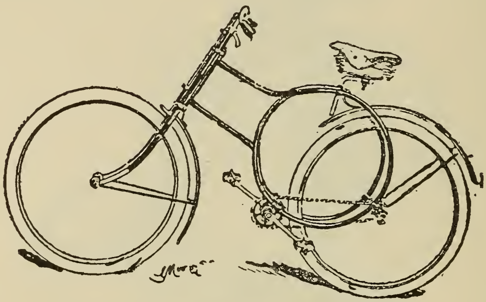


THE RACOON BICYCLE.

the main axle, at its junction with a tubular 'tail' or support, which falls away rearward, and ends in a small roller, serving to support the rider should he lose his balance backward."

A machine which in outline of frame somewhat resembled the Kangaroo type, but which had a lever action very similar to that of the Facile, while it had a distinctive feature of its own in the shape of its driving gear, was the Racoon. Its driving wheel was small, but was geared up.

"The Racoon driving gear is a combination of the lever and gear wheel movements. To the fork end, just above the bearings, a metal arm is attached, this curving slightly upward and ending in a bearing for a large gear wheel which gears with a second and smaller toothed wheel upon the axle of the driving wheel. The lower part of the afore-mentioned arm runs forward, taking much the same shape as the fore portions of the elongated Facile forks. At the extremity of this is a bearing forming the fulcrum for a lever, at

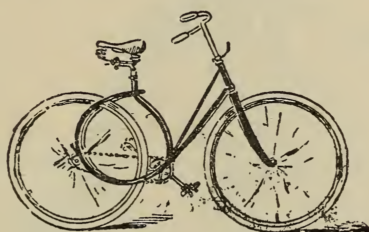


SPIRAL SAFETY.

the rear end of which the foot is placed upon a pedal in the usual manner, while the forward end is connected to the larger gear wheel before mentioned by means of a connecting rod attached, like the piston rod of an engine, to the side of the wheel. The action of this gear is, by means of the lever and intermediate rod, to draw the larger wheel round. This gear wheel communicates its motion to the smaller wheel, and through this to the driving wheel, and thus propels the machine at a higher rate of speed than the movement of the foot. As the lever action is very similar to that of the Facile, the combination, generally speaking, might be termed a geared-up Facile."

A simple and strong frame of unusual lines is that of the Spiral Safety. The "frame consists entirely of a single tube bent into two complete circles to carry the seat pillar, rear wheel, and crank bracket. The forks and handle bars, too, are composed of two tubes, running straight from the front bearings to the handle grips."

The Start Safety has a frame consisting of tubing, beginning at the head of the machine and circling

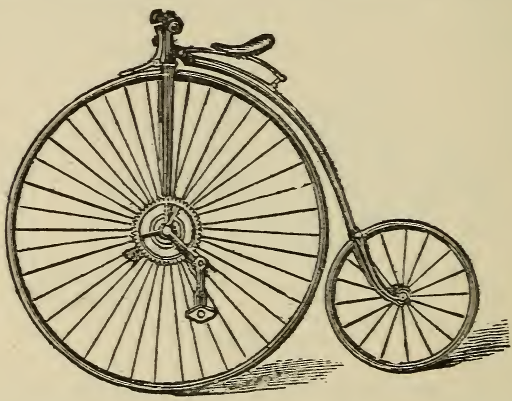


START SAFETY.

back to the rear axle, and around beneath, and up to saddle pillar again without a joint. The "machine is built with only two brazed joints in the entire frame. It is wonderfully rigid, light, and strong, weldless steel tube throughout, ball bearings, including head and pedals. Owing to the entire absence of heavy stampings it can be built lighter than any other known frame."

A sort of small, geared-up ordinary was the Sun and Planet, and its gearing was said to be "one of the simplest and prettiest mechanical machines in the market." The machine was built with a comparatively small driving wheel, and with the exception of this feature and the peculiar gear, it was essentially an ordinary.

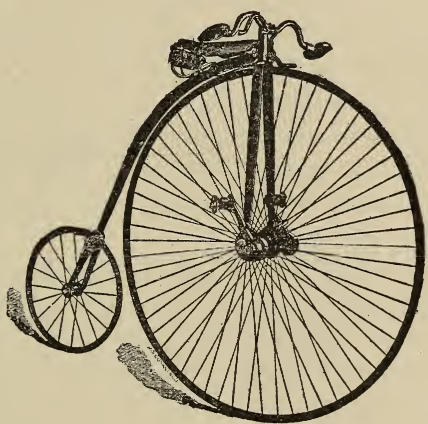
"Upon each side the hub a large 8-inch spur wheel is fastened just outside the forks; taken thus, the wheel and its attachments with a hollow axle run loose in the bearings; through this hollow axle a rod passes, carrying at each end a crank, which is provided at its end with a small spur wheel, so placed as to gear with



SUN AND PLANET BICYCLE.

the larger one; and the same pin that serves to secure the small spur wheel to the end of the crank serves to attach a second crank, which hangs loose and carries a specially constructed pedal at its lowest extremity. If either of the cranks be turned by itself upon its own center the small spur wheel will revolve and travel round the larger one, but if the feet are pressed so as always to keep the crank in a vertical position, the small wheel draws the large one round with it, at the same time causing it to travel about $1\frac{1}{3}$ revolutions to one of the pedals; thus, a 3-inch wheel travels as a 48-inch, and so on. It is but little harder to drive up hills than the ordinary, and a ten to twelve mile pace on a fair road is easily obtainable. Its steering action, foot motion, and position of rider are identical with those of the ordinary machine, while one has the advantage of being close to the ground, in a place of comparative safety."

A large wheel, front driver and steerer, lever action



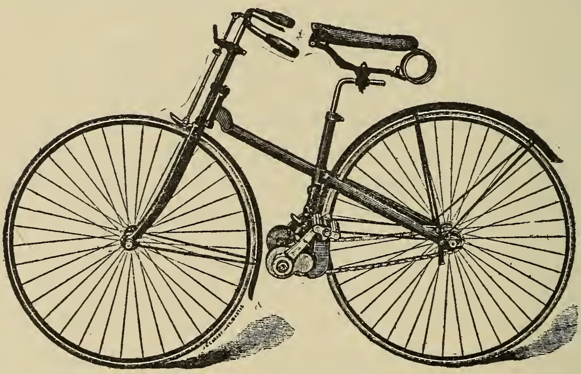
SPRINGFIELD ROADSTER BICYCLE.

machine, of American make, was the Springfield Roadster bicycle. It was on the market for several years, and was much liked by those who fancy that type of machine.

"The levers and clutch oscillate on a fixed axle, upon which the large gears rotate constantly after the power has been applied, which transmits the motion to the large wheel from a fixed shaft. The clutch forms a $\frac{3}{4}$-inch roll-bearing for the gears. Thus, we avoid all strain and friction from the direct application of power to the main shaft or wheel as occurs in the ordinary crank method, which method makes a side strain, and changes the friction upon the shaft or bearing case from side to side, as the rider alternates the application of power. To avoid all strain or friction on the axle-bearing from joints, we have lapped the bearing case over the forks, making it rigid, with $1\frac{3}{8}$-inch parallel bearings on each side lined perfectly central with backbone, with no strain except from the weight of the rider, which, in proper position, is always superimposed in the radius of the wheel. These bearings contain oil cavities, which will hold a sufficient quantity of oil to keep them constantly lubricated, without waste, protecting the steel from friction and wear.

"The rear wheel has adjustable bearings which are durable and easy to adjust. The rear wheel is larger by 4 inches in diameter than that used on the ordinary 50-inch crank wheel; consequently we lessen the friction and jar and secure a smooth-running wheel. Clutch and gears of forged steel. The clutch is perfectly noiseless and mechanically self-adjusting, the construction of which forms a complete roll-bearing when the levers are not on the downward stroke. It grips instantly when the power is applied, and locks firm and rigid. The motion of the levers downward and forward is 13 inches, being much less than any other device used for propelling bicycles. This gives better results, is less tiresome, and conforms more closely to the natural walking motion.

"The mechanical construction of this wheel is such that it changes the pivotal point from the axle to the point of contact or obstruction. The power being applied directly underneath the body and back of the center of large wheel, it prevents the fork and the backbone from traveling faster than the large wheel, as the clutch mechanism locks when this occurs, and the momentum and the weight of the body, or power applied, become factors in propelling the wheel forward. Thus, in striking an obstruction, instead of being thrown forward over the wheel, as would be the result if the forks were pivoted on the axle, the force of the blow rotates the wheel, and carries the wheel and rider over the obstruction; the rear wheel can rise and follow over the obstruction, as the locking of the clutch mechanism does not occur until the speed of the larger wheel has been checked. There is no extra friction or weight thrown on the rear wheel, as the device locks only when the fork or little wheel is raised from the ground, which is the equivalent to checking the revolution of the large wheel. Again, we transmit the motion to the axle of the large wheel from the front of the center of the axle, and from a stationary shaft, from which the levers oscillate and extend backward underneath the weight of the rider, for convenience and the better application of power, without loss of motion, dead centers, or without applying the power forward from the center of position of rider. By this method we apply the power to the front of the center of large wheel, as in the ordinary or crank bicycle, but with none of the disadvantages arising from it. We secure a safe and practical wheel. In short, with our clutch and lever motion, the backbone and fork cannot be forced forward without rotating the large wheel. This does not cause any extra strain on the mechanism or wheel, as the force of the blow is relieved by the levers upon which the rider forces his weight alternately, and thus the power applied has the tendency

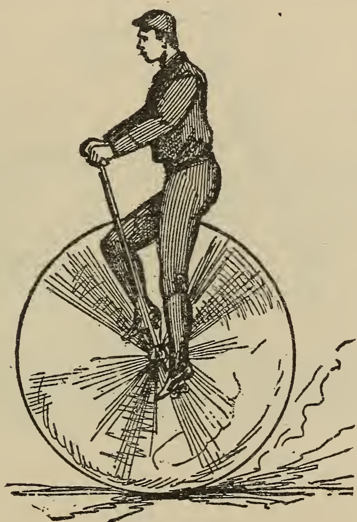


VOLANTE SAFETY BICYCLE.

to force the wheel to rotate, and carry it over the obstruction, and forward." The company also applied their driving gear to a small-wheel Safety bicycle, called the Volante, built with a cross frame.

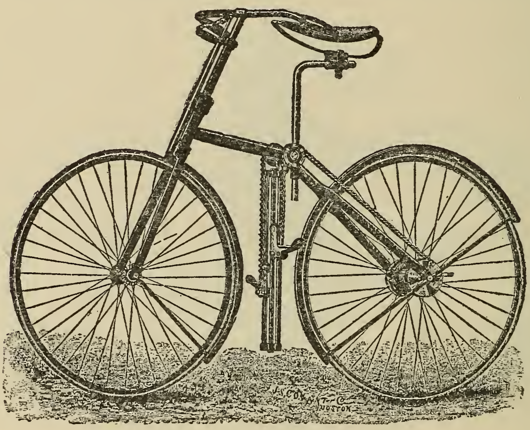
A few fancy riders and athletic young men have become expert in the use of a single wheel, or Unicycle, and able to ride one at considerable speed on the track, and also to use one on ordinary roads.

A Safety bicycle, called the White Flyer, was produced in 1889 at Westboro, Mass. Instead of the usual chain and sprocket wheels, it was driven by a chain running over hardened drums, the pedals working on a vertical "swing frame" which depended from the backbone between the wheels. The pedals could be stopped in any position and used as foot rests; pushing one down raised the other a corresponding distance. "The swing or guide frame hanging from the backbone, on which the pedals move up and



UNICYCLE.

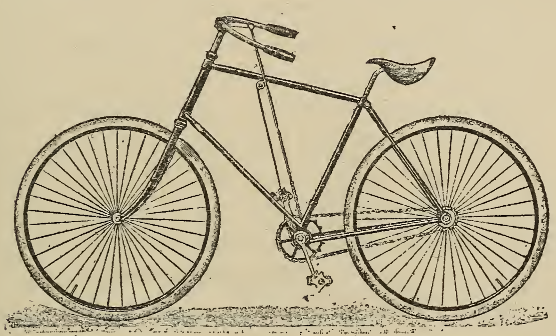
down, can be thrust, while the rider is in motion, to almost any angle. Thus, if he wishes a vertical tread, the frame can be swung so that the pedals come well under the saddle. If, on the contrary, the rider wishes to change the position, and get more of the thrust stroke which uses the thigh muscles (as in a rotary motion crank Safety), this can instantly be done by swinging the frame toward the front wheel. This ability to vary the stroke will rest the rider. When the driving pedal is on top of the guide frame, and in the beginning of a stroke, the construction is such that the rider has more leverage than at any other point in the whole stroke. The leverage lessens as the pedal moves down, and as the legs straighten out, thus equal-



WHITE FLYER SAFETY BICYCLE.

izing the force to be exercised necessary to drive the machine."

The Zimer Power Safety is an "ordinary Safety, fitted with a device to enable the rider to utilize his arms as well as his legs when he finds it desirable. The principle of the device, as a means of using one's arm power, in addition to or instead of one's leg force, is certainly better than any other manumotive machine on the market. The swinging handle bar is mounted on neat ball bearings, the clutch is in a gear box, and pulled at by a chain on teeth, and in the case of the tricycle the handle bar can be worked continuously on a crank between the bearings for the feet cranks. In the other form the power is applied intermittently on the up stroke only. The practical use of the gear must not be lost sight of, and it certainly enables any-one to get the full extent of his power out of himself



ZIMER POWER SAFETY.

into the propulsion of his machine. The man is the sole source of the energy; in the ordinary machine his legs are the only outlet for his powers; in this his arms may be brought into play (or work) as well. It adds nothing to a man's power, but considerably increases his means of using the power that is in him. The device is a machine, not an engine."

ANTI-VIBRATION DEVICES.

THE establishment in popular favor of the rear-driving chain Safety tended to revolutionize cycling in more than one way. Not only did the low wheel completely usurp the places previously occupied by other types, but it threw cycling open to both sexes and all classes; widened indefinitely its possibilities; and likewise ushered in a host of questions, concerning the new condition of affairs, that could be solved only by time, experience, and experiment.

The use of the Safety soon showed that considerable vibration was present in riding, even though at first it had been claimed that vibration would be but a small quantity, owing to the rider's position between the wheels. The first Safeties were heavy, and had fairly large wheels and tires, so vibration on them was perhaps not excessive when they were ridden slowly. But soon machines were much lightened, wheels were reduced in size, and tires were cut down so as to become mere strings. All these changes made vibration greater, and what to do in order to overcome it became a very important question.

Experience has shown that the effect of vibration is far greater than anyone supposed up to a very recent time. Dr. Richardson says that "nothing produces so much injurious fatigue, or so bad an effect on the health in cycling as vibration. It is a shock to the nervous system, causing a continued feeling of vibration through the body, a sense of nausea, and a degree of nervous prostration, accompanied with a reduced power of the lower limbs, which, to say the least of it, is very inconvenient, and which in a feeble person may be attended with actual risk.''

Besides this, it has been shown that in cycling the weariness which follows either a long ride or a fast ride is caused much more largely by vibration than by mere muscular effort. Anyone can test it by taking a light machine, with a thin, solid tire, and ride it ten miles at fair speed on an average road. Then take a cushion or pneumatic tired wheel and repeat the ride, and note the difference. If the reader has been using a cushion or pneumatic for a few weeks, he can easily be convinced by riding a light, thin tired machine for an hour. Its immense inferiority will be plain to him, but he may not so quickly realize that the inferiority is due to the great vibration, and the consequent fatigue and nervous prostration he suffers.

This was recognized as a fact only by slow degrees, and after much hard experience with the thinnest of tires. When manufacturers and inventors did see it, however, they looked about for a remedy, and soon fixed upon two distinct methods of counteracting the evil—increasing the cushioning properties of the tire, and so absorbing vibration at the point of contact with the ground; and by introducing a spring, or combination of springs, capable of absorbing the vibration caused by the road surface. The question of tires is treated in another chapter. In this one is considered what are generally, and somewhat roughly, known as "spring frame" machines, and under that head may be included any machine possessing an anti-vibration device, whether it be a single spring, a combination of springs, or a combination of springs and joints. But first a word regarding differences in vibration.

The most common sort of vibration, and that which is always present, is what is continuously produced by the innumerable little inequalities of every road surface. This differs in degree with the condition of the road, but is very appreciable even on surfaces which pass as excellent. It shows itself plainly in the constant trembling of the handles of a moving machine, and is *tremulous* vibration. The other form of vibration is produced by any sort of bumps or jolts, whether caused by passing over comparatively large obstructions, or by depressions in the road. It is *bumping* or *jolting* vibration.

The efficacy of good tires is shown in their ability to absorb tremulous vibration; they cannot absorb jolting vibration. Suitable springs may also partly absorb tremulous vibration, and *they alone* are capable of absorbing jolting vibration. Consequently, it follows that an ideal anti-vibration wheel requires a tire with great cushioning properties, and a well designed spring frame to absorb all jolts. Such a combination undoubtedly provides luxurious riding.

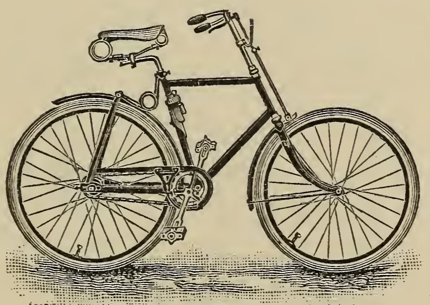
Inventors have gone to work in different ways to introduce their spring devices. Some have claimed that the worst vibration is felt at the handle bar, and have sought to remove that by means of a spring front fork; others have believed that the vibration from the rear wheel is worst, and have introduced springs to overcome that; and others again have used a spring or springs in other parts, sometimes enabling the whole frame to work in an easy manner. Just where these devices should be used, if they are applied to but a single point, is perhaps a question of temperament and individual taste. Vibration is felt most severely at different points by different riders. The following machines and descriptions will show what has been produced with the purpose of catering to all possible sorts of requirements:

AMERICAN DESIGNS.

THE following description of the spring frame of the American Rambler is from a recent catalogue of the manufacturers:

"The spring frame of this machine has been one of the chief factors in establishing its popularity. Vibration is the greatest evil to be encountered in the Safety bicycle, and the vices (for such some really are) and devices which have been invented to circumvent it are as many as they are varied and peculiar. We were the first American makers to recognize the value of the spring frame as an anti-vibrator, and that it has been shown to be a *sine qua non* to comfortable cycling, the attention and imitation centering in the direction of spring frames fully prove, and to-day, while others are but just awaking to their true value, and offering experiments therein, in our Ramblers we are able to present a spring frame which has long since passed the experimental stage, and one which is practical and does what is claimed for it, not simply because we say so, but because it has been so proven by three years of actual and extensive use. Others are beginning where we left off three years ago. We have yet to see or hear of an unprejudiced rider, it matters not what his mount, who, having tried a Rambler, has not testified to the excellence and positive luxury afforded by its spring frame.

"Anti-vibration devices have been placed in almost every conceivable place and position, but it must be apparent to the thinking person that four-fifths of the rider's weight being sustained by the rear wheel, that there must the vibration be most harmful, and there the greatest necessity for a preventive exist. It will be noted that Ramblers not only have the right thing, but have it in the right place. The relation of such a practical spring frame to the durability of the machine is also apparent; the force of all hard knocks and



AMERICAN RAMBLER SPRING FRAME.

concussions being lessened very materially by the elastic nature of the spring, increases the life of the machine in the same proportion that it adds to the comfort of the rider.

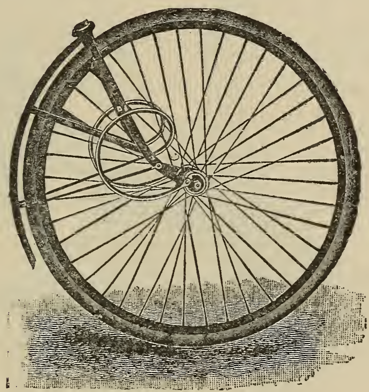
"The spring frame consists of a hinged rear fork and rear wheel, united to a frame carrying the saddle by a tempered and yielding spring, so arranged that an obstruction met by the rear wheel causes no elevation of the rider's seat or pedals; similarly a depression in the road, allowing the rear wheel to drop, does not produce that effect on the rider, as the spring, by expanding, permits the main frame to retain a normal position, largely independent of the condition of the road's surface. This spring action of the wheel is doubtless as great an advance in the cycle art as the adoption of the rubber or pneumatic tire, and is for the same object, the reduction of vibration; but it goes farther and operates through greater vertical distances, neutralizing the large concussion, while the tire reduces only the smaller ones. The mechanical effect results in conserving the energy of the rider for use in propulsion alone, instead of greatly expending it in raising his weight over and out of inequalities in the path.

"Three grades of frame springs are used, light, medium, and heavy, for riders weighing 120, 150, and 180 pounds respectively. The medium spring is invariably furnished unless otherwise specified in order."

The Bolte spring fork is fitted to the front wheel of the Giant Safeties, and the drop frame pattern, called the Giantess, has it fitted to the rear wheel as well. "The fork is made up in two sections so formed as to produce perfect steering. In fact, in this regard, it is the equal of a solid fork, and still permits of free spring action, thus absorbing the vibration entirely.

"The auxiliary fork is attached to the bearing of the wheel and extends around the wheel at the rim to the opposite side of shaft, where it is also attached to the shaft. The steering fork strides the wheel and is fulcrumed to the auxiliary fork, upon which fulcrum the two sections of the fork move, the extent of which is governed by the stops, which are set for the necessary action required.

"The springs, of which there are two, one on each side, are held in position, and are attached by a simple and adjustable device, which admits of taking up all wear and looseness. This is also true of the fulcrum by which the two sections of the fork are united. The springs are adjustably attached so as to permit of adjustment to the weight of the rider. The

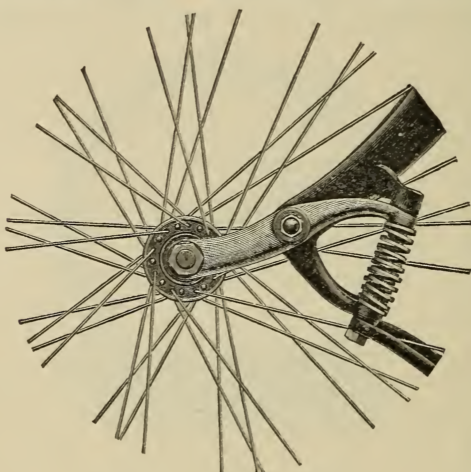


BOLTE SPRING FORK.

machines, when leaving the factory, are adjusted to an average of about 150 pounds. To strengthen the spring for heavier riders, the set screws should be loosened and the spring forced farther in. To weaken the spring, it should be pushed farther out toward its end. This adjustability to weight is not found in any other spring fork, and is an important as well as a valuable feature."

The Columbia Safety is supplied with continuous rigid forks, or with spring forks. Under the head of "steering," the manufacturers say:

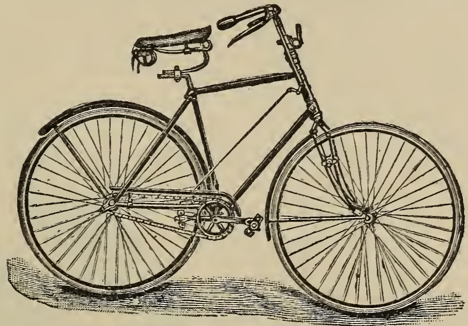
"Consideration of our Columbia Spring Joints comes appropriately under this head, for while the original idea is to relieve the frame and handle bars from vibration, the value of this point is largely counterbalanced in any case where it is attained in such a way as to affect the positiveness of the steering. We



COLUMBIA SPRING FORK.

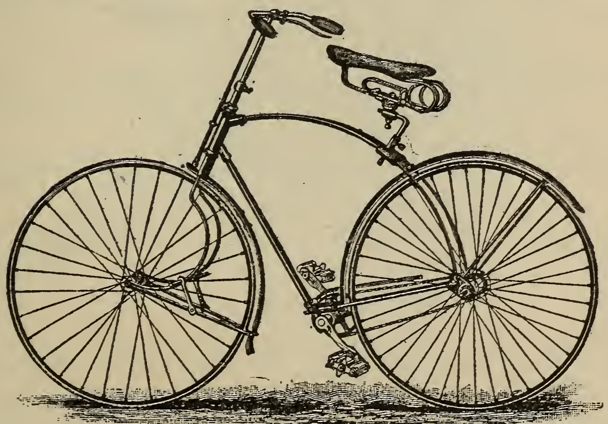
present an amply elastic spring joint, which does not detract from the neat appearance of the fork, nor in the least affect the positive steering for which all our Safeties are remarkable. The joints work on new conical bearings, which afford ample take-up for wear. The springs can readily be dispensed with, and the fork made perfectly rigid if desired."

The Dauntless spring fork possesses "the property of adjustability, or convertibility from a spring of any tension to that of absolute rigidity, thus combining in



DAUNTLESS SPRING FORK SAFETY.

one both a rigid and a spring fork machine. The ease with which the change or transformation is

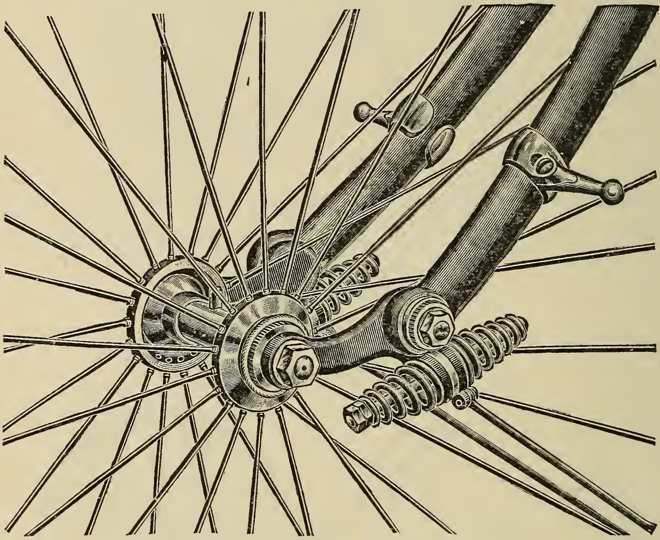


ECLIPSE SPRING FORK SAFETY.

accomplished, which is simply to change the position of the coasters by means of a wrench, up or down the fork, is another strong point of merit."

The Eclipse, as originally built, as here shown, had "spring forks made of the best crucible spring steel, tempered in oil and fitted with adjustable coasters that can be raised or lowered so as to change the tension of the spring to suit the rider."

The Kenwood Safety is fitted with springs to the front fork, in regard to which they say that they "seem

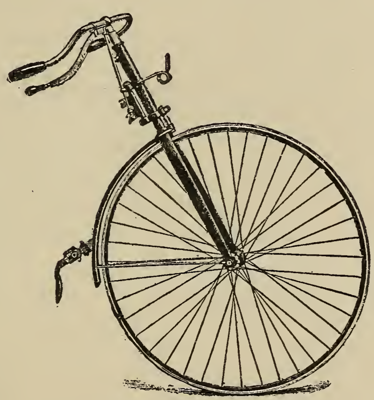


KENWOOD SPRING FORK.

to have been more fortunate than other makers. Kenwoods are the only spring fork machines on the market to-day in which the front wheel stays where it belongs. It will not strike the fork sides, and tracks steadily. We have avoided the cheap makeshift of a cone, or taper joint, and use instead a perfect ball bearing joint, such as is used in the wheel hubs.

Nothing can be more accurate and firm, and at the same time an entirely free joint is secured. We use four springs instead of two, and have by a very simple arrangement provided for the adjustment of the spring tension to suit the requirements of the rider. By this means a man weighing two hundred pounds can in a moment arrange the tension so that he can have the degree of spring he desires, and without the least trouble can rearrange it in a moment to suit a hundred pound boy."

The New Mail Safety bicycle has a spring fork, or rather a spring inserted in the tube above the front



New Mail Spring Fork.

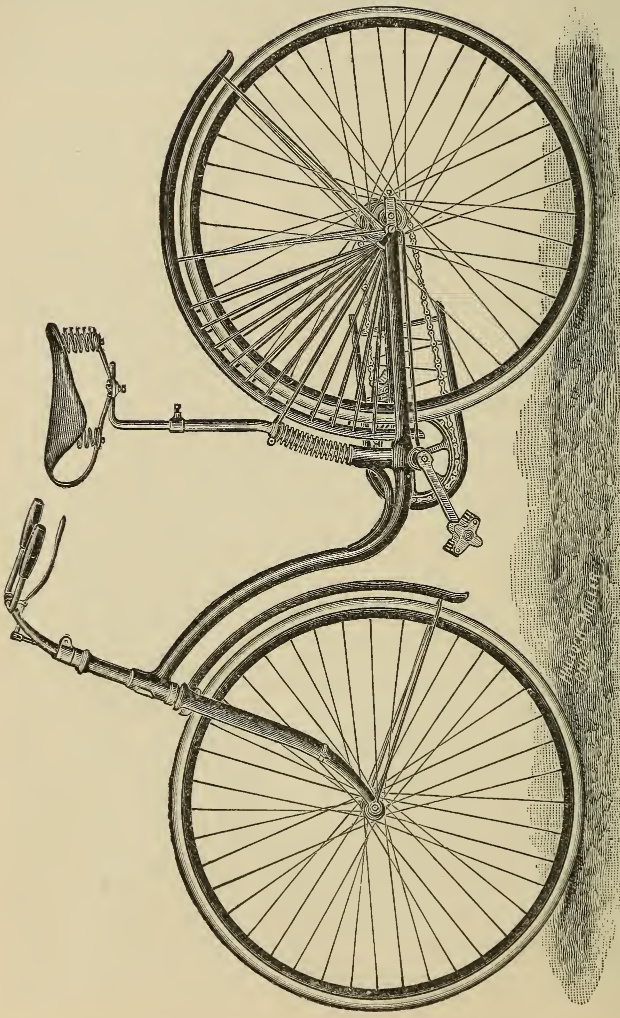
forks, which is quite out of sight. The only outward indication of it is the little rod, just above the front forks, on which the tube works. They say:

"We have adopted what we believe to be the best spring fork (a coiled spring inside the fork column), acting in a direct line from the arms of the rider to the point of any concussion. In no way does this spring fork interfere with steadiness of steering. Ours is a direct vertical action. A spring fork is an advantage if it does not interfere with steady riding. But there should be no yielding of spring *sideways*, for such throws the rider one side and causes the front wheel to swerve suddenly; in fact, the hands cannot be taken off the handles with safety for a moment. Excessive spring or yielding of forks also is a *disadvantage*, as the rider cannot use full power for propelling, especially in hill work, as the front wheel gives way, so to speak, but, while ours relieves all effect from concussion, it does not interfere with full power for propulsion. It is out of sight and neat."

The New York Safety has spring forks, concerning which the manufacturers say the "spring is our special feature, and so arranged as to become a perfect cushion and to give the utmost comfort to the rider without any liability of breakage. We guarantee our springs to be non-breakable. We can safely do this, owing to the fact that the elasticity of the spring is perfectly adjustable to any weight of person, and is so rigid as to obviate any possible flinch or side motion of the wheel, as both sides operate in unison. They are not in the way or cumbersome, nor liable to get out of order or rattle, as the very nature of the spring prevents that. The yoke to which the springs are attached is made of one piece running from one side of the hub up over the wheel, back down to the other side of the hub, thus insuring a perpendicular rise or fall. And the yoke slips through a split ball, which is perfectly adjustable. As the frame is one solid piece, the distance from the pedals to the saddle cannot vary. The arrangement of our yoke and springs is such as to take up all vibration from the rider's hands, and also from the frame; as the spring is entirely separate from the frame and from the handle bars, there can be no possibility of vibration."

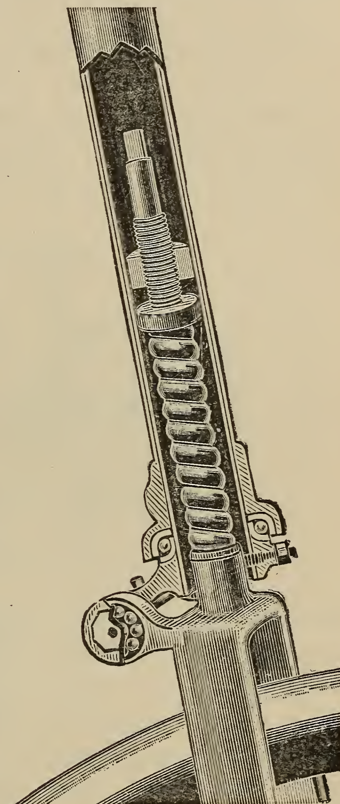
The Paragon Safety bicycle is a drop frame machine, regarding whose spring frame its manufacturers say:

"Our tubular spring frame with our equalizing device is undoubtedly the best invention ever introduced for absorbing the jar and vibration of a bicycle. The frame is made of the best steel tubing; it is triangular in form, the saddle post and pedal shaft carrier making the third side of the triangle. The frame is attached to the rear fork, directly in front of the rear axle, and springs downward and forward naturally, with the motion of the rider. The swing is controlled by a coiled spring made from steel wire drawn expressly for us. The spring is placed on a neat base, which forms part of the main frame, directly over the pedal shaft. It is held in check by a steel collar, that allows free play but prevents too much expansion or contraction. This spring is by a simple device made self-adjustable to the weight of the rider, and will ride as easily with a light as with a heavy person, and still we claim it to be vastly stronger than any similar device in the market. The pedal shaft sprocket wheel and bearings are attached to the swing frame, as is the saddle, so that the feet and body move together, doing away with all difficulty regarding the forcing of the feet from the pedals in rough riding. The spring being at the junction of the frame, the forks take off a large per cent. of the jar from the frame, thereby



Paragon Spring Frame Safety.

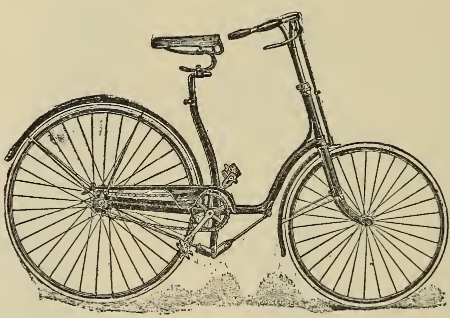
adding to the life of the machine and the comfort of the rider, besides saving much expense in repair bills, etc. The mud guard is of one piece and is a part of the swing frame; it is ample and light, and the whole device gives the machine an exceedingly graceful appearance, and, we know, will be appreciated by the rider."



Peerless Spring Fork.

The Peerless patent spring fork "works on the same principle as a watch case spring, or an ordinary door spring. Nothing can be more simple. It can readily be adjusted to suit the weight of any rider, by removing the handle bar and loosening or tightening the compression bolt, as the case may be, and then securing it with the lock nut. As the spring only compresses one-fourth of an inch it will never break. The distance between fulcrum and crown lug, which acts as a stop, is multiplied sixteen times, and consequently, if the spring works one-fourth of an inch, it springs four inches at the fork end."

In the Sylph the "spring truss frame consists of front and rear parts, each carrying a wheel, and an upper part carrying the load. These parts are hinged together at the crank axle, and held in the desired position by spring braces. The hinge is rigid in every direction except up and down, so that there is no loss of rigidity as in spring forks, where there is a hinge on each side of the wheel, one of which may act without the other, allowing the wheel to wabble.



SYLPH SPRING FRAME SAFETY.

When either wheel of the Sylph strikes an obstruction, it rises over it, compressing the springs instead of jolting the rider. The hinge is as far from each wheel as possible, so that very little spring action is required to allow the wheel to cross a large obstruction. This means that less vibration is transmitted through our springs than through most others, and that our springs will last longer.

"It is obvious that a frame trussed as is that of the Sylph is an exceptionally strong one, and as the springs take the shock, our machine, light though it is, can be ridden with impunity up and down curbs that would surely 'smash' a stiff frame machine of the same weight. Compressed coils are used, which are not only the simplest and most durable, but are so arranged in the cases that, if they break, the machine is still ridable.

"We call attention to the fact that the portions of the frame composing the hinge are not made of forgings, but of pressed sheet steel, carefully shaped, pinned, and brazed so as to combine great strength and rigidity with extreme lightness. So, too, is every part of the machine that cannot better be made of tubings or forgings. The springs are inclosed in cases which exclude dirt and grit. Passing through the springs and out through the cases are pistons, which compress the spring when weight is applied. It will be seen that all of the weight is sustained by these springs, and further that the upright saddle post is maintained in its upright position by them. This means, first, that either wheel is free to rise without affecting the saddle, and, second, that a back and forward swing of the saddle is permitted. The value of the first is evident, but the second requires explanation. Suppose the saddle to be exactly over the rear wheel. Vibration of the front wheel would not raise and lower the saddle, but would throw it back and forward. It is to meet this motion, as well as the up and down, that we use the three-part frame. Try for yourself by watching the saddle as the front wheel rises and falls over obstructions, and you will see once for all why a three-part frame does fully what other frames only half do. Pages of argument could be given to show the mechanics of springs, and why one form is better than another, but simple tests like the above are fully as conclusive.

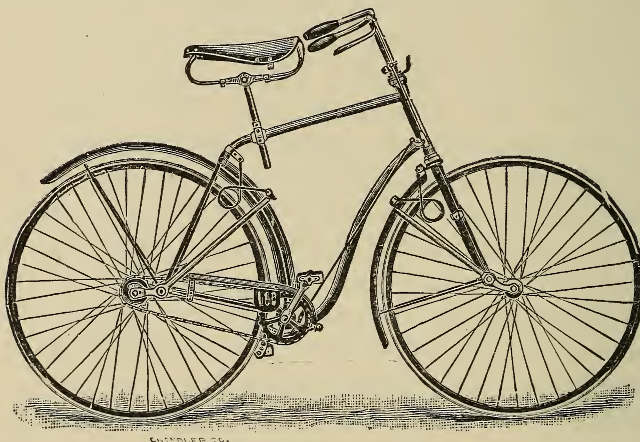
"Not only is our hinge at the best position between the wheels, but it is at the best position vertically. The hinge is the 'point of push' in spring frames, and should be below the front axle, for then the front wheel rises over obstacles easier. Try pushing a wheelbarrow, and you will understand this. With the rear wheel the position of the hinge is scarcely less important, for, although it will climb obstructions all right, it jolts severely in dropping down. Lead a wheelbarrow downstairs, and see if you do not hold the handle low. Yet there is a limit. The power is applied to the rear wheel, and the front one is pushed. If the frame be straight and stiff, no power is lost; but if the hinge be so far out of the line of the axles that a V is formed, the push tends to double the frame instead of driving the front wheel. This doubling destroys power instead of utilizing it, and has been the cause of much objection to springs in the frames of cycles. Put the front wheel against a wall or other obstacle, and drive the rear one. With some machines the wheel base can be shortened two inches. On such a machine every pebble checks the front wheel and destroys its momentum, which has to be supplied again from the rider's muscle. For this very serious reason the point of push—*i. e.*, the hinge—should be nearly in a line through the axles. Ours is there, and the objection that spring frames are useless for speed or hill-climbing does not apply to our machine. It takes less muscle to drive our machine up hill or over a rough road than any stiff frame ever built. Ask any teamster if a spring wagon is not easiest on his team.

"Our hinge joint is perfectly adjustable for wear, hence will not rattle or permit side play. As proofs of the efficiency of our frame, there is no tendency to jolt the feet off of the pedals, and many of our riders use no spring under the saddle. The springs, being coils, adjust themselves to the weight of the rider like a spring-balance spring, but that the weight may be supported at the preferred height from the ground, the truss rods are each provided with a means of adjustment which may be used to vary the position of the upright. This adjustability substantially allows the rider to build his machine to order, as it permits him to vary the distance between the saddle post and the handle bars, the position of the saddle over the pedals, the height of the pedals above the ground, and the angle of the saddle post. On no other machine are all these adjustments possible."

Some of the patterns of Union Safety bicycles are fitted with spring forks to both front and rear wheels, thus securing a spring frame. Their pattern known as No 12 is one of these.

"Heretofore, nearly all so-called anti-vibratory machines were fitted with springs on the front forks only. The fallacy of this idea can be easily seen when it is considered that more than two-thirds of the rider's weight is on the rear part, and in passing over an obstacle, the driving wheel acts in precisely the same manner as it would if in a perfectly rigid frame, without relieving the jar at all. We have fitted the same excellent device to both front and rear forks, and feel confident of having reached the highest stage of perfection to which it is possible to raise the spring frame.

"All tendency for the wheels to sway from side to side in the forks is overcome by means of the auxiliary forks, which are continuous around over the guards, and connected to the main frame by springs, formed in such a manner as to be sensitive to the least



UNION SPRING FRAME SAFETY.

irregularity, and at the same time withstand the greatest. These springs are readily detachable, and may be replaced by straight, stiff rods, thereby making the frame perfectly rigid. At the connections of the main with the auxiliary forks, we have fitted a neat ball bearing, by means of which the joints may be adjusted, and in addition, contributing a freedom of action, thereby deriving the full benefit of the springs."

The spring fork on the front wheel of the Victor Safety is a prominent feature. Regarding it, the manufacturers state in their catalogue:

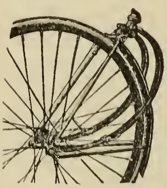
"It was ours to first recognize the necessity of a spring fork to absorb vibration, for the benefit of both rider and machine, and the Victor spring fork has been applied to all the Safety bicycles we have ever built, and has proved a feature of the utmost value. Many are the imitations with which it has been attempted to produce the results given by the Victor Safety, but all in vain. Like all imitations they have fallen far short of the original.

"As the wheels are small the vibration is great, and in studying this type of machine as made abroad we were convinced that it would require a front fork so constructed as to absorb this vibration, and thus, in effect, carry its own good road with it. We therefore purchased the principal patents bearing on such devices, and set about determining the best method of accomplishing the desired end. The result of our experimenting was the spring fork as now used in the Victor Safety.

"Each season's use has added to the enthusiasm of all who use it. The best indorsement of our theories is to be found in the fact that makers who have been arguing against the Victor spring fork ever since its appearance, and insisting that the old rigid fork was best, are now trying to get the benefit of the spring fork by the use of various kinds of springs which they claim will give the same results.

"The Victor spring fork has revolutionized the Safety bicycle, and riders may rest assured that the different devices which are claimed to be as good as the Victor spring fork are but poor excuses for the original and best. One method of absorbing vibration is to enlarge the front wheel. This makes a heavier and clumsier machine, and with an efficient spring fork is entirely unnecessary. An even flexibility throughout the entire range of the spring is demanded, and it is our opinion that the Victor spring fork is the only device which will give such action.

"The Victor spring fork is composed of four steel rods, made of the steel used in the finest sword blades. Its flexibility depends upon nine feet of steel rods. As the strain is taken by so great an area no one portion receives any appreciable amount, and breakage is almost impossible. As a matter of fact they do not break, as five years of service has demonstrated. The rocking beam and adjustable stay rods prevent all lateral motion. The joints in the rocking beam are furnished with Bown's Æolus ball bearings and are extremely easy in vertical action but very rigid laterally."



VICTOR SPRING FORK.

In the spring frame pattern of the Warwick Perfection Safety bicycle, springs made of steel and rubber were placed at the ends of both front and rear forks, between fork ends and bearing boxes, and were also used at the ends of the front forks of their ordinary bicycle.

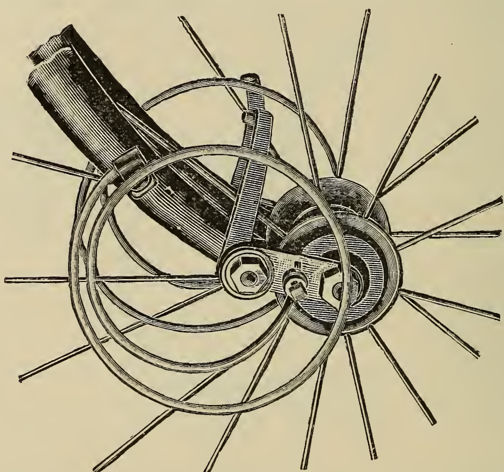
"This spring bearing is so constructed as to take up all concussions, resulting in the production of the only absolutely non-vibratory bicycle. Inside the bearing frame, and underneath the fork, is a spring made of steel and rubber. The steel takes the strain and the rubber takes the vibration, a combination that leaves the lateral rigidity of the wheel unimpaired. This is a point that cannot fail of inestimable appreciation. By means of a set screw the bearing can be perfectly adjusted to the weight of any rider. For a heavy man the screw is tightened, which closes the spring, allowing it to receive the extra weight. The bearing

WARWICK SPRING FORK.

is simply jointed to the bearing frame, which gives an elasticity and easy motion when the wheel comes in contact with rough surfaces on the road. Another device holds the frame rigid in such manner as to take up all side strain. The crank is detachable. On thorough inspection, it will be the universal verdict that the Warwick spring bearing frame is the only perfectly constructed spring bearing frame on the market, and the only invention in existence, on an ordinary bicycle, which overcomes concussion and prevents all vibration. A Perfection bicycle fitted with this device will stand more wear and tear on rough roads than any other wheel in existence.

"Vibration has been the study of inventors for years. The Warwick spring bearing frame is the first and only satisfactoiy solution of this problem."

The Winton spring fork, here shown, has as an advantage that "it can be attached to the small wheel

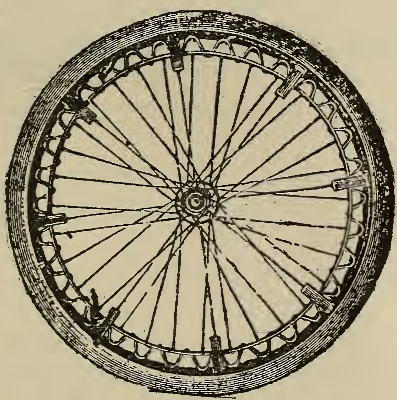


WINTON SPRING FORK.

of an ordinary as well as to a Safety, and that it can be attached by anyone without any boring or cutting."

ENGLISH DESIGNS.

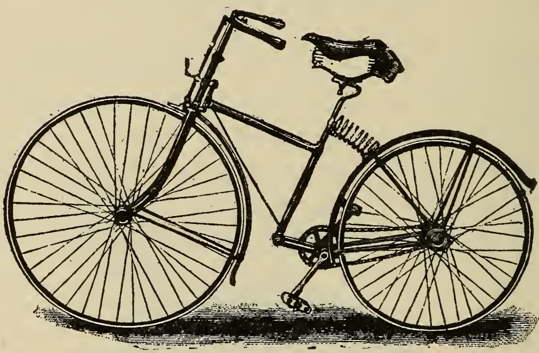
A PECULIAR wheel with two rims fitted with springs between them is called the Boaz. The outer rim, "which is tired with rubber, has metal loops inside it, to which spokes are fixed, and these spokes run to a large central ring, which is thereby suspended around the hub, whence radiate the spokes of the



BOAZ ANTI-VIBRATION WHEEL.

inner rim. The two rims are connected by a continuous band of rubber, in a series of loops bolted alternately to the one and the other. Briefly, it is a wheel within a wheel, the two being held together and kept apart by these rubber connectors."

The British Star has "the bottom of the seat pillar hinged to double stays; behind the top of the pillar is a round plate pad, between which and a corresponding plate on the top of the rear upper forks is a very



BRITISH STAR SPRING FRAME SAFETY.

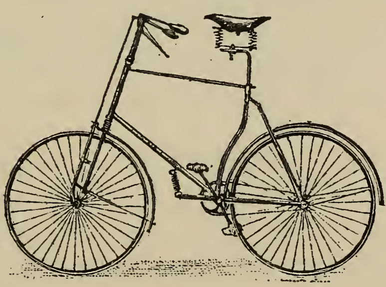
broad, flat coil spring. This absorbs any concussion felt by the front wheel, and gives a delightfully easy seat to the rider."

The patent spring fork of the Coventry Machinists' Co. is effective. "A glance at the construction of the spring, as shown in the accompanying drawing, will show that the side play of the wheel, hitherto such an inseparable objection to spring forks of any kind, is here entirely prevented. It thoroughly absorbs the vibration of the wheel, and at the same time fully preserves the rigidity of the machine."

The Don has "a practicable spring frame without complication in design or working. In the top of the rear forks there is a double link, connecting them with the top of the seat pillar, which receives the saddle-pin. The lower forks are horizontal and are taken forward beyond the bracket; and between the end and lower frame tube there is a strong coil spring. The

COVENTRY MACHINISTS' CO. SPRING FORK.

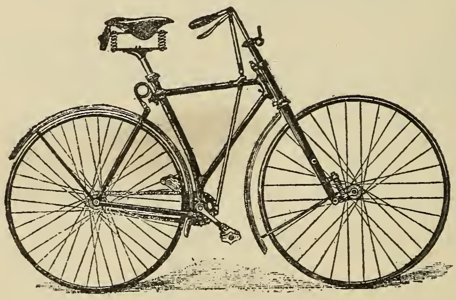
bracket, where the seat pillar and front tube unite, is hinged, to permit of a downward motion, which is checked by the action of the spring. This produces



DON SPRING FRAME SAFETY.

a very easy motion for the rider, and, so to speak, smoothes the road, reducing concussion and vibration to a low point. The front forks are double, and not continuous. The straight ones run to within three inches of the axle, and are connected by a spring with the pilot wheel forks, to which they are pivoted in the center; this also helps to take the strain off the forks when the brake is applied."

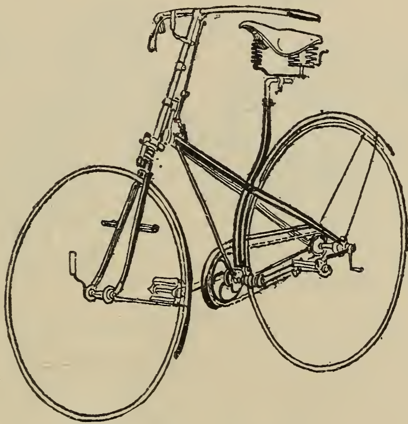
The Elland frame "is something like that of a divided diamond, but the head of the rear forks is attached to the seat pillar by a coil spring, which gives an easy motion to this part of the machine. Two stout tubes unite the pillar to the centers; on the upper tube is a bell crank, connecting the brake-rod with the lever spoon hinged to the crank bracket, which acts on



ELLAND SPRING FRAME SAFETY.

the rear wheel, low down, where it is very effective. The bottoms of the front straight forks come behind the pilot wheel axle, and are connected therewith by a hinged link, between which and a short arm above there is a coil spring, which receives the weight, and gives with any shock to the front wheel. Concussions to the rear wheel are absorbed by the top spring."

A pattern of the Excelsior is fitted with a spring fork to the front wheel. "An anti-vibration steering socket is put to the head, for the front forks; and the brake acts on the rear wheel, but is applied in the ordinary way, the chief communicating joint being a bell crank on the forward end of the backbone, or rather back-



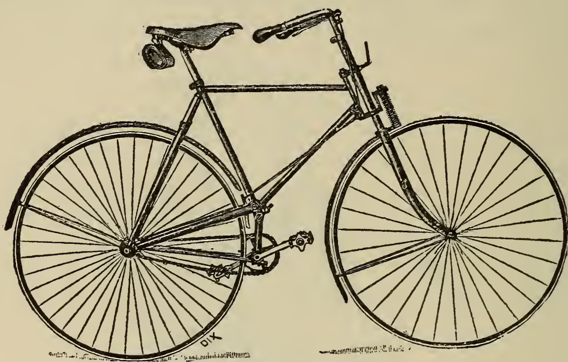
EXCELSIOR SPRING FORK SAFETY.

bones; it is very powerful. The stays from bracket to rear forks are very strong, and there are lighter stays from latter to the top of the curved seat pillar, and from the former to the head."

The anti-vibration spring used in the Freeman Safety is the same as that used in the Humber and Raleigh machines, and is illustrated on the last named.

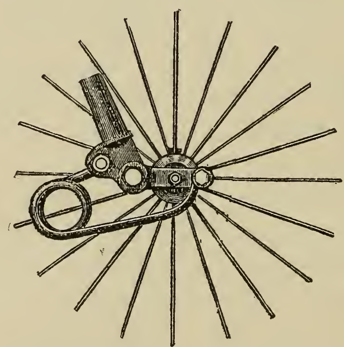
Harrington's "vibration check" consists "of a single coil of stout spring wire, one end being attached to the fork, and the other to the extremity of a short lever which is attached to the wheel pin. The whole weight is thus supported upon the spring, which gives to every obstacle it meets with."

The Horseley Safety, No. 1, has a front spring fork arrangement. "The fork foot, instead of running



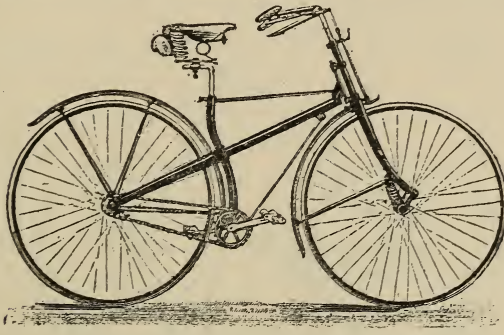
FLEETWING SPRING FRAME SAFETY.

direct to the axle, curves out a little above and beyond it; to a stud on the end is pivoted a short link, also



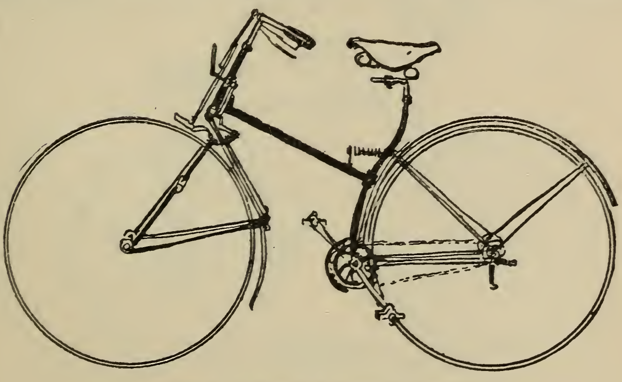
HARRINGTON'S VIBRATION CHECK.

pivoted on the axle end. With only this connection, the fork would of course drop down; but to restrain this, and receive the weight, there is, between this and a small elbow at the back of the fork, a strong coil



HORSELEY SPRING FORK SAFETY.

spring. Any concussion on the front wheel drives it backward, and these springs compressing, they absorb

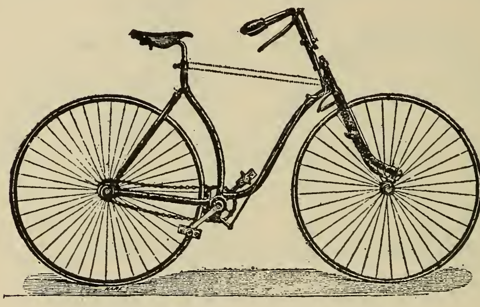


INVICTA SPRING FRAME SAFETY.

the shock, and relieve the rider of a great amount of vibration."

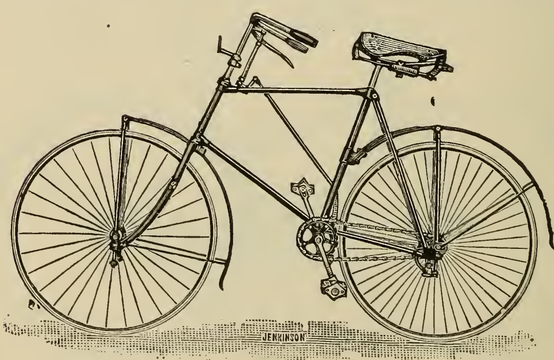
A pattern of the Humber is provided with a spring fork arrangement "under a patent shared with the Raleigh Cycle Company." It is shown in the illustration of the Raleigh.

One pattern of the Premier Safeties, known as



NIMROD SPRING FRAME SAFETY.

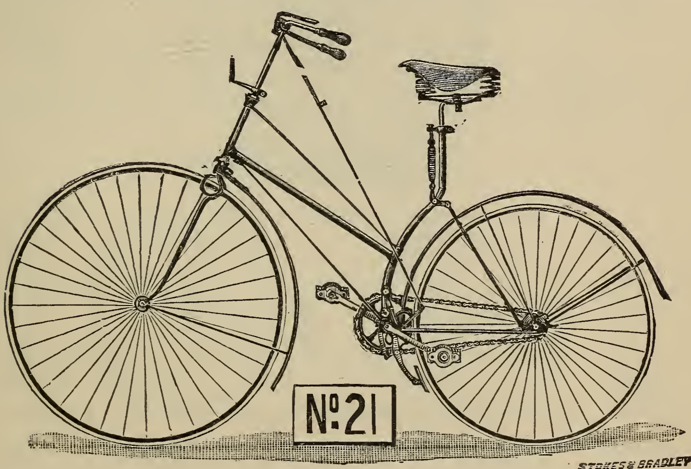
Model H, is fitted with Thompson's "patent spring system for rigid frame Safeties." On the subject of



PREMIER SPRING FRAME SAFETY.

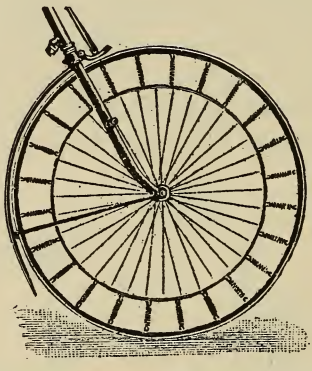
spring frames they say that "it is a remarkable fact that all passenger vehicles, from the heaviest coach to the lightest perambulator, have their frames supported on their axles through flat and laminated springs, excepting the bicycle and tricycle. The present spring system overcomes the difficulty hitherto experienced of supporting a rigid frame upon such springs. Passenger vehicles, excepting the bicycle and tricycle, have their springs resting direct upon their axles; this bicycle has its springs resting upon the tops of two forks, whose legs rest upon their axles; this in practice gives the same result. The principle of the bicycle spring arrangement is identical with that of the locomotive engine—viz., it has side rods or forks extending from the axles to the springs, working through guides upon its frame."

The pattern of the Quadrant known as "No. 21" is



Quadrant Spring Frame Safety.

a spring frame machine "fitted back and front with spring forks, the back adjustable on the same principle as our saddle spring. The standard pattern adjusts from nine to sixteen stone. Any rider above sixteen stone can have a pair of stronger coil springs on sending to us those on the machine. There is not a single joint that can work loose or rattle. The rider is protected at all points—hands, feet, and body—from vibration; not only the lesser vibration which is remedied by pneumatic and cushion tires, but from the greater vibration known as jolts, shocks, rebounds,

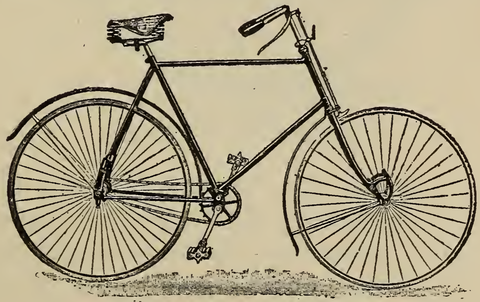


Quadrant Suspension Spring Wheel.

jumps, etc., which the air tires do not cure but in some cases rather aggravate."

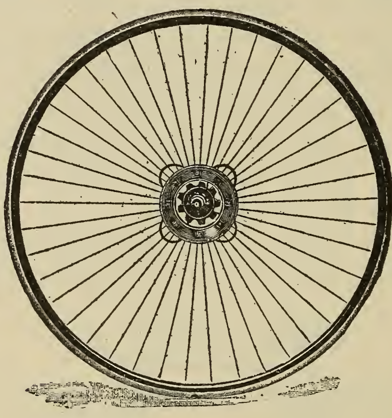
The Quadrant Company also have a "suspension spring wheel" which can be fitted to almost any of their machines. Its two rims, "united by the tensioned coil springs, form really a deep elastic tire, only that the elasticity is obtained by suspension instead of by compression. That portion of the rider's weight which rests on the front fork reaches the hub of the front wheel; then, instead of continuing its bearing through the bottom spokes to the earth, as is the case in an ordinary wheel, it is hung upon the whole of the upper half circle of coil springs. When, therefore, the wheel encounters any stone or rough ground, the shock or vibration exhausts itself in tensioning the half circle of springs, consequently can never reach the rider. The practical effect is that the vibration on an ordinary or rough road is not felt at all, while severe shocks reach the arms in the shape of gentle undulations. Additional weight 1½ pounds. We apply it only to the front wheel of our fork-steering Safeties—Quadrant steering machines do not require it. Not suitable for driving wheels; we meet the vibration of driving wheels by our suspension saddle spring. There is no complication whatever, and nothing altered except the spokes."

The Raglan radial spring frame is so named on account of its action striking a radius true to the cen-



RAGLAN RADIAL SPRING FRAME SAFETY.

ter of the crank axle, thus preventing any irregularity either in tension of chain or distances between centers. As a consequence, the relative distances existing between saddle, pedals, and handles are always constant, so that no possible loss of power is sustained, an essential point to a successful spring frame and one hitherto attained in but few existing spring frame machines. The whole weight of the rider is supported on four spiral springs (two to each front and back wheel), so that any shock caused by the unevenness of the road is entirely absorbed. The springs are inclosed by two blocks, which traverse a parallel slide

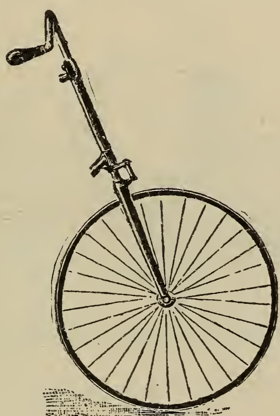


Raglan Spring Wheel.

and which being a perfect fit render any side-shake of the wheel impossible. A point worthy of note is that the springs are easily replaced by weaker or stronger ones as may be required, thus insuring riders of different weights being equally well suited."

The Raglan spring wheel is claimed "to be an entirely novel method of reducing vibration. The spokes are screwed into flanges somewhat larger in diameter than the hubs, and to these flanges are fixed four special springs, which hold the hub and consequently support the weight of rider. These springs are so arranged as to be capable of yielding in every possible direction to any shock which may be caused by the unevenness of the road, with the natural result that such shock or jar is entirely absorbed."

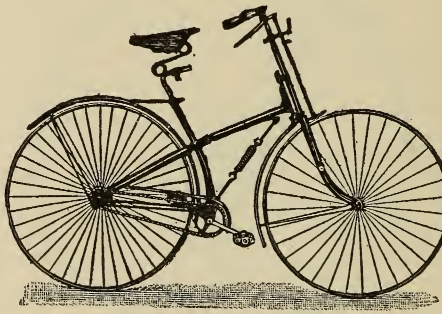
The Raleigh has a spring front fork arrangement in common with the Humber, and the same device is used on the Freeman Safety. "In front of the main



RALEIGH SPRING FORK.

sleeve steering socket there is a smaller sleeve case, which receives a guide; a short, upright pillar above a lug projecting forward from the fork tops. A considerable proportion of the weight rests on springs within the sleeve, which permits the pilot wheel to give way on meeting an obstacle without the rigid shock being communicated to the rider."

A pattern of the Rival is fitted with a spring frame which "is the only practical spring frame to which no objection can be raised. It possesses the great advantage of being adjustable as regards tension. In this most important respect it stands alone. This spring frame, for lessening vibration, is the best device that has been put on the market up to the present time. It is as superior to any other device for lessening vibration as the modern bicycle is to the old 'bone-shaker.' A rider of our 'spring frame Rival' may strike and run over a brick, and will hardly be con-



RIVAL SPRING FRAME SAFETY.

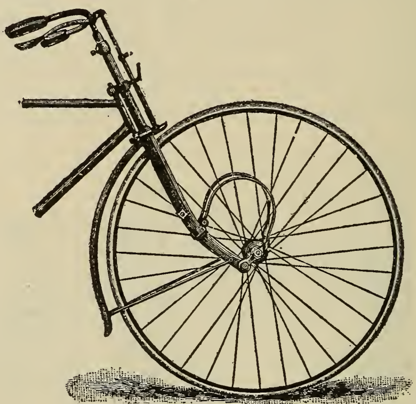
scious of it. A great advantage of this style spring frame over any other is, that the steering is not affected by striking an obstacle, even as large as a brick. The machine, with the exception of the spring attachment, is in all its details identical with our No. 1 Rival Safety. It will be noted, upon reference to the above illustration, that the main framework is jointed immediately below the rider. The spring, a strong spiral one, is especially made for this machine, and is connected in such a manner that it offers opposition to the weight of the rider, and receives every shock that the machine may meet with while being ridden."

The spring frame pattern of the Rover Safety is fitted with the Roamer spring front. Saddle, pedals, and handles are constant in their relation to each other. "The frame is like that of an ordinary Rover, but slightly shorter, and the steering post, in place of

ROVER SPRING FRAME SAFETY.

being a rigid connection with the top of the steering forks, ends abruptly. At the top and bottom of this a link is fitted some three or four inches in length. These links attach, one to the top of the steering forks, the other to the extremity of a secondary steering post to which they are attached. A simple single-coil spring is placed betwen the two steering posts, which serves to support the parts in their proper relation to each other, yet allows them to give to every contact of the front wheel with an obstacle."

The Royal spring fork "is the only spring that can be applied to any wheel; the only spring that makes a

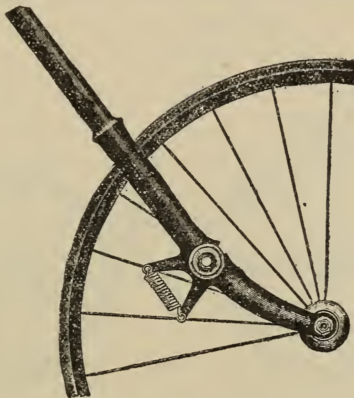


ROYAL SPRING FORK.

wheel steer better; the only spring fork that won't pitch; the only spring that has a double action; the only spring with a pressure caused by levers."

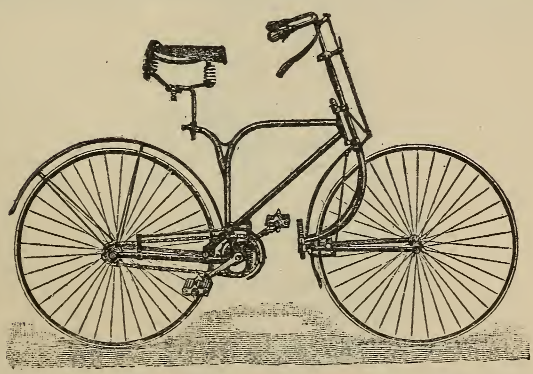
In the Rudge spring fork "the fork sides are hinged in the middle, and to each end an arm is attached. The two arms depart from their common center at nearly right angles, and their extremities are connected by a strong spiral spring. As a result, all the weight placed on the forks is borne by the springs, which give to every obstacle."

One of the patterns of the Sanspareil is a full spring frame machine. "This latest machine entirely supersedes the pneumatic tire, as the springs eliminate all vibration, and riding upon even the roughest of roads is thus transformed into a perfect delight."



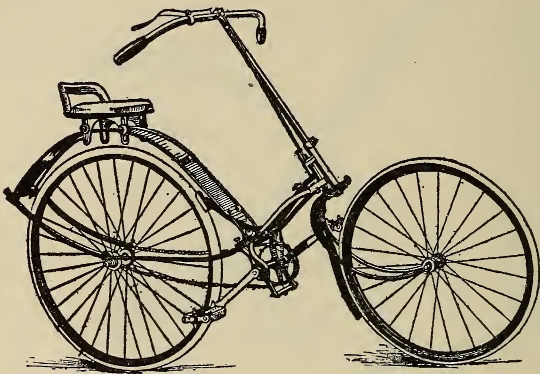
RUDGE SPRING FORK.

The Seabreeze spring frame Safety is built on unique lines, the frame being thoroughly distinctive.



SANSPAREIL SPRING FRAME SAFETY.

Curved steel rods take the place of tubes; there are spring front forks, and the saddle rests on a long spring. It is said that it "is the hygienic bicycle, and is most suitable for either sex. Its luggage-carrying



SEABREEZE SPRING FRAME SAFETY.

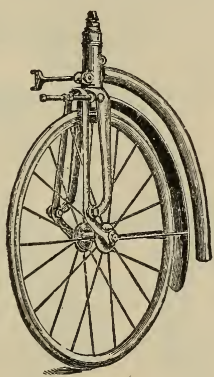
capacity and ease over rough roads make it one of the best touring machines out, and it is mounted as easily as sitting in a chair."

SINGER SPRING FORK.

The Singer spring fork is adapted to both Safeties and tricycles.

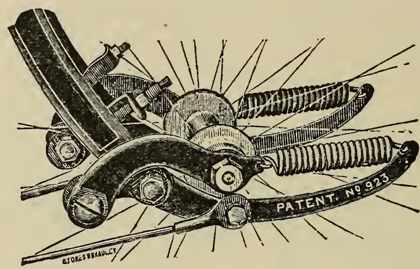
"The wheel is attached to the ends of two small levers, which are pivoted to the fork. A smaller fork is attached to the rear ends of the levers, and is supported by a coil spring placed below the main tube of the framework. This spring is capable of being adjusted to suit the weight of the rider. When the wheel is passing over an obstacle the shock is absorbed by the coil spring, and by the use of a single spring the wheel has no tendency to be moved out of the center of the fork. The adjustability of the spring is another advantage."

The Singer spring fork for tricycles "is a most effective arrangement, and it has also the advantage of being capable of application to any tricycle, without



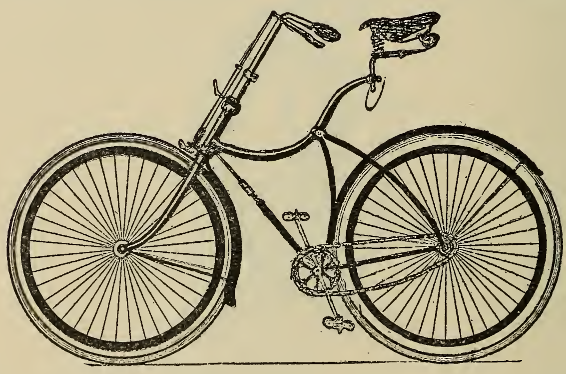
SINGER SPRING FORK.

altering anything except the lower ends of the fork. The rigidity of the wheel and steering is not affected in the slightest degree, the weight is only very slightly increased (the wheel and tire may be lighter to compensate for the weight), it cannot possibly get out of order, and, indeed, the whole arrangement acts in the most satisfactory manner. The wheel is fixed in a kind of frame or vibrator in front of the fork, and is



SMITH'S SUSPENSION SPRING.

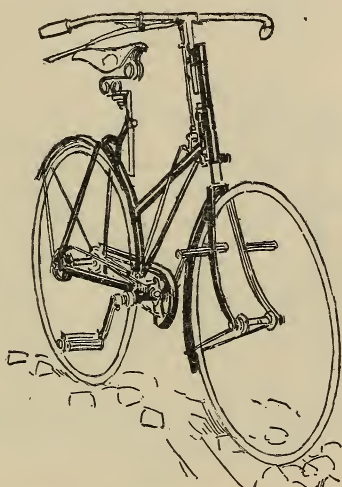
attached to it by pivots upon which it works. At the upper end of the vibrator there are two spiral springs, which are attached to the fork. When a shock is



SNARK SPRING FRAME SAFETY.

communicated to the wheel, it is absorbed by these springs in the most unmistakable manner. That there is considerable vibration proceeding from the small wheel is shown by the fact that when the spring fork is used, the movement of the frame and springs is almost continuous."

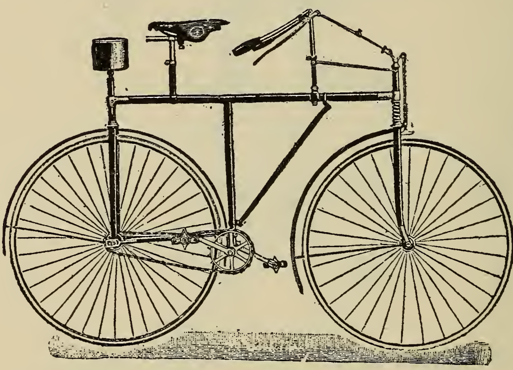
The Steeplechaser is provided with spring front forks. "The springs are entirely confined to the sliding socket, which goes over the steering pillar of the pilot wheel; the working parts are out of sight, dust-



STEEPLECHASER SPRING FORK SAFETY.

proof, and noiseless. A strong coil spring is placed over the solid head of the pillar, and the pliability of this can be regulated by a screw cap on the top of the socket sleeve. The spring slides by ball guides in grooves cut in the pillar, which prevents it twisting round, and produces a most effective spring frame, adding greatly to the pleasure of riding, and extending the life of the machine without interfering with the rigidity or even the appearance of the machine as a whole.''

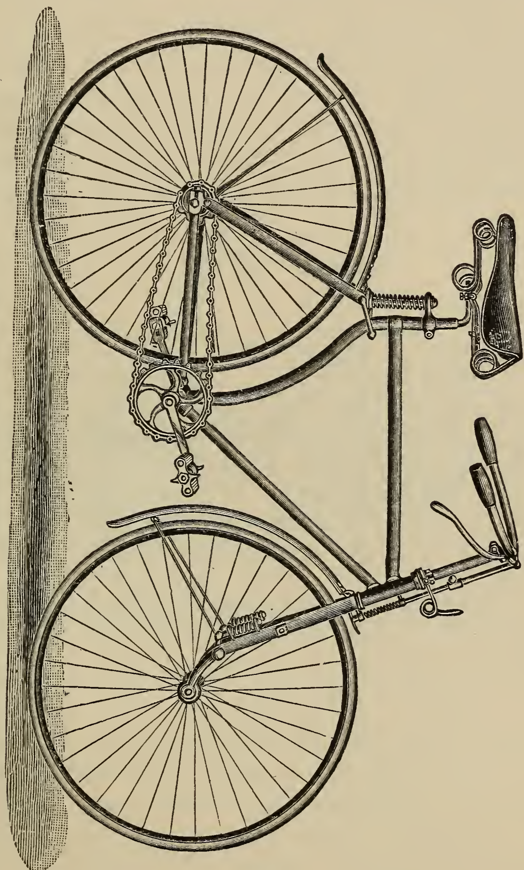
The Stuart spring frame Safety is built with two equal-size wheels which have vertical forks, connected near their top by a horizontal backbone. A vertical tube, running down from the backbone, carries the crank axle. The rear wheel drives, and the saddle post is midway between crank and driving-wheel axles. Springs are at the head of the forks, and the handles



STUART SPRING FRAME SAFETY.

are secondary, being connected with the front forks wheel by means of a rod.

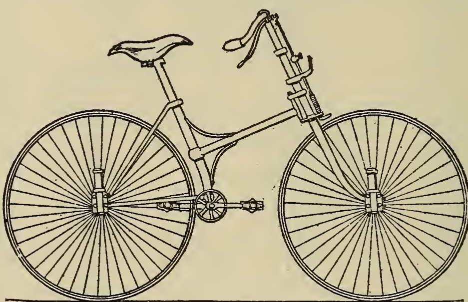
One pattern of the Swift Safety is provided with springs above both wheels. The machine ''has been greatly improved by using one central spring at the back of the saddle tube. When traversing rough ground, the rear wheel works vertically on the hinge at the back of the crank shaft bearing bracket, so compressing the spiral spring at the seat post. The tension of the spring is adjustable by means of a half-inch nut, allowing the rider to regulate the amount of spring without any inconvenience. By tightening the



SWIFT SPRING FRAME SAFETY.

hinge at the back of the crank shaft bearing bracket the rear wheel becomes rigid. Our adjustable spring fork in the front still gives universal satisfaction."

In the Tiger spring frame "the vibration is taken up by means of a coil spring inclosed in a suitable case, and compressed by a piston, the rod of which is connected with the axle of machine. The use of these springs to each of the bearings meets all the requirements of riders using pneumatic tires, and certainly prevents all vibration. It provides luxurious riding. It is easy and fast on roughest roads. It surmounts obstacles of large size with surprising ease, and without



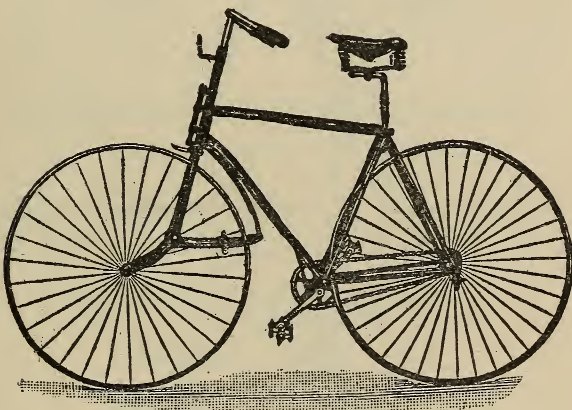
TIGER SPRING FRAME SAFETY.

any check to speed with total absence of feet or hand vibration."

Vale's patent Kohinoor Rocker Safety is fitted with their "rocker" spring fork and "is absolutely the strongest and most rigid machine made. The 'rocker' fork, which entirely absorbs vibration, is greatly improved. No loss of power to the rider. No sacrifice of rigidity. Has a powerful and wonderfully improved foot brake, which answers both as rest and brake. A perfect luxury for downhill riding, without any additional weight." The fork is shown on their spring frame Safety.

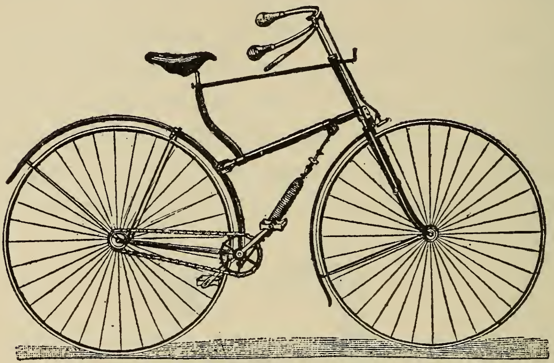
The Cycledom special Velox Safety is fitted with a "non-vibrating spring frame" as shown in the illustration.

In the Wenham, vibration is reduced by the construction of the frame, for which strong anti-vibratory properties are claimed. "All brazed joints have been entirely done away with. This frame is made in two sections, made of one single tube without a joint from end to end. Starting from the top of the neck till it



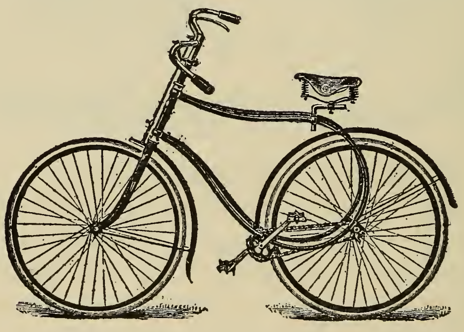
VALE SPRING FRAME SAFETY.

reaches the seat pillar, where the two sections are fixed and bolted about two inches apart; from the seat pillar the tubes curve down in a semicircle past the back-wheel axle slots and crank bracket, where it is most strongly stayed by two tubes placed transversely top and bottom, from these back to lower part of neck. Upon looking at the illustration it will be seen that this frame combines all the advantages of the double diamond frame (the best, except this, known) with none of its disadvantages. The wheels are so placed



VELOX SPRING FRAME SAFETY.

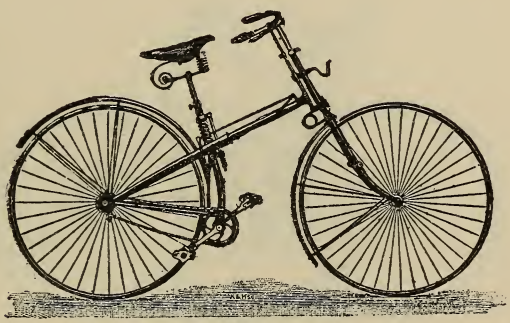
on the frame that the shocks from the road do not reach the frame in a vertically direct manner, but in



WENHAM DUPLEX FRAME.

the center of a strong double semicircle, which acts as a most powerful spring, without disturbing the rigidity of the frame or tread in the least."

In the Weston spring frame Safety "the fork of the rear wheel is carried forward some distance, and has two legs or projections extending below the edge of the fork tubes; pivots pass through these, and screw into a rocking collar, through which slides the seatpillar. Above this there is a fixed collar on the pillar, and between a coil spring; from the upper collar a rigid guide rod passes through a boss on the lower collar, both being attached to the machine forks. The entire

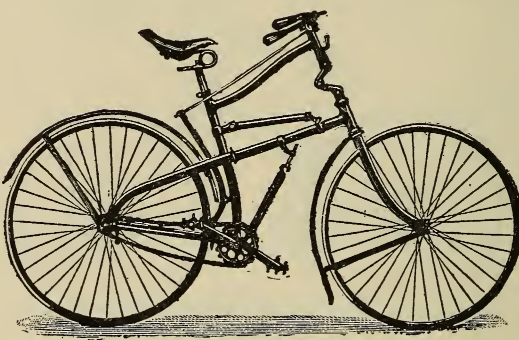


WESTON SPRING FRAME SAFETY.

weight rests on the coil spring, which therefore takes up any vibration, and produces a very easy seat. The front part of the machine is also isolated by a novel method. The steering socket and handle bar are connected with the forks, which curve out, by two curled Arab-like springs. In order to preserve stability, there is also a rigid connection, hinged to give play to the springs. Both springs answer very well."

The Whippet spring frame is original in character and "one of the most successful forms of spring frames, and has, indeed, given rise to the introduction of them all.

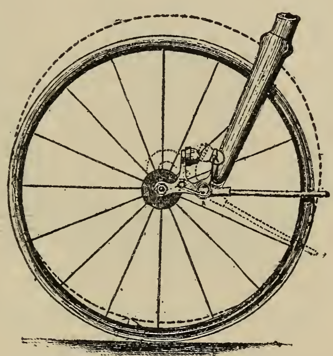
"In general appearance the machine would be described as a single frame with two front upper stays; the higher of these forms a rigid connection between the part of the steering pillar below the handle bar and the top of the seat-pillar; the lower stay is attached by a link to the backbone, and also holds the seat pillar in position, but permits it to move up and



WHIPPET SPRING FRAME SAFETY.

down in the head of the rear forks. At the foot, the ⊥ crank bracket is supported in the center by a very strong coil spring, held by an adjustable screw at the top to a lug below the backbone. The whole *weight* rests on this spring, but is unaffected by the pedal action; the two rear stays are pivoted on the axle, so as to move with the spring action, but at the same time keep the pedals at the same distance, and perfectly rigid. In order that the handle bar may respond to the movements of the suspended portion, the steering pillar is divided, and joined by flat, jointed links which permit the handles to dip and rise again; they do not interfere with the steering, and equal command is obtained over the pilot wheel, whatever the position of the movable parts."

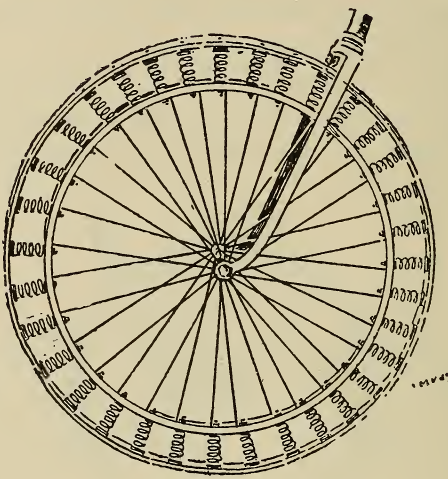
A device to annihilate vibration, applicable to the steering wheel of a Safety, or the rear wheel of an ordinary, is called the Will-o'-the-Wisp Anti-Vibra-



WILL-O'-THE-WISP ANTI-VIBRATOR.

tor. It "is a single coil of stout steel wire arranged as in the annexed illustration. The fork ends attach to one arm of a lever, and rest upon the spring. A side arm projects upward from the lever which is attached to the wheel pin, and bears at its top a button or pad of rubber against which the fork brings up should the spring be greater than usual. The springs on each side are kept stiff and firm by a continuation or fork of strong wire, which passes round at the back of the wheel and unites them."

The patent Zulu rim is similar in principle to the Boaz and Quadrant already shown. In this case the insu-



ZULU ANTI-VIBRATION WHEEL.

lating arrangement placed between the two rims is composed of spiral springs.

PNEUMATIC AND CUSHION TIRES.

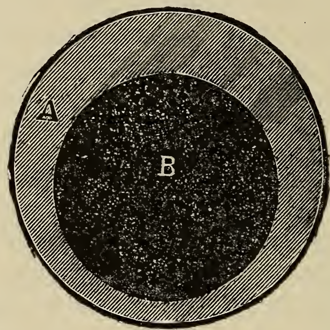
ONE of the most curious facts connected with the development of cycling is that nearly fifteen years' experience with the wheel was needed to teach wheelmen the real significance and full value of the tire. For many years, the importance of its function was not half realized; the vibration produced was disregarded; and its effect was practically unknown. Even more than this, in order to save weight, the size of the tire was constantly reduced, and finally came to be, on light roadsters, that of a mere string—about $\frac{5}{8}$ or $\frac{1}{2}$ inch in diameter. Such small sizes possessed a minimum of cushioning properties, and, consequently, were of very little value as annihilators of vibration. It was not until apostles of anti-vibration had arisen that the matter began to attract general attention. Various spring devices were introduced into the frames of machines, some with good results, and generally more popular here than abroad.

But it was not until 1890 that the tire question was discovered to be one of the first magnitude. During 1889 the "pneumatic" tire had been introduced to the public; it had proved itself to be far faster than the solid—or, to be more accurate, it made it possible for its rider to be far faster than he was on a solid tire, and much more comfortable as well. But it added materially to the cost of a wheel, and was, at the start, very liable to puncture and leakage. This led to a general attempt to produce a tire that would be as fast and comfortable as the pneumatic, but more reliable, and also less expensive. The result was the "cushion," which is usually a rubber tire of 1¼ inches, with perhaps a ½-inch hollow core. The cushion proved to have less resilience than the pneumatic, and consequently was not so fast or comfortable; but it cost less, was more reliable, and far superior to the small solid in every way.

Both pneumatics and cushions increase the weight of a machine over one with a small solid tire, but riders at last learned that reduction of weight does not necessarily mean increase of speed. Speculations were many as to what did make the rider of either of these types faster than he was on a solid, and men were slow to comprehend that it was due simply to the reduction of vibration. Reduction of vibration means large saving in nervous energy, and that in turn allows the rider to increase and maintain his speed. The merely muscular exertion required to propel bicycles shod with tires of different kinds—other things, such as weight and bearings, being equal—does not differ materially, but the difference in the amount of nervous energy expended is very great, especially when riding at high speed, or over rough roads.

The views of R. J. Mecredy, editor of the *Irish Cyclist*, on the features of a perfect tire, are interesting. Mr. Mecredy has been familar with the pneumatic since its introduction, and was almost the first racing man to acqurire fame on it. He says of a perfect tire: "1. It will be speedy, the sides will be thin and flexible, and even the head will not have much substance in it. 2. It will be comfortable, in other words, it will set on a flat or practically flat rim, thus rendering the whole of the tire available for cushioning purposes, and it will be flexible and yielding. 3. It will be comparatively light. 4. It will be affixed to the rim in a simple and effective manner. 5. It will be self-healing in all ordinary cases of puncture. 6. It will be capable of easy and rapid repair, should by any chance a gash be made too serious for self-healing properties of the tire to effectively close. 7. Repairs will be permanent. In dealing with this question it must be borne in mind that compressed air is an exceedingly difficult agent to manage, and nothing but prolonged practical experience will guarantee the efficiency of any particular method of confining it. Almost any air tire will work well for a short period; many will behave excellently for months, but nothing less than a season's use will demonstrate beyond yea or nay the practicability of any particular form of air tire."

Taking up the tires in alphabetical order, the first one is the Beer Spongy tire, which, it is claimed, will not split from within; is light and elastic; does not puncture, and can be made to fit existing rims. "In this invention a large hole is made in the tire, slightly eccentric to its outer diameter, and is then filled with spongy rubber such as is occasionally employed for flesh-rubbers and similar toilet articles. Its elasticity is very considerable, its lightness is pronounced, it is next to impossible for it to get cut by the rim, and, as a matter of fact, it is a modified form of pneumatic; that is to say, in the process of manufacture, the spongy rubber assumes the shape of cells, all of which are charged with air at normal pressure,



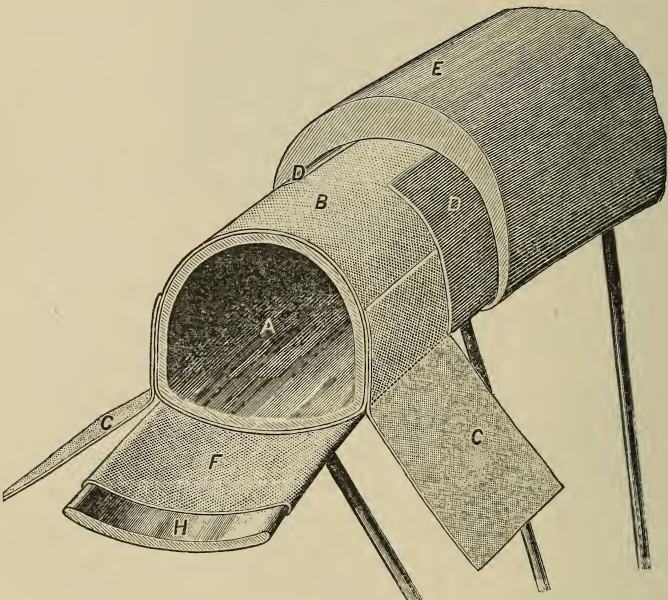
Beer Spongy Cushion Tire.

and this air is being continually compressed at the point of contact."

The Bidwell [Thomas] tire is shown in the following cuts. "The air tube is the one part of a pneumatic tire that causes the most trouble, and has been the subject of considerable experimenting. To confine and retain air under pressure in a rubber tube, and guarantee the tube against bursting, was the object sought and accomplished. Our air tube is constructed of pure Para gum, and treated with a compound that closes all the 'blow' holes which exist in rubber, and which cause the leakage in most pneumatic tires. We guarantee our air tube against bursting and leakage of any kind not caused by puncture through the outside covering. The non-expansible tube is next in importance, as it protects the air tube and prevents the expansion of the rubber tube to a bursting point. In all other pneumatic tires this tube is made from two pieces of linen canvas, and consequently the fabric tube has a seam on each side. It is the parting of this seam that generally causes the bursting and collapse of the air tube. In the Bidwell [Thomas] tire, the non-expansible tube is made seamless to an exact diameter and by a machine designed and constructed especially for the purpose. In almost all pneumatic tires the valve is a crude affair, composed of a simple rubber tube cemented to the air tube by ordinary rubber cement. It is well known that a proper joint cannot be made in this way, and as a result almost all tires leak at the junction of the air tube and valve. Our valve is constructed of brass, is automatic, admitting the air and closing at each stroke of the pump, and is vulcanized to the air tube by the rubbermakers while making the tube; thus the valve actually becomes by the vulcanizing process a part of the air tube, rendering leaks about its junction impossible.

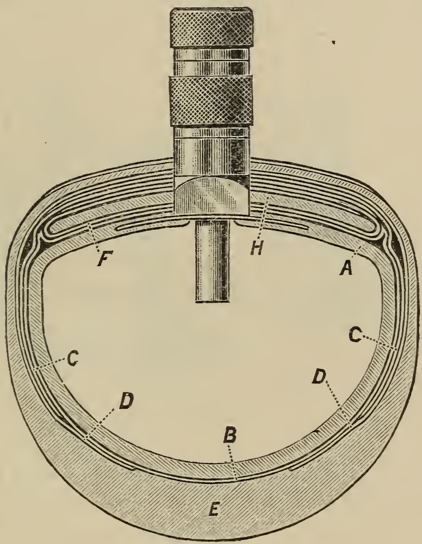
"Another feature we claim is the very important one of deflating the tire. With the ordinary valve it is impossible to deflate the tire except by puncturing the air tube. With our valve, by simply unscrewing the inside cap the air is permitted to escape, thus deflating the tire, and greatly facilitating any repairs that may be necessary, at the same time rendering the tires safe for storage or shipping. The outside cover is of pure Para gum with sufficient compound to render it strong and pliable. Our cover is molded under hydraulic pressure, and reinforced on its inner surface by an elastic fabric or braid. This braid will allow the cover to stretch lengthwise, but not sidewise, and, like the seamless tube, is made on especially designed machines for our use.

"Cut No. 1 shows construction of the Bidwell [Thomas] tire, each separate part lettered to facilitate the explanation or for convenience in ordering parts. This tire is built up as follows: Starting at the rim of



CUT. NO. 1.—BIDWELL PNEUMATIC TIRE.

wheel (*H*) the canvas strip (*F*) is cemented smoothly to rim, entirely covering the rim. The rubber air tube (*A*) which has been encased in the seamless non-expansible linen jacket (*B*), to which have been sewn linen flaps or wings (*CC*), is next put on and the flaps firmly cemented beneath the rim. An extra reinforcing strip of linen (*DD*), to prevent cutting at the edge of the rim, and to prevent slipping, is then cemented to the seamless jacket (*B*) passing under the rim, as shown in Cut 2. The rubber wearing shoe (*E*) is put on over all, firmly cemented over the rim, and a strip of black rubber friction cloth secured on

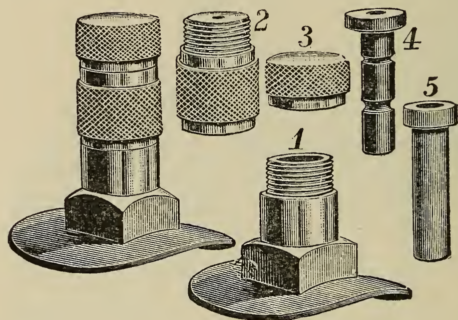


CUT No. 2.—CROSS SECTION AND VALVE.

the inside of the rim covering the edge of the shoe (*E*) to protect the inner construction against moisture and dirt. The valve is fully shown in Cut No. 3.

"This cut represents exact size of valve. It is very simple, easy to adjust, and incapable of getting out of repair. No. 1 is the base, which is vulcanized into inside air tube. No. 2, deflating cap. No. 3, cover cap. No. 4, hard rubber valve seat. No. 5, soft rubber valve cover and air check. To inflate, unscrew cover cap and apply pump. To deflate, unscrew No. 2, or deflating cap, and remove plug. See that caps are firmly secured after inflating.

"Should your tire at any time deflate without seeming cause, remove deflating cap (No. 2), and taking out hard rubber plug (No. 4), remove the soft rubber



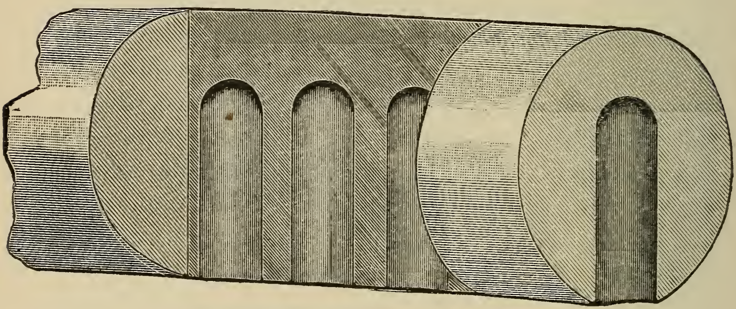
Cut No. 3.

jacket or air check (No. 5) and apply new jacket, first moistening slightly the hard rubber plug (No. 4), to facilitate application. Any parts of valves Nos. 2, 3, 4, and 5 can be obtained from any bicycle manufacturer or dealer, or direct from us on application.

"Should anything happen to your tire, do not be under the impression that you must take it or send it to a repair shop. You can easily fix it yourself. A little care and patience until you understand the construction is all you want. It will give you confidence and convince you that your tire is as stable as any other part of your wheel. See that the tire is kept well inflated, and never ride it when at all deflated. Therein lies the whole secret of the long life of the tire and almost entire freedom from trouble—observe this rule and your Bidwell [Thomas] pneumatic tire will be 'a thing of comfort' and 'a joy forever.'

"There is little liability of any trouble except a possible puncture, which is an exceedingly rare occurrence, owing to materials used and method of construction. Should tire be punctured, note the following: It is almost always possible to easily locate puncture by cut in outside shoe. When this is impossible inflate tire as much as possible, revolve wheel slowly in shallow basin of water, and at point of puncture slight bubbles will appear on surface of water. When located, deflate tire, break loose the inside strip of friction cloth for a space of about 12 inches. Do the same with outside shoe. Turn that part of shoe over edge of rim. Cut a + in canvas jacket. Clean the rubber tube at point punctured. Cement a small round patch of rubber over puncture, let it dry fifteen minutes, then inflate lightly to enable you to cement a small square of canvas to canvas jacket where cut. Moisten the edge of the shoe with cement. Spring it back into place, smooth the friction cloth also into place, properly inflate, mount your wheel, and go ahead. Materials for these slight repairs go with each set of tires. Also circular giving directions how to repair—and very few of you will ever have use for it."

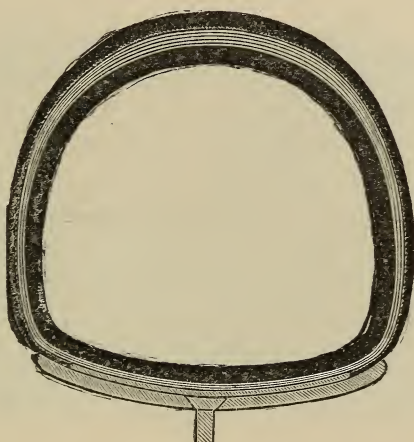
The Bolte cushion tire differs from the ordinary pattern of cushions in having a series of transverse holes instead of one hole running throughout the length of the tire. Its makers claim for it "that the improved Bolte cushion tire has more resiliency than any other cushion made, whether applied to an ordinary solid tire rim or to the regular $1\frac{1}{4}$- or $1\frac{1}{2}$-inch rim. Instead of running the hole longitudinally through the tire as heretofore (hose-pipe fashion) the holes are put in transversely about $\frac{1}{8}$ inch apart, the elastic partition between giving it both strength and softness. We find that it does away with any possibility of cutting through to the inner hole, which would of course happen at times when the tubular tire



Bolte Cushion Tire.

was used. Although these tires were first made to apply to old solid-tired wheels only, we are now able to furnish them in regular form for ordinary cushion rims. However, as every mechanic knows, the smaller rims make much more rigid and lighter wheel; and, as the best qualities of our improved cushion tire are brought out by using the smaller rim, we strongly advise them even in new machines."

The Bolte pneumatic tire claims that "the leading feature is the fact that there is no cloth or canvas cemented around the inside of the rim, but the metal of the rim is exposed the same as on any solid or cushion tire machine. The Bolte pneumatic has no inner expansible tube; the tire is cemented the same as any cushion, or solid, the linen duck which forms the principal feature of the main tube being vulcanized in layers around a $\frac{1}{8}$ inch thick inner coating of rubber. The thickness of the tire at the tread (referring to the cut) is not so great as on the ordinary



pneumatic, but in place of a thick body of rubber the Indestructible has five thicknesses of twilled linen duck wrapped in such a way as to bring the laps over each other at the tread, where the puncture is liable to occur, and making punctures practically impossible.

"In case of puncture, the laps are pulled off from the inner tube in the same manner as they were put on before being vulcanized, until the last layer of linen, which is one continuous strip running around next to the inner tube, is reached. This linen strip must not be removed from the inner tube to which it is securely vulcanized, but in case of puncture, which is almost impossible, a small triangular opening is made by cutting two slits one-half inch each in length at right angles with each other directly over the puncture, as shown in cut, care being taken not to cut through the inner rubber covering. The lip can then easily be pulled off and a patch of gum rubber applied

BOLTE PNEUMATIC TIRE.

to the exposed puncture in the usual way, and the laps cemented back in place. The valves, which are impervious against leaks and the other troubles that have beset pneumatic tire machines, are so constructed that the air may be released instantly after unscrewing the cap, which is kept screwed down against the hard rubber seat within.

"Its capacity for holding air seems to be without limit. They are making these tires in three different sizes, viz., 2 inch for road use, $1\frac{3}{4}$ for light roadsters, and $1\frac{5}{8}$ for racing machines. The company claim they are considerably lighter in weight than any other pneumatic tires of the same class. Their patents cover not only the construction of their tires, but the process of manufacture as well."

The Boothroyd is one of the best known pneumatics. Its inventor says "the essentials of a pneumatic tire are: rubber to retain the air, and canvas to withstand the strain of air under great pressure. In the Boothroyd these materials are all vulcanized together, there being practically three tubes of rubber, supported and divided by 2-ply of canvas. The walls of roadster tire are about $\frac{1}{4}$ inch thick. Nothing but the best Para rubber is used. The advantages of the tire are: its cheapness, durability, ease of affixing to ordinary rims, small liability to puncture, and, above all, ease of repair from the outside, owing to the walls being all in one piece. In regard to speed, I believe it is faster than any other form of pneumatic, and this opinion has been indorsed by some of the most prominent riders in England, and the already large number of fine rides made on this tire during the short time it has been before the public, goes far to prove this point.

"The tires are made $1\frac{1}{4}$ inch, $1\frac{1}{2}$ inch, $1\frac{3}{4}$ inch, and 2 inches outside diameter, or even larger to special order. The $1\frac{1}{4}$ inch may be used to replace $1\frac{1}{4}$-inch cushion tires, and riders will do well to try them, as the cost is not great. But for new machines, I would not recommend less than $1\frac{1}{2}$ inch, while $1\frac{3}{4}$ inch has so far been the favorite for Safeties. One and one-half inch, is, I think, quite large enough for ordinaries. I do not think 2 inch need be used except for very bad roads.

"The rims are the usual cushion U or hollow, but should be the proper section for the tire, *i.e.*, a rim for $1\frac{3}{4}$ inch tire should have $1\frac{3}{4}$-inch radius, so that the tire fills it properly when inflated. The rims should not be more than $\frac{1}{2}$ inch deep, and may be used much lighter than for cushion tires. The spoke-heads should be sunk level with the surface, so as to leave no projection to cut the tire. They should be of such a size that the tire will go in, before inflating, with hardly any stretch. Before placing the tire in the rim, coat the rim lightly with good cement. I find the best way of doing this is to get the rim rather hot and paint the cement in from the stick instead of first melting the cement and pouring in. By the former means you get an even and thin coating. Lay the tire in place and inflate, but not too tightly. Then warm the rim and the tire will be perfectly secure so long as it is inflated. Take care that the nozzle is in right position, and not subject to any strain or cutting tendency from edge of rim. While cementing, it is a good plan to wrap tape round rim and joint, so as to keep the nozzle in its proper place until cemented.

"The valve is very simple, and will be readily understood if the cap is unscrewed. It is really a tap, and there is no non-return valve in the tire. To inflate the tire, screw the small piece at the end of inflator tube tightly into hole in valve, then unscrew slightly the cap of valve. The air can now enter the tire. When fully inflated, screw up the cap tightly before removing the tube, holding the upper milled edge of valve so as not to put strain on the nozzle. If you suspect that the valve leaks, you can test this very readily by immersing in a wineglassful of water, and watching for a minute or so. If it should leak at all, the chances are that a little grit has got between the leather washer in valve, and the flat inner end of cap. Occasionally it happens that a little piece of chalk from inside the tire gets into the upper end of nozzle and prevents the air entering freely. In this case unscrew the cap, and carefully poke a piece of wire through valve to clean it.

"The inflator is also very simple, and the construction will be easily understood if the parts are unscrewed. The most important parts are the leather washer or plunger, and the non-return valve in small end. If the former gets out of order, and allows the plunger to be pressed down without compressing the air, a few drops of oil on the leather will often set it right. At need, you can put in another washer, or any shoemaker will do this. It should not be too thick, as it has to serve a double purpose, and collapse when plunger is withdrawn, to allow the air to get behind it. It is absolutely necessary that the non-return valve should work properly or the tire cannot be inflated at all. Fortunately, it is so simple that it can be repaired in a few minutes by unscrewing the nozzle of inflator and tying another piece of oiled silk or similar material over the hole. The non-return valve is out of order if, after attaching the inflator to an inflated tire, the plunger flies backward quickly, thus showing that air is allowed to escape freely from the tire.

"Perhaps the most important question for the rider is how to repair the tire temporarily. The first thing to do, when you find the tire deflated, is to discover the cause, which is generally a cut or puncture. If valve is all right, inflate tire fully and look carefully all round the wheel. If the puncture is at all a serious one, you will be able to see it, or will hear the air escaping, and so locate it readily, but if there is any difficulty in finding the spot, get a little water and rub the tire all round with a very wet rag, then spin the wheel round and pour a glassful of water on it; then look carefully, and you will see the air bubbles. Having found the puncture, deflate the tire, clean off the place with a knife and dry it as far as possible, clean the dirt out of puncture, and if the hole is large enough, give it a good dose of solution right through; spread a good coat of solution over the surrounding part and on the binder with your finger, and then tie the binder tightly round the rim. Now inflate the tire, and the cut part will be pressed tightly up against the binder, and if there is any escape it will be so slight as not to prevent riding 20 to 50 miles, and perhaps inflating every 10 or 15 miles, and perhaps not needing this. If you should be without the binder, the same result may be attained by using a roll of common linen tape ½ inch to ¾ inch wide. Tie one end round a spoke and wrap round the part for about three inches long with several layers of tape, afterward fastening off the other end round a spoke. Use solution on every layer if you have it, but if not, you can make tire approximately air-tight without any solution.

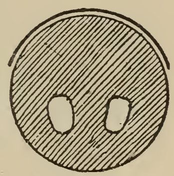
"The above does very well for temporary repair, but something neater and more durable is wanted to make a good job. Small punctures can generally be repaired effectually and permanently by injecting a good dose of rather thick solution. I have had a small syringe made for this purpose, but the solution can be poked through with a piece of wire or something of the kind. Take care to line the hole and to get a good quantity right through. Leave overnight before inflating, and you will generally find it perfectly sound.

"The plug repair seems, however, to be the most satisfactory, and is so simple that it may even be done on the road. According to the size of puncture, take the large or small cutter (the small one always if cut is not too large), inflate the tire (unless cut is too bad to allow of this), wet it and press the sharp end lightly on the rubber, and twist to and fro or round and round with the finger and thumb, using plenty of water. In a few minutes a clean hole will be made through the tire. It is wonderfully easy to make a clean hole in this way, but in order to avoid the chance of spoiling the tire, I would recommend a beginner to first experiment on a bit of rubber. The edge of cutter should be kept very sharp, and care should be taken not to force the cutter, especially when it is nearly through. Dry the parts thoroughly, and clean sides of the hole and the plug with benzoline. After allowing the benzoline time to dry, coat the sides of hole and the plug with solution, and give it time to dry thoroughly. Then give another coat to both, and insert the plug at once, small end first, and push it in, leaving about $\frac{1}{4}$ inch projecting outside. Leave it as long a time as convenient, and you may then cut off the projecting end and inflate. If you want to use quickly, it is a good precaution to tie round with tape at first. If a large plug is used, it is sometimes advisable to put a patch over it, in order to make doubly sure, but so far this method has been very satisfactory.

"I am often asked whether the tire should be inflated very tightly, and whether it should be deflated when not in use. With regard to the former, my impression is that the degree of hardness must be the matter of experiment with each individual rider. On very good roads I think you can hardly have the tire too tight, but on bumpy macadam it is better a little softer. When going at high speed a little flabbiness in the tire is not felt so much as when going slow. As a general rule, I should say it is better to err on the side of having it too tight than the other way. I don't think it is necessary to deflate when not in use. No doubt this is theoretically better for the tire, but experience does not seem to show that it is required.

"Care should be taken not to expose a tightly inflated tire to the heat of the sun on a hot day, or to that of a very warm room in cold weather. A little air can be let out in a moment by unscrewing the valve cap. Don't ride with a really flabby tire, or it will get cut by rim or otherwise injured. Keep an eye to the cementing, the same as with a cushion tire. There is very little trouble from this cause, as the pressure of the air holds the tire almost sufficiently without cement. Still it is best to see that cementing is good, especially near the nozzle. If you have occasion to take out a tire, deflate it and warm the rim slightly a good distance from nozzle. The tire can then be pulled out without warming all round."

The new patent Buffer cushion tire has two small holes and is especially designed to prevent any possibility of having the tire cut by the rim. It is claimed that "at last there is a cushion tire on the market that really cannot be cut by rim. The new patent Buffer cushion tire, while possessing all the elastic and cushion properties of the best cushion tires, has, in addition, the one advantage to make such tires a complete success—it will not cut on rim. Owing to the position and peculiar construction of the holes, any spread or squash that takes place, from direct or side pressure (such as turning corners), is confined to that part of tire which is well below the edge of rim, thus preventing any cutting whatever."

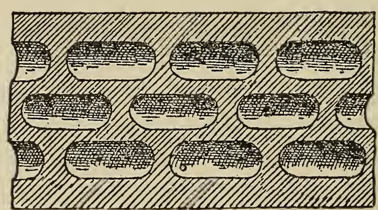


BUFFER CUSHION TIRE.

The Cellular tire is something quite out of the usual run. It is "composed of seven small tubes of rubber which, in their soft state, are forced together into a mold, and surrounded by an outer covering or tube of rubber. As they are forced into the mold, air is forced into the tubes until a pressure of three atmospheres is obtained, and the tubes are closed at intervals, thus causing the tire to be filled with a number of cells, each filled with air at a pressure of three atmospheres. The complete tire makes a very soft whole."

It is also said that the cells are "of uniform size, $\frac{3}{4}$ of an inch in length and $\frac{5}{16}$ of an inch in diameter, and in number about 50 to each foot of tire. The advantages claimed are that an inflated pneumatic tire is obtained without the trouble of inflation, and consequently is non-puncturable."

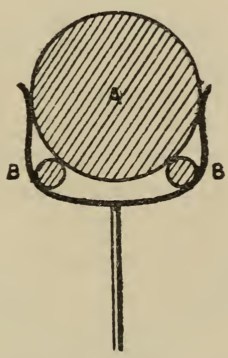
The advantages claimed for it are that "a firmly inflated pneumatic tire is obtained, which does not require inflation, and cannot collapse by being punctured; the air cells, charged under considerable pressure, in combination with rubber, giving an increased elasticity, render these tires less liable to cut than any tire in existence; also reduce vibration to *nil;* they



CELLULAR PNEUMATIC TIRE.

may be punctured in numerous places without materially affecting the running of the tire; the weight is always suspended on air, with the rims well off the ground, as the compressed air cannot be forced from its position; they have been tested under a variety of conditions, and have met every requirement; they run easily over wet, muddy, or sandy roads, or up hill, and are not liable to slip; they may be fitted to any machine with $1\frac{1}{2}$-inch or $1\frac{1}{4}$-inch rims, and are twenty per cent. lighter than ordinary cushion or pneumatic tires."

The Christian cushion tire consists of the large principal tire A, and two small subsidiary tires B B. "In appearance it is similar to ordinary tires, but underlying the visible one are two small rubbers in either side of the rim upon which the outer one rests when the machine is in motion, thereby causing the cushion to minimize vibration. In reality this idea might be called a treble tire, seeing that three distinct rubbers are used. A small ordinary tire is employed for the outer and main wear, which naturally necessi-



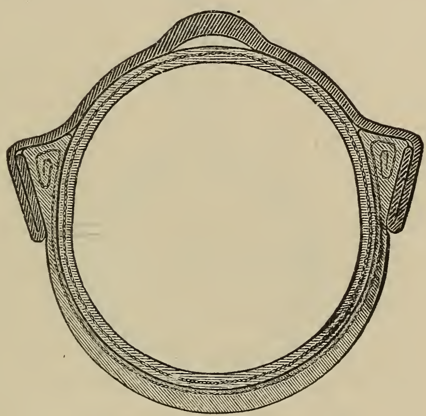
CHRISTIAN CUSHION TIRE.

tates a saving in weight, and while the rim is no larger than that usually used for cushion tires, it contains the small rubbers, and still has enough space for cushioning. The running, we are told, is extremely steady, and no retardation in the steering of the safety is perceptible."

The great advantage claimed for the Clincher pneumatic tire and rim "is that no cement is required in fixing them, and they are consequently able to be separated from each other at any time. The tire consists of two parts, viz., the outer band, and the inner tube, which is blown up by an inflator. The action of inflating the tube 'clinches' the band to the rim. When the tube is deflated (which may be easily accomplished at any time by pressing the head of a pin down the mouth of the valve in order to release the air), both band and tube are easily removable from the rim, an advantage which may be appreciated for the convenience of adjusting loose or broken spokes. The insertion of cloth in both band and tube reduces the chances of puncture by stones, etc., to a minimum. The valve employed for inflating the tube is made with a check action of our special invention, and is so simple in construction that it is impossible with fair usage to get out of order. In cases of accident, the advantage of being able to replace either band or tube, together or separately, without sending the wheels back to the makers, will be readily recognized. The outer band is, we consider, practically indestructible, as, judging from recent trials, it is not nearly so liable to be cut by stones as its solid rival, there being less resistance to cut against. By having both wheels the same diameter and width, the bands and tubes become interchangeable; thus the rider, by carrying a spare tube, can make himself practically independent of accident by puncture.

"The inner tube should first be placed in the rim and then inflated; the band should then be placed over the tube, care being taken that no undue stretch or gathering takes place at any part. This is very important, as it insures equal distribution of the tube and band around the circumference of the wheel.

The tube should then be deflated, after which the edges of the band can be tucked in at the sides of the rim, taking care that they are well pressed down all around to the base of the rim. After having got everything into position, it now only remains to finally inflate the tube, and while doing so it is important that the rim and tire be firmly grasped at the valve hole so as to insure that portion of the tire being

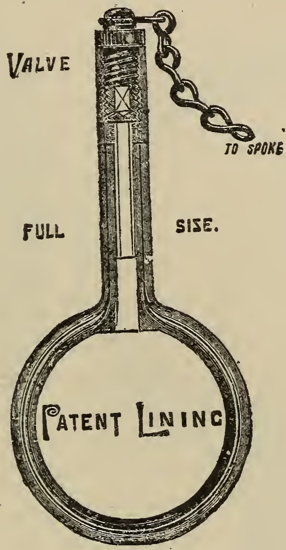


CLINCHER PNEUMATIC TIRE.

equally 'clinched.' This is a very particular point, as, if it is not attended to, the action of inflating tends to drive that portion of the band and tube away from the rim, and an uneven 'clinch' is the result. The process of inflation is rendered much easier by seeing that the screw at the end of the inflator is fairly screwed into the mouth of the valve.

"The tire should always be kept fully inflated and blown up as hard as possible, as if it is ridden deflated or too soft, the tube has a tendency to run around the rim, thereby straining or cutting off the valve tube. The harder the tyre is pumped the stronger it 'clinches.' There is not the slightest fear of its bursting. The valve tube should point to the center of the wheel, any slanting deviation indicating that the tube is slack and requiring adjusting and reinflation. Care should be taken to leave no air between the band and the tube, the presence of which can be detected by tapping the outside band with the finger. Such a discovery indicates that the band and tube are not evenly placed in the rim, and that they are unduly stretched at some point. The valve cap should be firmly screwed down, as it is this that really keeps the tube air-tight, the check valve being merely of use during the process of inflating. If any leak occurs it will either be at the valve or the tube. In the former it may be detected by holding a glass of water in such a position that the valve is immersed, when, if any leak exists, bubbles will appear on the surface of the water. A new washer will generally cure this complaint, and if this measure does not prove effective, some grit will likely have got into the valve, and if such cannot be shaken out, the valve must be removed from the tube. If the leak is not in the valve it is in the tube. Take it from the rim, and after blowing it up as hard as possible, immerse in water (a bath is a convenient place), when the bubbles will at once show where the leak is, and a repair can be effected in the usual manner."

The Closure pneumatic tire is said to be puncture-proof, or rather to be practically in no danger of leaking even when punctured. "The patent lining of this tire has the property of automatically closing up after being punctured, thus avoiding the necessity of repairing and patching, the widespread objection to which



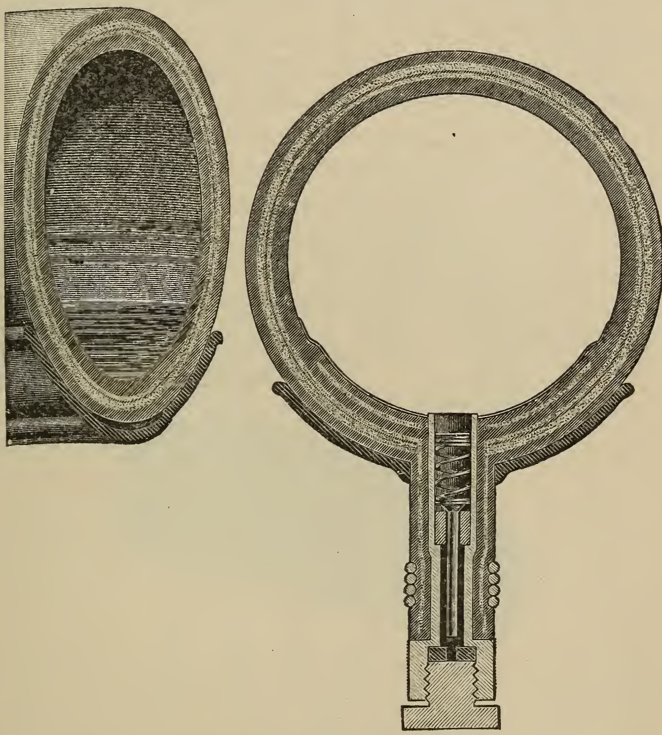
CLOSURE PNEUMATIC TIRE.

operation has bid fair to put the pneumatic tire out of the market, in spite of the greater speed and comfort obtained from this type of tire. Closure tires remain tight with hundreds of punctures in all parts of the tire."

The Columbia pneumatic tire has "a winning feature" in "its combination of strength and durability with great resilience and simplicity for the user. The complete and perfect air tube is there, with the canvas protector, and the tread ; each part as carefully prepared for its respective purpose as in any wrapped tire.

"The combination of these in such a way that each will support and aid the others, without damaging them, the building together so that every good point of other types will be secured without their objectionable features, and with all the unmistakable advantages of a built-up one-piece tire—this is where patience, skill, and experience have been called for and unstintingly given. Our selection of this type of tire was made after careful inspection, study, and tests of all varieties obtainable, and it was determined upon by the unanimous vote of our board of experts. With our improvements upon the original, and as the result of all the effort we have devoted to it, we are making to day the simplest and best pneumatic tire that we know of ; a tire that looks well, rides well, and wears well ; that is easily kept in order and readily repaired when necessary. It is the only type admitting of an effective temporary repair with tire tape, and the valve is correspondingly simple and satisfactory.

"We have based this upon the Boothroyd tire, of England, as our general type, and have improved upon it very much, as we took the English type cushion tire a year ago and improved upon that. We construct it with a complete and perfectly air-tight tube fully equal in all respects to the air tubes of the wrapped tires. Upon this we build the canvas protector, and then the tread of somewhat tougher and stronger rubber than the air tube, vulcanizing the whole together in an endless, seamless tire, which we place our full confidence on as the simplest tire in use, the neatest in appearance, least liable to get out of order, and the easiest to repair effectually, should it require it at any time. This type is the only one that in case

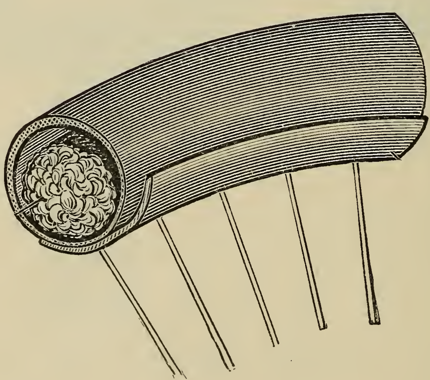


Columbia Pneumatic Tire.

of puncture can be ridden until a convenient time for repairs, by simply winding the punctured part with adhesive tape. Under our special methods of manufacturing it, which have been determined as the result of several months' experiment and experience, we have brought it very far in advance of its prototype, and while it is as difficult and expensive for us to make as any other practical tire would be, we think that it will afford a saving in the long run over any other pneumatic tire to whoever uses it.

"We have devised a valve which is of correspondingly simple and effective construction. We believe that we have had more experience with the general subject of pneumatic tires than any other of the large manufacturers of this country, and we have never felt more confident than we do to-day that we have made the right choice."

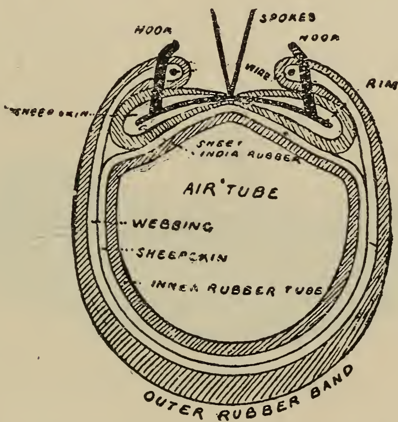
The Combination pneumatic tire is one which is susceptible of use even after it has been deflated by



Combination Pneumatic Tire.

a puncture or cut. As shown in the illustration, "this is accomplished by the insertion of a peculiar cotton fabric, which is chemically treated, so as to prevent it from packing."

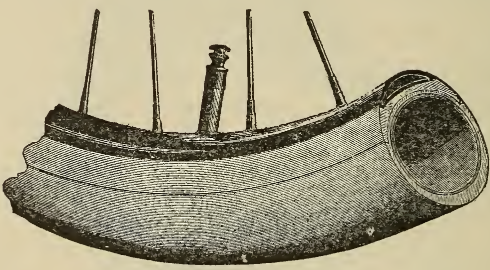
The Preston Davies pneumatic tire "is light and resilient. No solutioning or sewing is said to be required for repairing, and the canvas tube is dispensed with. It is also said to be very strong. Recognizing the necessity of freedom in the canvas cover, the arch is lined with ribbon laid like the base of a Venetian blind,



DAVIES PNEUMATIC TIRE.

thus securing the most absolute freedom and elasticity in movement. The air tube is simply wrapped up in two folds of soft sheepskin, these folds being otherwise unfixed, while the cover is fixed by continuous wires, which go over certain small projections in the rim when inflated. This tire effectually excludes all wet and grit, and is very noticeable for its resilience and bounce; a 30 × 2 inch racing tire will weight 1½lbs. The design throughout is decidedly clever and effective."

The Dorr pneumatic tire is said to have "astonished manufacturers and riders alike. Its simplicity is marvelous, combining all the good qualities, and none of the defects of other pneumatics." It is said to be the best: "1. Because it can be applied to any style of rim, and especially the crescent or hollow rim, which is the best suited for the Dunlop or Thomas Tires. 2. It requires no cement or fabric to hold this tire on the rim. 3. It shows the entire



Dorr Pneumatic Tire.

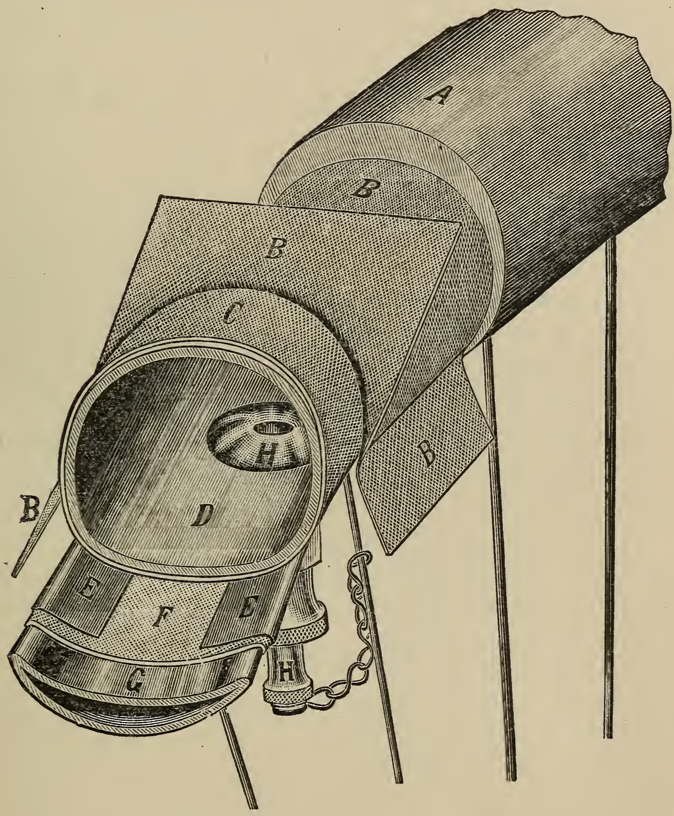
surface of the rim of wheel fully japanned. 4. It is held on the rim by a rubber pad and the inner tube when inflated. 5. It can be entirely detached from the rim in one-half minute. 6. It can be placed on the rim and inflated, ready to ride, in one minute. 7. Because it is constructed on strictly scientific principles. 8. Because it has a pad which protects the tire from puncturing by the rim when ridden over sharp obstacles. 9. Because no tire yet produced equals its resiliency. 10. Because the pad protects the tire from contact with the rim, thereby preventing friction or chafing. 11. Because it will not creep on the rim. 12. Because the inner tube can be taken entirely out of the case, without tearing or otherwise damaging the inner tube, in one minute. 13. Because its simplicity makes it the king of pneumatics. 14. Because the case, tube, and pad are endless. 15. Because one workman can fit on two hundred tires in one day. 16. Last but not least, manufacturers can place tire on wheels at their own factory, thereby avoiding delays in shipments to and fro, and know to an absolute certainty that their work is properly done."

The Dunlop pneumatic tire is the one whose invention revolutionized cycling and precipitated upon wheelmen the perplexing tire question. This tire found its origin in this way, as stated by the *Irish Cyclist.*

"In the year 1888 the young son of Mr. J. B. Dunlop (a veterinary surgeon of Belfast) complained to his father of the excessive vibration he experienced when riding over the Belfast setts, and the idea occurred to Mr. Dunlop that compressed air might be utilized to intercept this vibration. Accordingly, he constructed tires for his son, which proved so satisfactory that he went on experimenting, and in conjunction with Messrs. Edlin and Sinclair he turned out, during the season, some thirty tires. These he kept running under his own eye; none were permitted to leave Belfast, and among others he declined supplying ourselves and Ar. Du Cros, and the latter was not able to get a pneumatic until August, 1889. It was not until the September of 1889 that Mr. Dunlop and Mr. Harvey Du Cros, Sr., came together, and late in the autumn a company was floated by them to work the patents.

"Early in 1890 the pneumatic tire was fairly put on the market. In appearance it resembled the tire now made, but the canvas pocket was formed by solutioning two pieces of canvas together, the ends forming flaps to bind round the rim. This form of tire worked admirably; the inner tubes never wore, and the canvas round the rim stood well, but it had one weakness —oil dissolved the solution, when the canvas pocket separated gradually, and the inner tubes burst. With careful riders this rarely occurred, but with the careless or ignorant, who in oiling let the oil run down the the spokes on to the tire, it happened frequently, and toward the end of the season reached such a pitch that it was decided to sew the canvas in future; but time did not permit of testing the efficiency of the method thoroughly. For a while it worked admirably, bursts became a thing of the past, but a more serious difficulty arose. The stitching wore the inner tube into long slits which allowed the air to escape, and nine out of every ten cases of so-called puncture were due to this cause. Thousands of tires had gone out before this was discovered, but the company had been meanwhile experimenting and had a remedy ready, and toward the end of the season of 1891 the present form of tire was adopted. We shall briefly describe the pneumatic tire as now made.

"The air tube has been strengthened without seriously increasing the weight, and after many experiments the very best quality of rubber has been fixed on, and the increased strength has not been secured at the expense of flexibility, the air tube being still distinguished for that silky softness for which it was always remarkable. A seamless woven pocket is now



DUNLOP PNEUMATIC TIRE.

A. Outside Cover, or tread portion of Tire. *B*. Canvas Wrapper which secures Canvas Pocket *C* to Rim. *C*. Canvas Pocket. *D*. Air Tube. *E*. Rubber Strips, forming cushions for Air Tube to press against. *F*. Canvas Foundation Strip, cemented to Rim. *G*. Metal Hollow Rim. *H*. Valve, which allows Tire to be deflated to any degree at will.

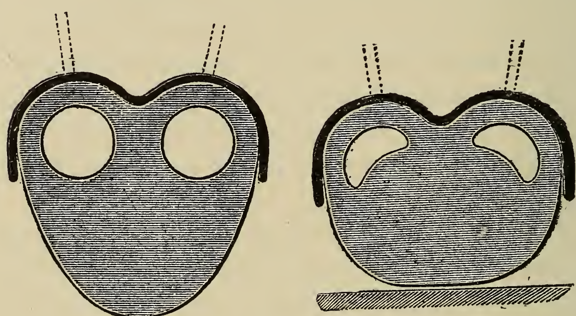
used to confine the air tube, so that there is no stitching or seam to cut it, and it is bound on to the rim by an additional piece of canvas, which is solutioned round it, while a narrow slip of specially prepared rubber at the edge of the rim gives the affixing flaps additional purchase and provides for the friction set up by the constant motion of the tire at this point, thus preventing fraying. The woven tube and the confining canvas are of specially made material, selected after exhaustive trials. The method of repair has been simplified—the confining canvas being so cut as to overlap the other end ; and to get at the air tube it is only necessary to peel it back. After repairing the tube it is not necessary to stitch the canvas down. A perfect inflating and deflating non-return valve has been adopted, thus getting over the difficulty experienced from suddenly collapsing tires, and consequent punctures, or nips between the rim and the ground."

The latest improvements are: " An entirely new method of constructing the canvas pocket, which doubles the strength of the pocket and makes it an impossibility to break or burst on the sides of the rim where fitted. The fitting of strips of pure rubber in a special manner on the rim before fixing the pocket, thereby forming a bed for the canvas pocket, which, when fitted, makes a solid foundation for the tire and entirely surmounts the possibility of the air tube being nipped by the rim. This nipping caused nearly two-thirds of the punctures last season. The adoption of a special air tube upon which our rubber manufacturers have been experimenting for two years, and which they have now succeeded in making a complete circle without a seam. The weight of this air tube is also increased. The material used is of the purest Para rubber obtainable. Our rubber-makers have also devised a means of manufacturing these tubes and also outer covers without taking from the strength or elasticity of the rubber in any way. We have now, after very careful study and experiment, patented and adopted a deflating valve which is perfect. It is simple to fit in place of the old existing valves, and there is not any part of it complicated or liable to get out of order. When fitted, this valve stands outside the rim and can be adjusted without interfering with the tire in any way. It is not necessary to have a new inflater, as that which is now in use will fit this valve with the aid of a special coupling. With the foregoing improvements, we are confident that all difficulties are now practically overcome, and that this tire, with our new valve, will give unqualified satisfaction.

"Our new valve consists essentially of two parts—one part being a metal tube threaded externally, and fitted with nut and washers, and having at one end a mushroom shaped head—the other part being a perforated stem or spindle, threaded at one end, for attachment to the inflater, and at the other end covered with rubber tubing in such a manner that while freely admitting air to the tire it prevents its escape, until, by the removal or loosening of a cap, which keeps the stem in position, the air is allowed to escape at pleasure. The thread portion of the stem is protected from dust and dirt by a small metal cover, attached, by means of a short chain, to the nearest spoke to prevent its being lost or mislaid.

"The rubber valve tubes will last an indefinite time, but they can at any time be replaced, if necessity arises for so doing, with a new one, by removing the old one, cleaning the stem, moistening it, and pushing on a new tube, which, after being pushed up to its place, over the conical portion of the stem, should be slightly drawn back to elongate it and insure of its being easily and freely inserted in its position in the metal tube."

The Duplex rim is formed to take a cushion tire of somewhat peculiar shape, having two holes near

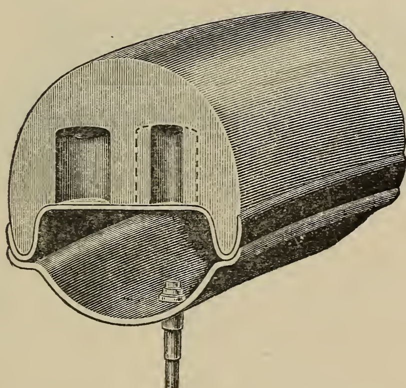


DUPLEX CUSHION TIRE.

the rim. The first cut shows the tire in its normal shape; the second one, its condition under the pressure exerted by the rider's weight.

"The tires are of the very best quality, and cannot possibly cut, the rubber receding within the rim. There is an entire absence of drag uphill, so noticeable in other hollow tires. This is due to the weight of the rider, etc., being directly supported by the solid portion of rubber between the two holes, and not by the outer walls or sides. This arrangement gives great elasticity; which most important quality it never loses, even under the heaviest load, the holes never being completely closed. The rim, though considerably lighter than the ordinary one; is of immense strength, and by fixing the spokes in pairs or alternately right and left, the wheel possesses a strength and rigidity defying all attempts at buckling."

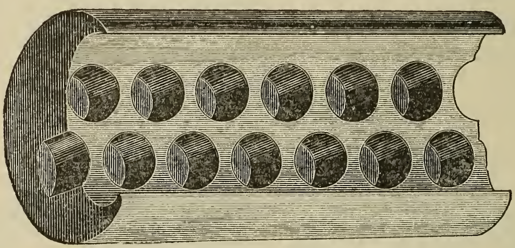
The Duryea crescent cushion tire is practically "the long sought for ⌂ section tire, but instead of the



Duryea Crescent Cushion Tire.

rim getting a cementing surface on the rubber by extending up the side of the tire part way as in all ⌂ tires heretofore made, the rubber has lips extending down into the rim, which is provided with grooves to receive said lips. This leaves all the tire proper up and above board so that it has no dead rubber at all, It cannot cut on the edges of the rim for they are lower than the rim proper. It cannot be torn off, for no strain can reach the edges of the lips. It is the *ne plus ultra* shape for a tire. They intended to market it in 1891 and so catalogued it, but were so late about getting their cycles that they did not use it. The tire, therefore, comes out with the benefit of a full season of experimental use.

"They introduce some further common sense in their method of securing their cushioning properties.



DURYEA CRESCENT CUSHION TIRE.

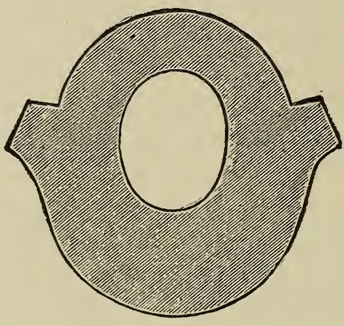
They claim that if a tube (or hollow tire) is laid on its side, and load applied, it is not truly compressed ; it is simply flattened out of shape. Whereas, if it is set on end, it actually compresses. In the first case, more rubber is required to support the same weight, and the constant flattening will in time break even rubber. In the second case, there is no flattening, and the hole provides room into which the rubber may compress so that the amplitude of compression is increased with no loss of resiliency or durability. By honeycombing the tire on its under side with two rows of alternating holes they secure the effect of a large number of tubes on end. Its light weight, its great width, full $1\frac{1}{2}$ inches, and its hollow rim, together with its appearance and actual worth promise a large future for it.

"The rims on the cushion tire machines are hollow, and distinctly different from the ordinary type. To begin with, our rim not only is light, but so much of its depth is within the tire that it appears shallower than other hollow rims and looks light instead of heavy and cumbrous. We are enabled to produce a light rim, and yet one that is materially stiffer and stronger than other hollow rims by the simple device of inverting its inner section so that its curve is opposite to that of its outer section.

"The ordinary solid rim is U-shaped and must be quite deep and heavy to be strong enough to resist buckling strains. If now a shallower U be set inside the other so as to form a crescent, you have the ordinary hollow rim, which is a great improvement, but we turn our inner section the other side up so that our rim is practically a tube, and therefore more secure than any other against any variation in shape, for a tube is the strongest form for its weight. A hollow rim is obviously far superior to a solid one; hence we use it, though the expense is very greatly increased."

Dale's Eclipse Combination tire is claimed to be "the very best rim and tire ever yet introduced to the public for the road and ordinary wear. The tire is non-collapsible, and combines all the advantages of the pneumatic without its disadvantages. As buoyant as an inflated tire. No inflation needed, nor risk of puncture and consequent loss. Warranted not to cut. No skidding or slipping on the muddiest road."

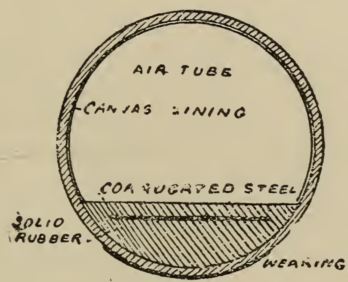
Dunn's Patent Eclipse pneumatic tire is claimed to be unpuncturable, and it certainly is of unique



Eclipse Combination Tire.

character. It "has no inner tube, but is itself a large tube of very thin rubber and canvas combined, and is non-stretchable beyond a certain limit. Within the circle is placed an insertion of solid rubber, backed up by a long strip of exceedingly thin steel, corrugated. It is an absolute impossibility to get through this and reach the inner tube ; the tread of the tire always remains the same, any yield owing to the elasticity of the air taking place above it. It is a new idea of a decidedly promising character, the principle being somewhat of a departure from other pneumatic tires."

These tires "are constructed on entirely new and improved principles, and exhibit in the highest practicable degree all the merits a tire can possess. They are protected from puncture by a band of steel embedded in the rubber running surface. To give the band elasticity in its length, which is necessary to prevent its impairing the resiliency of the tire, it is corrugated transversely, at the same time increasing its flexibility and its length, and making it transversely flat and rigid. The weight of the band is about three ounces, and it does not in the smallest perceptible degree impair the resiliency of the tires, no friction being produced on their flexion between the rubber and the band. But their chief novelty and merit is that they have a narrow running surface constant in breath, which



ECLIPSE PNEUMATIC TIRE.

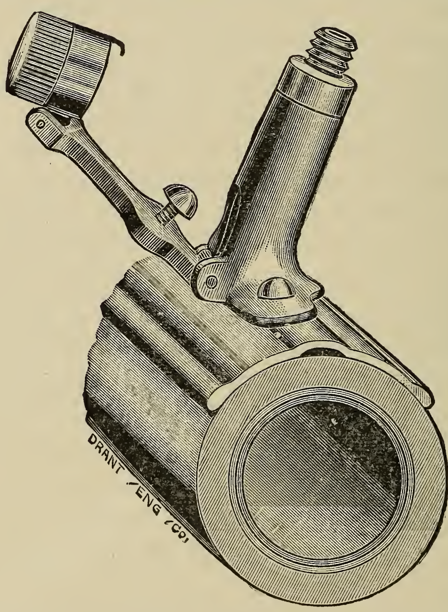
is independent of the degree of the compression of the air column. This is produced by the transverse rigidity of the corrugated steel band preventing the tires flattening out on contact with the ground. The running surface is thus reduced to about a third of the breadth of that usually produced by other pneumatic tires, and to about the same as in small solids. A great saving of power in road friction and suction, especially on wet roads, is thus secured, and slipping is reduced to the same degree as in solid tires. Further, the narrowing of the running surface reduces proportionately the area of the tire, which it is necessary to make thick to withstand wear and puncture, whereby the tires are rendered very much lighter and more flexible than is otherwise possible.

"It is to be observed, too, that in these tires the rubber strip with the steel band embedded in it, which forms the running surface, is inclosed within the canvas binding, so that the rubber is constantly under the pressure of the air column, and consequently little further compression of it takes place on contact with the ground. The loss of power is thus reduced to a minimum, being indeed quite imperceptible. The constancy of the running surface gives them a further important merit for road use. It permits of their being used with more spring in them than is possible with other tires without seriously impairing their ease of running. They are as desirable for speed on the path as for reliability and resiliency on the road. Being unpuncturable, they may, without fear of failure, be made of smaller sizes than has been found practicable with other tires, so that they can be fitted, of such sizes as will pass the forks, even to machines intended for solid tires. The protecting band used in these tires may be introduced into any other composite tires, whereby they will be perfectly protected from puncture, and greatly improved in running. They are made with solid walls, so that there is no loose air tube in them, and should any accident befall them, they can be repaired with the greatest facility. To make them as light and easy running as possible, they are made very thin, and should they wear on the running surface, a new wearing strip can readily be put round them. This is the only repair they should ever require. They are manufactured by new and improved methods, under the personal supervision of the inventor, and are guaranteed to be of the very best material and workmanship."

The Fleetwood claims to be the best pneumatic tire on the ground that " it is reliable ; it is absolutely non-bursting ; it has no loose air chamber to cut and chafe ; ordinary clean punctures close automatically ; all repairs done from the outside ; it can be repaired in two minutes ; it has never to be removed from the rim ; stripping, patching, sewing, resticking, etc., are done away with ; it is more resilient than any other tire ; it is as fast as any tire on the market ; it is built up to keep the air well under the weight ; it is fitted with a reliable valve ; it is fitted with our ' patent non-slipper ' cover ; it is made of best materials only.

" Small holes made in the tire close up automatically owing to its construction, but should a rider be unfortunate enough to meet with a more serious puncture the tire is easily repaired from the outside. All that is necessary is to plug the hole with a small piece of pure rubber dipped in naphtha. If the plug is tied in its place by a tape passing around the rim, the tire may be reinflated and ridden at once. Five minutes is ample to accomplish the repair, and the tape may be removed as soon as the naphtha has evaporated. We have no loose air chamber to contend with, and all tires that depend on this are faulty, as the inner tube is certain to cut and chafe. In our tire strips of rubber are placed on the edges of the rim ; this effectually preventing any cutting, and at the same time keeping the air well under the weight just where it is wanted to give the best result. We use a side inflating valve of entirely new design which can be inflated at will. All sizes of tires are made from 1¼ inch (to suit cushion rims) upward. The usual pneumatic rims, both hollow and solid, are suitable for our tire, and it can be fitted to any machine."

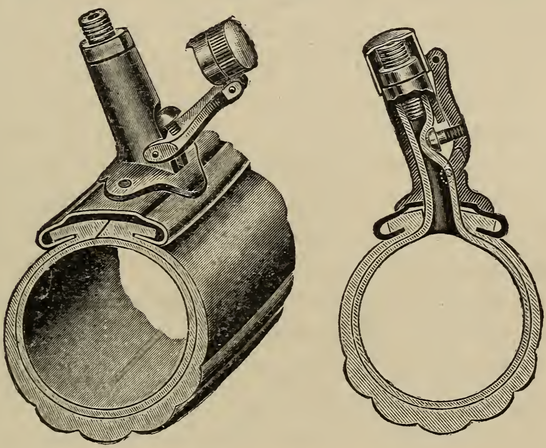
The "G. and J." inflated cushion tire is composed



GORMULLY & JEFFERY INFLATED CUSHION TIRE.

of an outer thick rubber tube, a canvas tube, and an inner thin coating of rubber. The air tube and cap used are the same as those in their pneumatic, and will be found described under that head.

It is said that in the " G. and J." pneumatic tire " there are no rags to be unwrapped, resewn, or reglued ; no needle or thread or pastepot is needed ; the case can be removed, the puncture patched, the



Gormully & Jeffery Pneumatic Tire.

tire replaced and inflated within four minutes, and this without the use of a tool of any sort.

" In the cuts the tire is shown in perspective and section, one cut showing a central section through the valve. The tire consists of an outside case of india rubber that is lined with thin canvas so as to prevent stretching, and has on its outer surface a series of ridges or lengthwise corrugations that afford not only a good wearing surface but prevent side slipping on the roads. This case is divided lengthwise on the under side, and they are thickened so that the lengthwise slits or sockets that face outward readily receive the inturned edges of the rim of the tire. Inside of this case is the inflatable rubber tube which, when fully expanded, fills out the case and engages the hooked edges of the rim in the socket referred to in such manner that they are most effectually locked together and prevent the tire from coming off as long as it is inflated. It is, in fact, impossible to remove the tire, while it is inflated, without tearing off the edges, and they are strongly re-enforced by the canvas lining vulcanized with the tire in the process of manufacture. As soon as the tire is deflated, however, a side pressure on one of these edges will readily disengage it from the rim.

"The valve consists of a rubber inlet tube having a brass nipple on the outer end, for the attachment of the pump that is secured on to the nipple. This valve and its nipple are supported in a metallic tube that is firmly riveted to the rim. After the pump is screwed in its place it is not necessary to hold the pump or nozzle with the fingers, as with the usual pneumatic inflating arrangements. The valve usually placed in the air tube is dispensed with and placed where it operates more effectively—in the pump. To close the inlet tube on the removal of the pump, a lever is provided, as shown; in the perspective view, in its position when the inlet tube is open; and in the sectional view, with the lever in the position it assumes when the inlet tube is closed. In both views will be noticed near the base of the lever an adjusting screw, the head of which is adapted to press the side of the inlet tube and close its orifice. The cap hinged to the extremity of the lever turns over the threaded end of the nipple and keeps out the dust, and with a little spur on one of its edges, together with the consequent outward pressure of the rubber air tube, locks the cap in place and consequently locks the compressing lever and its screw into place until removal is desired to inflate or deflate the air tube.

"The case portion is molded endless, the air tube being made complete in a rubber factory. The attachment of both to the wheel is a simple matter, requiring neither tools nor cement and a very small degree of skill for its completion."

The following directions should be noted in case repairs are necessary: "When a puncture is suspected in an air tube, the air must be allowed to fully escape by unlocking the lever of the valve, if necessary. The tire case must then be removed by a sideways pressure of the rubber, using the unaided hands, or, if convenient, an instrument like the loop of a buttonhook, or of a lamp bracket. A screwdriver will answer the same purpose, but the operator runs a risk of making a hole through the tire case. Care should be observed to press as near the base of the rubber as possible, sideways and toward the hollow of the rim. The left-hand side of each wheel, and that to which the valve is directed, is designed to be first removed, and for this purpose the inclined edge of the tire is placed so that it will slide above the opposing edge when pressed, as directed above, toward the right. After this edge has been removed, the other edge can, if necessary, be pulled out in a manner that will suggest itself to the operator. We recommend that the second edge be not removed unless necessary. Any part of the air case not near the valve can now be pulled out and repaired as directed below.

"Before removing any part of the air tube near the inlet pipe, the operator must remove a nut from the threaded nipple forming the connection to the pump. When this nut is removed, the nipple can be pressed backward into its metal support and withdrawn by a slight strain on the air tube. We caution the reader to pull lightly, and aid the removal by using the point of a lead pencil or wire pressed on the nipple. When the injured part of the air tube is exposed, the surface should be rubbed smooth with sandpaper, or scraped with a knife, to expose a fresh rubber surface, which must be coated slightly (a heavy coat is no stronger and requires more time to dry) with rubber cement that is furnished in collapsible tubes for this purpose, and a piece of rubber somewhat larger than the aperture should be first roughened and coated, and applied to the injured part. If an interval of from five minutes to half an hour is allowed to elapse between the coating of the two pieces and their application to each other, a better union will result than if they were applied after one minute of drying, and for a very secure and difficult piece of repair we recommend two coatings and two intervals of drying to elapse before pressing the pieces together. If the rider is compelled to use the machine without waiting for it to dry, it can be used at once.

"The tube must be placed carefully inside its casing and the edges of the casing in their proper position in the rim, taking care not to twist the inlet tube, or strain it sideways, for it may become cut, or have its air duct closed. In replacing the cover, the entire right-hand edge must always be applied first, and then the air case. In applying the left-hand edge, see that it enters its position under the air tube, and does not leave any folds of air tube between the abutting edges of the tire case and the air pumped in. As the case begins to expand, the operator should see that the edges at all points go evenly under the rim, and before tightening up the nut of the inlet pipe (if it has been loosened) see that the nipple goes fully into the support, and that the little key or pin in the nipple gets into its seating in the support. Failure to do this will be liable to break off the key, or the nipple will fail to hold when the pump is applied. If the rubber inlet tube leaks, or is improperly joined to the air tube or nipple, a new union must be made by removing the old one and cleaning off the old cement before applying a new coating. The cleansing can be done readily by scraping, or the use of benzine, gasoline, naphtha, ether, or chloroform, and either of these substances can be used to dissolve pure unvulcanized rubber to produce the cement, if the operator can wait half a day for the solution to be made.

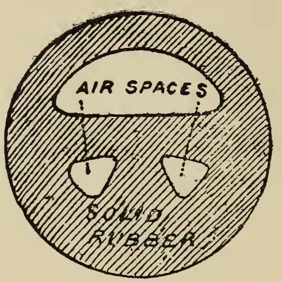
"Sometimes a puncture is suspected when the cause is at the valve, which is not tight. This can be tested by applying soap water, or saliva, to the surface of the inlet pipe, before the lever is moved back. The tightening at this part is adjustable by movement inward of the little screw near the base of the lever; but this must not be unduly tightened, or the rubber at this point is liable to become broken. If the tire is gripped by the hand, when uninflated, a sound near the inlet tube will be produced. This sound is caused by the air between the tube and tire case, and does not indicate that a leak or puncture exists, as might be supposed, for it occurs when the air tube is perfect, as well as when defective. The tire must not be ridden on without being inflated, unless the owner is prepared to insert a new air tube and perhaps a new air case.

"If the repairer should have any difficulty with the pocket pump supplied with the 'G. & J.' pneumatic tire, the defect is likely to be in one of three places—either the nozzle is not screwed tightly to the inlet nipple, or the valve in the piston is not working right, or the leather cup around the piston is not as it should be. The first can be remedied by using a small piece of leather about $\frac{1}{16}$ inch thick, cut circular $\frac{1}{4}$ inch in diameter, with a hole in the center about $\frac{1}{16}$ inch, noticing carefully that the leather is placed in the bottom of the threaded pump nozzle, evenly, and that its hole in the center does not become closed up by contact with the nipple when both are screwed together. The valve in the piston rod can be removed and examined by unscrewing the cap at the back of the piston, when a leather disk about $\frac{1}{4}$ inch in diameter will be found, held in its place in the cap by a spring. The disk should be smooth and even in its seat, and free from metallic particles or dust. The best results are obtained by using a rubber disk instead of a leather one, and when this is used in the pump, care must be taken that no oil comes in contact with it. If they should become oily and extremely soft, then new ones can be cut from the rubber patching we supply for repairing tires, or any other smooth, even rubber, about $\frac{1}{16}$ inch thick.

"The other source of trouble is sometimes in the cup-shaped leather that fits inside the pump. This must be kept soft and pliable. If it becomes hard, it should be greased and pressed outward with the fingers, so as to enlarge the cup portion. A wire spring will be found expanding the cup, and it is well sometimes to remove the wire, straighten it out into a larger circle, and replace it, so that it presses the leather outward, taking care that when the cup is replaced and screwed against the piston end, its screw sets up tightly, and on replacing it in the cylinder, take care to insert it evenly, *i. e.*, without any folds occurring. A little attention to these details will make the work of reinflating the tire a pleasure, where, without the attention, it would be laborious and almost impossible."

The Harford spring and cushion tire has three holes running throughout its length, placed in such a manner, and of such sizes, as to enable the rubber, when pressure is applied, to retire within itself, instead of spreading out over the rim.

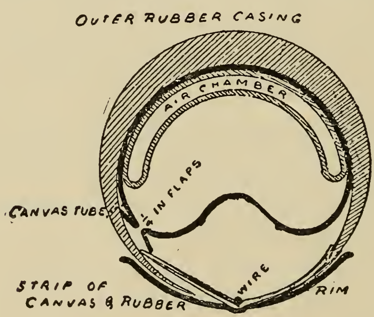
"The tire is constructed as follows per section: There are air spaces, the remainder of section being solid rubber 'Best Para.' When compressed, the solid part acts as a spring, and is deflected, and thus tending to draw in the sides of the tire and prevent their being cut. After the compression, the resilience of the released rubber insures the parts



HARFORD SPRING AND CUSHION TIRE.

returning to their normal position. The large space permits deflection into it. The small spaces permit the tire to deflect or be compressed within itself."

It is said that the Heale patent pneumatic tire "cannot burst, and can be repaired by anyone in a few

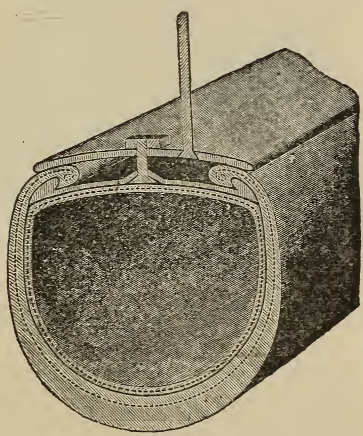


HEALE PNEUMATIC TIRE.

minutes. The canvas tube is never cut, no matter what repair may be necessary. It is built in a special

2-inch shallow rim by fastening a strip of canvas and rubber vulcanized together into the rim by a wire. The outer rubber casing has its points smeared with rubber solution and passed between the flap and the rim, after the canvas tube, containing the air chamber, is placed inside with the seam (having $\frac{1}{4}$-inch flaps) just below the point of rim. When the tire is inflated, the outer rubber is gripped by the rim, and cannot be pushed from it. To repair: deflate the tire, push it back from the rim, pull the point away from flap, rip the stiches of canvas tube, pull out and patch air chamber, sew up the two or three inches of canvas seam, cement point, place it, inflate, and ride at once."

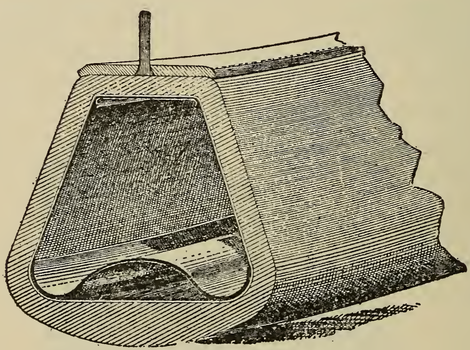
The Hill and Gilbert pneumatic tire is here shown. Its construction "can readily be seen from the illustra-



HILL AND GILBERT PNEUMATIC TIRE.

tion. No canvas flaps or cement are used, the mode of attachment consisting of an inner rim of steel, of thin section, fastened to the rim proper by four or five clamping screws around its circumference. In case of puncture, the outer covering can be quickly removed by loosening three nuts and pushing the tire to one side sufficiently to allow the enlarged edge of outer covering to be withdrawn—this will expose the air tube, which may be quickly repaired and the outer covering again clamped in position and the tire re-inflated. All the air space is outside of rim on a flat base, thus insuring speed. The inventor claims it to be the quickest repaired pneumatic on the market."

The Hill and Gilbert suspension tire "consists of a rubber tube thickened at the point of ground



Hill and Gilbert Suspension Tire.

contact, and is supported and distended by two bands or hoops around its two inner circumferences. In construction the tire is as follows: The inside band, to which is fastened the rim of the wheel, is of steel with curved edges to prevent cutting. A larger inside band is made with three corrugations forming curved surfaces, the center corrugation making a depression which forms a cushion for the ground contact of the tire. An endless suspended tube is constructed by incasing the two bands or hoops in canvas. This canvas constitutes the lining of the rubber. The tube is then placed in the mold, and the rubber is molded to its outer surface.

"The advantages which this tire possesses are that its resiliency is equal in every way to that of the pneumatic, while it possesses none of the disadvantages of the air-inflated tires. It requires no attention after it is once fastened to the wheel, it is not affected by puncture, while it employs the principle which has made the pneumatic tire a success, viz., an endless circle or support for the outer circumference of the tire."

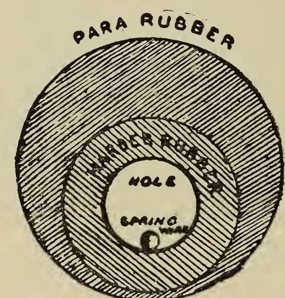
The Holdfast pneumatic is rather a novelty, the tire being made and fixed as follows: "The rim is rolled of a V section, but below the point of the V opens into a circular tube, the whole being a small size, but, of course, very strong, almost a tubular rim, with a V rim on the top of it. The arch of the tire has two thickened ends, which take the shape of two small half-circles of vulcanized rubber, which when put together just about fit the tubular lower part of the rim. By passing each half through separately, they can be easily inserted, but any attempt to withdraw them together fails, the two semicircular pieces of rubber making a firm circle inside the tube, too

HOLDFAST PNEUMATIC TIRE.

big to pass through the orifice at the bottom of the V, simple yet effective, and as the V is, relatively to other inflated tire rims, small and narrow, practically the whole of the air tube is available for cushioning purposes.

"The rim so rests on the outer case or tire that it cannot cut or chafe the inner tube, but protects it from chafing. The patent valve is so constructed that the act of putting on the pump opens it to admit air, and taking off the pump closes the valve and prevents escape of air. A loose cap, carried on the top of the pump-handle, when screwed on to the valve deflates the tire at once."

The Hookham patent spring wired cushion tire has the outer portion made of the usual high quality

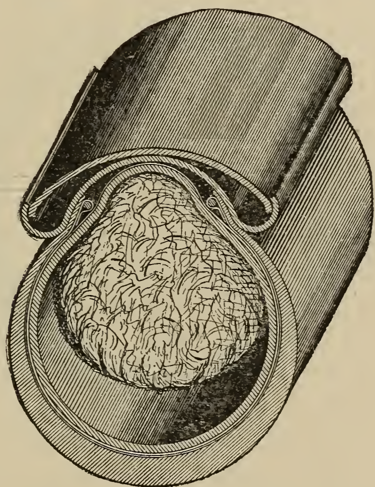


HOOKHAM'S SPRING-WIRED CUSHION TIRE.

rubber; the inner portion of harder rubber, while through the hollow core the corrugated spring wire is carried, thus holding the tire on firmly without any stretching. The advantages claimed for it are that

"1. You can see what the inside is like,—the size, shape, and position of the hole. 2. The tire is put on without stretch, and is therefore '*at rest*,' which every rubber manufacturer will admit to be the right thing. In case of small cuts there is no tendency to gape open. 3. In case of deep cut or injury, a portion may be removed, and a fresh piece substituted. The wear of these tires is excellent."

The Ideal pneumatic tire has received its name "because it possesses all the desirable features which



IDEAL PNEUMATIC TIRE.

the imagination of writers has given to the perfect ideal pneumatic tire, which may be enumerated as follows:

"*First.—Resiliency.*—When mounted upon our double hollow rim of cold rolled tempered steel, it possesses all the resiliency that can be given to compressed air and rubber backed by a rigid rim of the most improved construction.

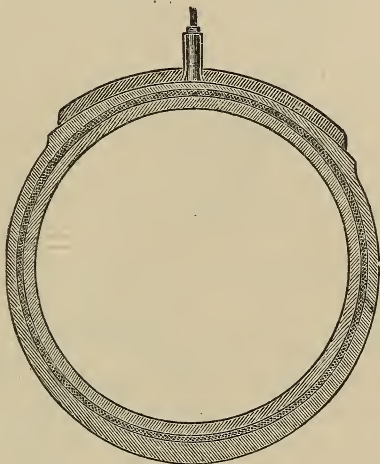
" *Second.—Speed.*—As speed depends entirely upon resiliency and lightness it is evident that the Ideal possesses these qualities in the highest degree.

" *Third.—Self-Healing.*—The Ideal pneumatic is now being fitted with a regular inflation tube with our elastic core inserted, which, in our opinion, is as reliable a construction as can possibly be made. The core is made of patent elastic felt, weighs but eight ounces per wheel, does not interfere in the slightest degree with the resiliency of the tire, but effectually prevents any nipping or cutting on the rim, which is the real cause of nine-tenths of all punctures, and it affords a most excellent cushion tire to ride home on if a puncture occurs on the road. We are also at the present time experimenting with a self-healing inflation tube which will automatically and instantly close any small puncture, and a large gash can be repaired by simply darning up the hole as you would a hole in a stocking.

" *Fourth.—Ease of Repair, Renewal, Etc.*—There is no tire at present on the market that can be taken to pieces and repaired or renewed more easily than the Ideal. The outer envelope can be removed, exposing any portion of the inflation tube in a few seconds, and replaced almost as quickly. A whole new tire, or any part of it, can be put on by a novice in a few minutes without the aid of a single tool. The act of securing the outer envelope is instantaneous and perfectly positive. The harder the inflation the tighter it binds the rim.

" *Fifth.—Adaptability to any Rim.*—The Ideal can be easily and quickly applied to any ordinary concave cushion rim. Old cycles with worn-out cushion tires can be fitted with the Ideal pneumatic tire in less time than it would take to fit new cushions or solid tires."

The Imperial pneumatic tire is claimed to be "lighter than any pneumatic tire ever constructed,"



Imperial Pneumatic Tire.

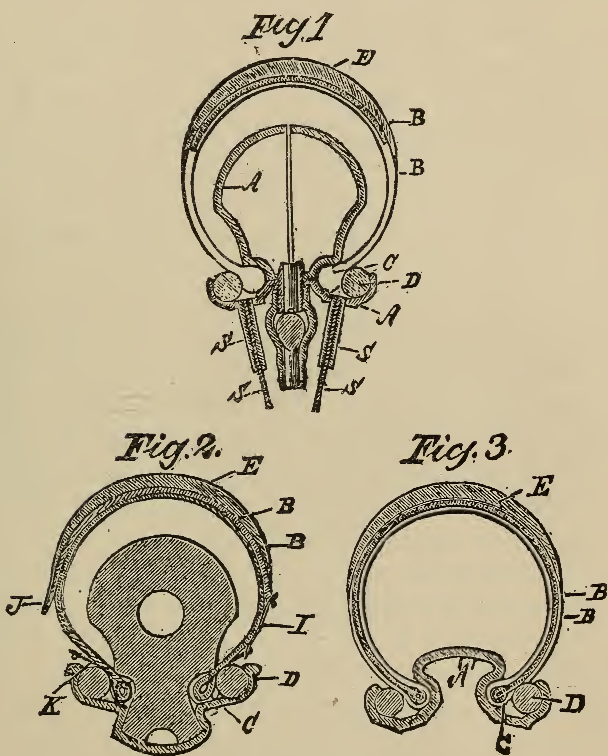
to possess more life and resilience, and to be exceedingly simple. The " air tubes are made of the finest Para rubber, calendered in three piles, and are without blemish or weak places ; they are made larger than the opening in casing, and from this fact are not under any strain when tire is inflated. Casings, or outer non-expansible coverings, are made seamless and, although very light, have yet fully five times the strength required. They are lined with canvas, preventing any stretching. The valve is of the simplest and best description, and one that hard road-riders have thoroughly tested for over a year, and is deflatable. Workmanship throughout is of the highest order, all tires being put to a hard test and rigid examination before being shipped, nothing being shipped that is not of the highest order." For repairs "it is simply necessary, after deflating tire, to remove from wheel commencing on side opposite valve, cut the lacing and withdraw the inner tube, make repair, and replace tube and lacing."

The Kelly pneumatic tire is said to be similar to the Boothroyd, which is fully described elsewhere, "the only difference being that the tread is thickened."

The Lungren pneumatic tire has the following features :

"In constructing the wheel rim so that this forms a supporting center upon which the tire can collapse in case of puncture and still be in serviceable condition; and in making the inflatable envelope in the form of a band or strip, instead of a closed tube as heretofore constructed, so that repairs can be made upon the inside, and attaching this band to the wheel rim in such a manner that while it can be readily removed for repairs it is securely held when in position.

"The supporting centre may be formed either by the metal wheel, *A*, as shown in Fig. 1, or by the rubber centre, *F*, as shown in Fig. 2. The inflatable envelope, *B*, is held in place in the wheel rim by being formed with enlarged edges, *C*, which are held between the outer edge of the rim and the center by the retaining rubber rings, *D*. These rings, which can be readily put in place before the tire is inflated, serve



LUNGREN PNEUMATIC TIRE.

to securely hold the edges, *C*, and to bind them more tightly in place the greater the pressure of the air. The inflatable envelope may be made as shown in Fig. 1, in which the outer part is rendered non-stretchable by the insertion of a web of canvas, *B*, or the whole of the envelope may be made of non-stretchable material, as shown in Fig. 2, the necessary elasticity to bring it down to the supporting center in case of puncture being obtained by an elastic lacing, *I*, the envelope, *B*, folding upon itself as it is drawn down, or the elastic lacing may be dispensed with and the flaps, *J* and *K*, buttoned together, as shown to the left of the figure.

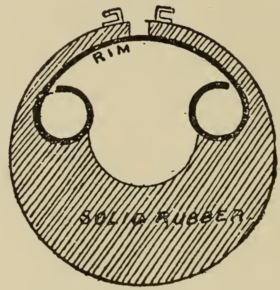
"When the wheel rim is constructed as shown in Fig. 1, spoke nipples may be conveniently placed at the center of rim channels, as shown, and when the construction shown in Fig. 2 is used, they may be placed in the usual manner, the base of the rubber, *F*, being cut away, as shown, to allow it. A suitable form of charging valve is shown in Fig. 1, the valve being screwed into the metal rim. For racers and semi-racers, in which the supporting center is relatively unimportant, the tire may be made as shown in Fig. 3. In this case the envelope, *B*, is preferably formed with a web of canvas, *B*, throughout."

The Mackintosh laced pneumatic tire "is laced on to the rim in a way peculiar to itself, but the especial feature of it is the non-puncturable tube. This is made non-continuous, so that, should a repair be requisite, it may be withdrawn entirely. It is made larger than it is required when expanded, a portion of the tube being built upon the outside of a canvas-curved strip, which, when blown up, is reversed as to its position, and this contracts the rubber which it supports.

"It can now be fitted with our puncture closing air bladder tube. The wall of the tube closes up after all clean punctures, and remains air-tight. It will resist about nine out of ten punctures met with. The tenth can be remedied by withdrawing the cap-ended air tube by means of two slits in the casing (placed just free from the edge of the rim, and covered, when not in use, by the two larger tabs), repairing and replacing; or by inserting a spare tube, and repairing the other at leisure. The exchange can be effected in two or three minutes, by the novice in cycling, on the roadside at night. The tire is not removed, there is no unsealing, sewing, or sticking. The luxury of the pneumatic tire may now be enjoyed without its attendant terrors.

"The tire is now being fitted with a new metal inlet pipe and valve which hold the air inact for months. A touch of the finger deflates it or regulates the pressure as desired. The tire is made in $1\frac{3}{4}$, 2, and $2\frac{1}{4}$ inches outside diameters, weighing from $5\frac{1}{2}$ to $6\frac{1}{2}$ lbs. per pair. It will fit any shallow pneumatic rim. No pneumatic tire should be put in a deep rim, as the edges strike against obstacles. Rims rolled to the curvature of the tire are supplied when ordered. Trials have abundantly proved that it is the fastest tire in the market. The secret of speed—given good rubber, flexible backing, and large air space—is in every part of the inner curve of the tire being absolutely immovable on the rim. This is effected by cementing them together. The tire may be used perfectly well without cement, but we recommend its use for speed. No tire held to the rim by pressure alone can be so fast."

The Mackintosh suspended tire has no rubber in the bottom of the rim, but the other portion of the circle is well filled, and the rim itself is of peculiar

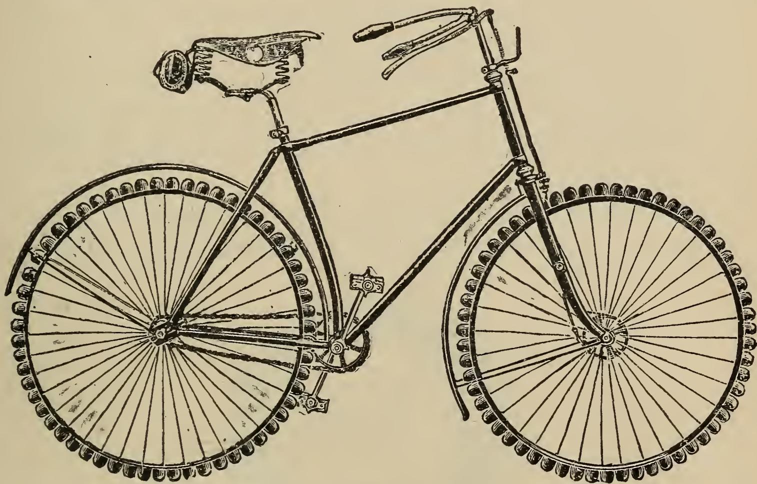


MACKINTOSH SUSPENDED TIRE.

shape. The tire is said to weigh no more than a $\frac{3}{4}$-inch solid.

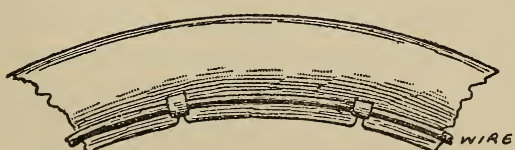
The Manhole pneumatic tire is a name sometimes given to the Swindley, which is elsewhere described.

The Maxim stud tire is a sort of cushion tire, composed of a series of hollow rubber studs fitted close together into the rim. It is said to be equal to any good cushion, and is very easily repaired, as any stud can be readily replaced. "The firm claims that the stud tire is an advance on the cushion, that it possesses greater elasticity and quicker resilience, carrying the weight of the rider without collapsing upon the rim, and is free to expand in every direction when on the road, instead of bulging out sideways only. The studs have so much independent motion that they readily give way to any impediment or obstruction. The tire also grips the road even under the most adverse atmospheric conditions. The studs are each separate. They may be easily replaced when damaged."



MAXIM STUD TIRE.

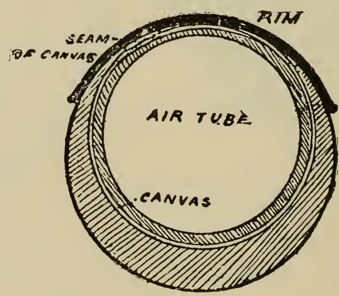
The Michelin pneumatic tire is a French invention. It is a wired tire, with a flattened rim "or rather the wires, which are made of square steel, are embedded in grooves below the surface, so that none



MICHELIN PNEUMATIC TIRE.

of the actual tire is sunk in the rim; the rim is also broad. A single air tube is formed with butted ends, one slipping into the other, to facilitate removal without taking out the wheel. The outer cover is canvas-backed, with a kind of flange or edge at each side. These are fitted into deep grooves at each side of the rim, and on the top of them are placed circles of square wire the exact circumference of the wheel, and with two projecting ears on both ends of each which slip through little slits in the rim and are secured with a thumbscrew."

The Mikado pneumatic tire is of light construction and very simple. "It has the ordinary air tube

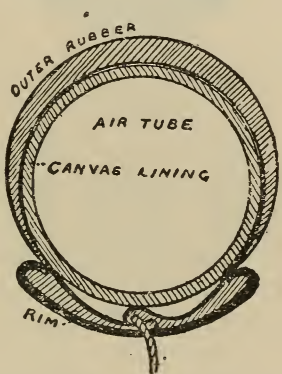


MIKADO PNEUMATIC TIRE.

surrounded by a canvas casing, which is sewn with the stitches on the outside, but so that the sewn portion rests on the rim. Under the edge of one side of the outer cover is solutioned a flap of rubber which lies on top of that portion of the canvas casing which rests on the rim, and the other edge of the cover is solutioned down on top of this. The complete tire thus formed is cemented bodily into the rim, or it can be bolted through the rim at intervals, a flat washer fitting under the canvas flap already mentioned for each bolt to pass through; the canvas being cut on the cross also makes it grip the rim of itself."

The Moffat and Huss pneumatic tire "is described as the combination of a pliable, non-extensible, outer layer of rubber, with an internal body of rubber seated against the outer layer and maintained under compression, whereby a puncture will close automatically."

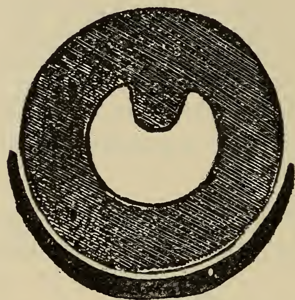
In the Nedderman pneumatic tire "the canvas edges of a clincher-like arch are much thickened, and



NEDDERMAN PNEUMATIC TIRE.

slip into the incurved edge of the rim. Inflation only pulls these projections more firmly into their seats, while a very simple contrivance makes the tire immovable in case of a collapse."

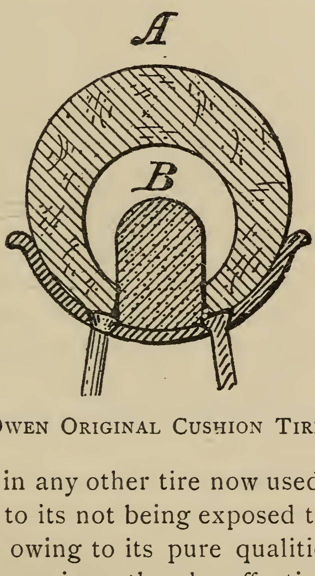
The Non-Collapsible cushion tire has the usual hollow core: but a tongue of rubber projects into the core on the side whence flattening comes during use, thus preventing the hole from ever completely closing. This feature is said to add materially to its life and constitute a point of great superiority over other cushion tires.



NON-COLLAPSIBLE CUSHION TIRE.

The Owen cushion tire "consists in making a tire of two separate pieces of rubber, each running longitudinally through the rim, with about the same amount of weight of rubber as the ordinary solid rubber tire, but separated into two parts for distinctively different kinds of work, an outer and inner section of rubber, as will be seen by the drawing. Suppose the ordinary tire to possess 100 parts of good qualitity of rubber, and let 75 parts with ingredients be used for the outer, or harder more refractory covering, *A*, and let 25 parts remaining be made of a pure soft more elastic rubber, and molded so as to serve as a longitudinal seat or cushion, *B*, for the outer shell, *A*, to rest against, when compressed as in riding.

"The outer portion of rubber must be made hard and refractory to take the wear, and separate from the inner more delicate rubber, and when cemented properly in the felloe or rim of the wheel, the soft virgin rubber is almost hermetically sealed by the outer hard shell from the elements. The advantages of making a tire thus are both great and obvious. The proportion of the hard and soft rubber being properly distributed together with an inner air space between the same will afford ease and comfort in riding, and in case of wear or damage the outer coat or covering can be removed and a new one substituted at a much



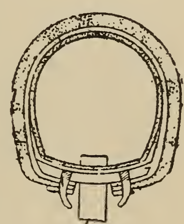
Owen Original Cushion Tire.

less cost than in any other tire now used ; as the inner rubber, owing to its not being exposed to the elements and wear, and owing to its pure qualities, will outlast several outer coverings, thereby effecting a saving to the owner, besides making, when ridden, the most perfect tire of the cushion type. Inasmuch as the rubber is so separated into distinctive working parts, the quality of the one makes the quality of the other much more efficient and useful, and admits of the inner to be of any desired shape for either the hollow or the solid rim.

"The inner section, *B*, or core, may also be any degree of elasticity of rubber and of any size, even so that if it fills the air chamber entirely, when the outer jacket or shell is cemented in place in the rim, as long as they are molded separately and put together when needed. In this case the outer shell may be molded like any hose pipe or present common cushion tire, but cut at the bottom longitudinally for the reception of the inner core or cushion, and likewise for the change of the outer shell for a new jacket or covering when found necessary. The raised center in a rim, also shown, is recommended for this double section tire and hollow rim, as the cushion is nearer the center of the tire, where it meets and yields more healthfully than otherwise to outside impressions, as in riding. These sections and points tend to keep the outer tire or covering more in shape and not allow it to flatten out sidewise and cut by use as some hollow tires are apt to do, which are left unsupported from within."

The Palmer pneumatic tire is said to be composed of "a thin piece of first quality rubber molded in the form of a half circle or crescent moon, for it is gradually thickened from the ends to the center, being thickest at the center. Then you have your regular inner air tube over which you bend your semicircle, *but reversed*. This reversed band of rubber covers the tube over all parts which are not within the rim. Over this inner tube, and its re-enforced tread surface, you place the regular pneumatic outer covering. This supplementary band of rubber is vulcanized on to canvas and on to the inner tube. In reversing, the grain of the rubber is compressed, and as soon as a puncture is made the rubber automatically closes. The advantages are: That no valve is necessary; that when the tire punctures the incision is at once closed, and but only an inappreciable amount of air escapes; when inflation is necessary you simply put a hollow needle in the pump, 'stick' the tire, and inflate."

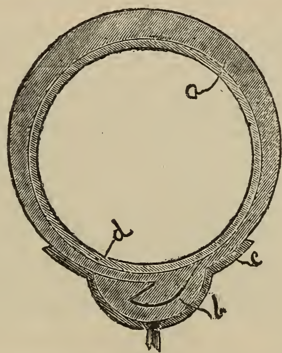
In the Payer pneumatic tire "the rim is nearly flat, and provided with a number of studs or pins at intervals of about an inch projecting outward. The inner tube is placed upon the rim, and the outer case, which is made in various thicknesses and weights, and with canvas lining vulcanized to it, is pierced with eyelets, which slip on to the pins, and the inflation of the tire keeps it tight and firmly attached. Should anything go wrong it can be deflated and turned back at any point, and the condition of the inner tube examined. It is a wonderfully simple form of construction, and provides great facilities for easy repair."


PAYER PNEUMATIC TIRE.

The People featherweight tire "is composed of sections of cork cut from cork wood of suitable size and shape, to fit the rims of wheels. These sections of cork may be steamed or not, as preferred. The inventor prefers to steam the cork, as it is then soft and pliable, as well as elastic. These sections are cemented or applied to the rim in the ordinary way, and the wheel is then ready to use for any board floor race, or any good smooth track; but the inventor prefers to cover the projecting or outside part of said cork tire with some strong fabric, such as a strip of rubber-coated canvas, or any suitable material, to save the wearing part of said tire. For road use, the inventor prefers to stretch a rubber band of a U, or any suitable shape, over the outside surface of said tire in order to protect the cork from being damaged by sharp stones, pieces of glass, etc., besides giving a trifle more elasticity to the tire. The inventor also claims that this rubber band, which covers the outside of said cork tire, may be made and fastened on a suitable rim, or on the cork tire, in order to be inflated. Should this inflated rubber band get punctured, and deflated, the cyclist could still ride on the solid cork tire as long as he pleases. The following is the weight of some of the inventor's tires for a 28-inch wheel. A 1⅓-inch tire six ounces; 1¼-inch ten ounces; 1½-inch twelve ounces; 2-inch tire sixteen ounces."

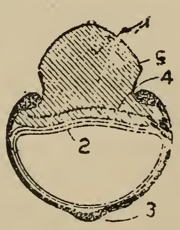
A new pneumatic tire, to which no name was attached, was recently described as follows: "*a* is a divided canvas-lined cover adapted to completely surround the air-tube, and provided with interlocking edges, the permanently secured edge fitting in a trough-shape recess in the rim; the opposite side of said cover being provided with an engaging projection adapted to interlock with the permanently secured edge; *b*, band or clamping plate adapted to firmly secure one edge of the divided cover to the wheel rim, said clamping plate being formed with a projection to strengthen the interlocking parts; *c*, rim; *d*, air-tube.

To repair the air-tube, the tire being deflated, a slight pressure on the side having the loose edge will unlock the edges of the cover, when the inner tube can be reached and a patch placed in position ; rehook the



PNEUMATIC TIRE.

edges and inflate. A few advantages claimed : Ease of repair. The interlocking edge being independent of the rim, and placed where they will receive the least wear and strain. From its construction, the tire cannot slip or creep, and can be inflated to suit the weight of the rider. Convenient as the clincher, and with the resiliency of the true pneumatic. Air tube does not come in contact with the metal rim. Battered edges of the rim will not affect the interlocking parts."



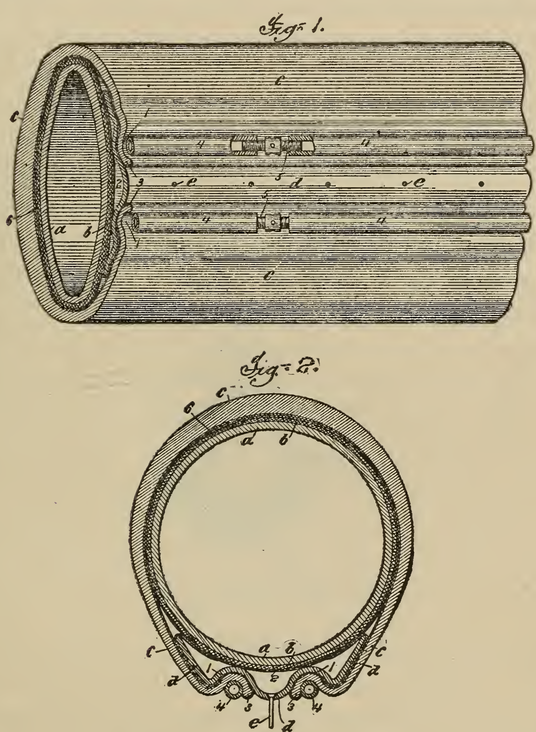
QUERTIER PNEUMATIC TIRE.

The Quertier solid pneumatic air spring tire is practically an outer solid rubber tire superimposed upon an inner pneumatic tire, the air tire being fitted into the rim, thus protecting it from puncture, and the solid rubber being imposed on it.

A new material called Rathite is "composed of pure rubber with the addition of pure silk fiber, and is guaranteed to contain no adulteration. It is incomparably tougher and more durable than any ordinary rubber. Rathite cushion and solid tires are warranted not to burst or split during a whole season. Light, durable, and non-slipping. Rathite pneumatic cushion tires are built up of alternate layers of hard and soft Rathite, forming an excellent spring without the aid of inflation. Light, durable, and non-slipping. Superior to a pneumatic for hill-climbing and on dirty roads. Rathite pneumatic tires lace over any ordinary cushion rim. The whole is removable by mere unlacing. Is difficult to puncture, and non-slipping. Rathite covers are made for Dunlop and other pneumatics. Prevent puncturing and side-slipping, and protect the tires."

The Resilient pneumatic tire "is a true pneumatic of the highest type. It is mounted on a special hollow rim, the inner member of which is corrugated to receive the edges of the envelope and the securing hoops, and the outer member is concave, making a remarkably strong rim. A piece of canvas is first cemented into the rim upon which the inflation tube rests. The edges of the outer envelope are beaded and folded underneath the rim, after which two hoops, made of small brass tubes slightly less in diameter than the rim, are pressed into the grooves behind the beaded edges and then expanded by means of expansion joints shown in Fig. 1. The hoops grip the edges of the envelope so tight that it is next to impossible to force them out.

"The inflation tube has canvas insertion to prevent bursting and is provided with the Phelps elastic core,

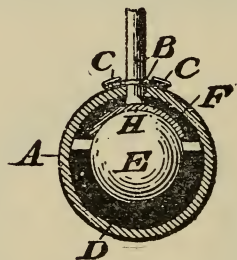


RESILIENT PNEUMATIC TIRE.

which effectually prevents nipping on the rim, and affords a most excellent cushion tire to ride home on if the inflation tube becomes punctured on the road. This elastic core weighs but eight ounces and does not interfere with the resiliency of the tire. It has been thoroughly tested and adopted by several of the largest manufacturers of tires."

The inventor of the Richwine ball tire says "my invention consists of a tire formed of a tube and elastic balls, which are seated in an elastic bed in said tube and thereby prevented from displacement, the combined action of the parts producing a highly elastic, easy riding, and durable tire. Provision is made for access to the interior of the tube, and other features are presented, as will be hereinafter fully set forth.

"*A*, designates a tube constituting the tube proper, the same being formed of suitable fabric, such as

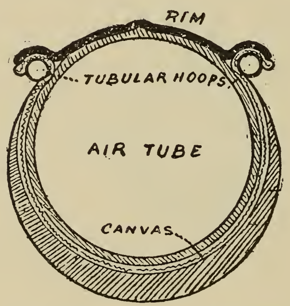


RICHWINE BALL TIRE.

rubber cloth, which is bent into shape and has its ends brought together at the inner periphery of the tube, and retained in closed or approximately closed position by means of lacings, *B*, which are passed around studs or pins, *C*, on the tube on opposite sides of the ends of said tube. *D* designates a bed of rubber or other elastic material, which occupies a portion of the tube, *A*, and is provided with pockets or depressions in which are seated the rubber balls, *E*, which, as will be seen, are arranged side by side throughout the tube and are solid or hollow as desired. *F* designates a rim or plate of metal or other rigid material, which is located within the tube, *A*, at the inner periphery thereof, and having secured to it the spokes, *G*, of the wheel, of which the tire constitutes a part, said spokes passing from said rim to the opening formed by the ends of the tube. Interposed between the rim, *F*, and the balls, *E*, is a piece or strip, *H*, of felt or other fabric or soft material, forming a cushion, and preventing contact of balls and ribs.

"It will be seen that balls are held in position within the tube, owing to the pockets of the seat, and thus prevented from shifting, and as said balls and the seat are elastic in their nature, access is had to the balls for removal of the same, or other purposes, by loosening the lacing and separating the tube, when the balls and bed may be displaced, the same being true of the spokes, rim, and contiguous cushion ; it being also evident that when the bed, etc., is placed within the tube, the latter may be closed around the same and secured by the lacing, *B*, the parts thus being retained in position and the structure of the tube preserved. Having thus described my invention, what I claim is new, and desire by letters patent is : First : a tire consisting of a tube with pocketed bed and balls therein, said balls resting in said bed, substantially as described. Second : a tire having a divided tube of flexible or elastic material, with means for lacing or connecting the ends of the same, substantially as described. Third : a tire consisting of a tube with balls and a spoke-attaching rim therein, said rim being located between the balls and inner periphery of the tube, substantially as described. Fourth : a tire consisting of a tube with a pocketed bed, balls in said bed and a spoke-attaching rim therein, substantially as described. Fifth : a tire consisting of a tube with balls, a spoke-attaching rim, and a cushion therein, the latter being between said balls and rim, substantially as described. Sixth : a tire consisting of a tube with a pocketed bed, balls in said bed, and a spoke-attaching rim, said tube being divided and provided with means for closing the same, substantially as described."

The Scott pneumatic tire is very light, the rubber arch being fixed in a groove by means of wires. "The



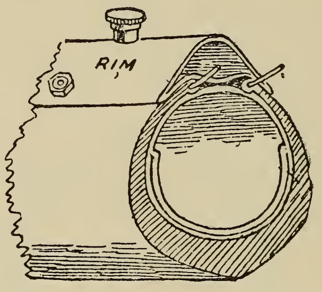
SCOTT PNEUMATIC TIRE.

bed of the tire is very slightly hollow, and the groove for the wire is shallow. The air chamber is continuous, and the outer cover is backed with canvas, and has small beads at the edges. These are not wholly contained in the grooves, but the edge of the cover goes round the wire from the inside, so that the bead is clipped between the wire and the edge of the rim.

The ends of the wire are drawn together by a right and left handed screw, into the center of which a short lever engages, which tightens and slacks it easily and effectively. In another pattern, the outer cover is brought round the edge of the rim and wired into grooves underneath, the wires being held in place by a thin supplementary rim, which is screwed down on to them. The rim is shallow, and the shape of the tire is rather oval than round. The system of repair is undoubtedly very easy and rapid, for, the tire being deflated, the outer cover and canvas casing can be unhooked from the rim and the air tube left bare."

The Seddon pneumatic tire is fixed in place by a wire. "The air tube is of a specially patented material, which, while unstretchable as to its length, *is* stretchable as to its breadth. Over this is placed a rubber arch having in either edge a long rim with a hook coupling, which is fixed by means of a very simple tool, which can be made part and parcel of an ordinary wrench by certain ingenious devices in the method of construction. The tire, when blown up, becomes of an egg-shaped section, the part in contact with the ground being much sharper than the rim end. The slightly flattened sides and the narrower tread reduce materially the tendency to slip, the available cushioning space is considerably greater than that of any other tire of the same dimensions, while the rim affords extra support along its edges, and its center, being slightly convex, throws up the air chamber. One of the most singular points about the Seddon tire is the fact that there are *two* tubes or bladders, one normally inflated by one valve, another being deflated and lying flat, only to be inflated if the first should be punctured, the very slight addition to the weight being amply recompensed by the added security."

The advantages claimed for this tire are: "1. A greater depth of available cushioning area than any tire in the market, and a consequent increase in speed and ease of running. 2. By means of the system of fastening the cover, the air tube can be removed there-



SEDDON PNEUMATIC TIRE.

from in less than a minute, and replaced in three minutes. 3. The canvas bag of the older systems is dispensed with entirely, the only canvas used being an insertion of specially prepared flexible web in the outer cover. This plan has been found to work extremely well in practice, increasing the resilience of the tire, while avoiding the complication of unnecessary parts. 4. There is a second air chamber, which can at once be inflated through an independent valve in the event of the inflated air tube becoming punctured. 5. It is less of a mud slinger than other tires, from its narrower ground-bearing surface, and also for the same reason it is almost perfectly free from side slip. 6. Its great depth, and the fact that the cover is of molded rubber, make it possible for the tire to be ridden as a cushion tire in the unlikely event of both air chambers being punctured. This will not damage either rim or tire.

The Singer wired cushion tire has so small a hole that it is almost solid. "It is compressed, not stretched on the rim. It is more elastic. No cement is used. It cannot come off accidentally. The wire is of specially strong quality. It is passed through the hole in the center of the rubber and its ends are interwoven. As the tire is longer than the circumference of the felloe, its ends are joined by compression. On a 30-inch wheel, the tire, instead of being several inches shorter than the circumference of the felloe—as is the case with tires that are stretched and cemented on—is four inches longer than the circumference of the felloe. This gives us about twenty-five per cent. more rubber than they have, forming a very decided elastic cushion. The rubber will not as easily cut, and any cut made will be pressed together, not distended under tension.

"The tire may be pushed aside sufficiently to admit of the putting in of a spoke. It is made of the very best soft rubber, $1\frac{1}{8}$-inch diameter, and the chief object of having a hole through it is to admit of its being fixed, without stretching in the rim, by means of wire, instead of the unsatisfactory cement usually employed for fixing tires. Thus, a very *shallow* felloe can be safely used, and this renders a large part of the tire effective, the shape of the rim entirely preventing danger of cutting. We also secure a neater, safer, and more elastic tire than the ordinary style of cushion, the lower half of which is confined in the felloe, and

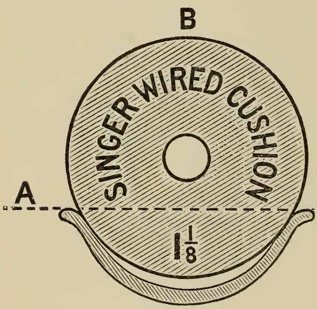


Fig. 1.

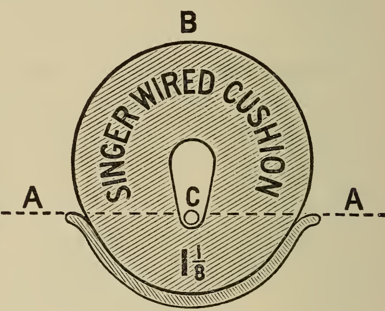


Fig. 2.

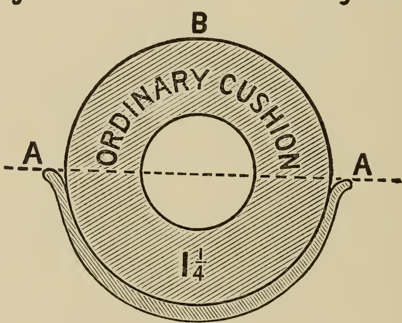


Fig. 3.

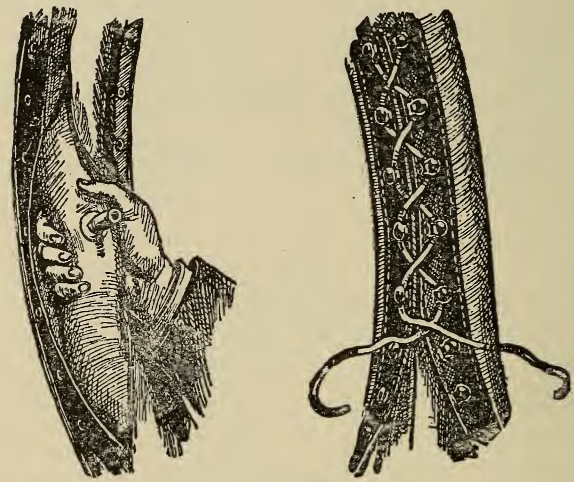
SINGER WIRED CUSHION TIRE.

is useless except for the purpose of cementing it to the rim. It also needs to be *stretched* upon the rim instead of being *compressed*, as is the case with the Singer wired cushion. Fig. 1 shows the $1\frac{1}{8}$-inch tire before it is fixed to the rim. The sections of rim and tire do not correspond, so that when fixed the tire assumes a slightly irregular form, to prevent its rolling in the felloe. Fig. 2 shows the tire when fixed by the wire, C. Fig. 3 shows an ordinary $1\frac{1}{4}$-inch cushion tire. The effective part of the tire, A B, which is above the line, A A, is not so deep as the corresponding part in Figs. 1 and 2, although the diameter of the former is greater. The cemented $1\frac{1}{4}$-inch cushion tire, being stretched some 9 inches when on the rim, has its diameter thus diminished ; whereas, the $1\frac{1}{8}$-inch wired cushion is compressed into the rim, which has a tendency to increase its diameter."

The Smith patent detachable balloon tire "consists of, substantially, an air tube, fitted with a suitable valve, and inserted through an opening in a casing of leather and rubber (instead of canvas and rubber), the whole being then laced on to the rim. It may be readily detached from the rim in case of puncture, and, if need be, sent for repair, or the rider may execute the repair himself by sticking on a patch." Moreover, "this tire can be 'laced' on any existing pneumatic or cushion rim without any alteration to wheel ; can be readily detached, and the air tube withdrawn in case of puncture or repairs. It is made in three sizes : $1\frac{5}{8}$-inch, $1\frac{3}{4}$-inch and 2-inch."

To fix the tire on the wheel, "unscrew the elbow or pump connection of the stem of valve, pass the stem through the hole in the rim, then screw the elbow back in its place. If the tire is found to fit tight on the rim, tie the tire on each side of the valve with a strong piece of string, then pull on gradually from each side until the tire is completely on the wheel.

Then commence to lace the tire, as shown in sketch, (cross lacing), using two laces, viz.: one laced over the other. To inflate the tire, first unscrew the elbow a few turns, then screw the pump on the side of the elbow (removing the dust cap); when the tire is fully inflated disconnect the pump, then screw up the elbow tight to its seating. To deflate the tire, unscrew the



Smith Pneumatic Tire.

elbow a few turns, and press the steel ball inward, and replace the dust cap.

" To preserve and to obtain the best results from this tire, it is absolutely necessary to have the tire inflated hard when in use. The air pressure can be reduced by the valve when not at work; riding a slack tire will often injure the same beyond repair, and render it more liable to puncture.

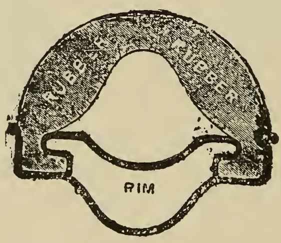
"In case of puncture, unlace the tire from the wheel, and should the position of the injury be known, it is only necessary to lift up the flaps or wings of the under side of the tire about seven or eight inches to enable the 'operator' to pull out sufficient of the air tube to patch the same; to do this, the surface of the air tube and the vulcanized rubber patch should be scraped or sandpapered perfectly clean, after which well rub the two surfaces with a thick coat of solution which can be laid on with the finger; allow the solution to dry for about ten minutes, then press the patch down with a roller or weight.

"If the position of the leakage is not known, undo the case near the valve about six to eight inches, test the angle of the joints by dipping the finger in water and running a little around the two joints (taking great care not to wet or damp the case). If the joints show any air bubbles, the joint must be undone and rejointed with solution. If, on the other hand, they are sound, the flaps of the case must be lifted up all the way around and the air bag taken out and tested in a vessel of water; the damaged parts will be shown by the air bubbles, which should be marked with an ink pencil, and when the tube is perfectly dry the parts can be patched as above.

"To replace a spare air tube the *modus operandi* would be as above, viz.: undo the flaps all the way round, place the air tube in the tire, solution the sides of the flaps, allowing a few minutes for the solution to become tacky, after which fasten them down over the air tube, care being taken to keep the flaps or the channel of the tire regular in width to suit the size of the rim. We recommend this plan of replacing the air tube, rather than unjointing the tube and replacing by putting the tube in the tire by the aid of a cord, as there is no risk of having unsound joints in the air tube.

"Do not cut any portion of the leather stitching or linen, as provision is fully made for all kinds of repair without cutting away any part of the tire. The tire should on no account be placed in water, or it will injure the inside of case. The air tube itself must be taken out of the case, if found necessary to test it in water. To avoid punctures, examine the tire after riding and, if any cuts are found, carefully clean all grit or dirt from the cut, then fill up with solution and allow the same to dry before pressing parts together."

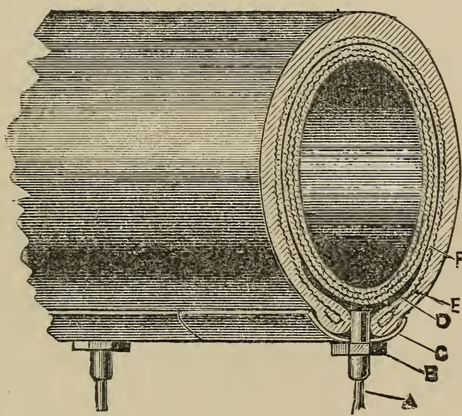
The Stelfox patent cushion tire and rim "requires no inflating; cannot burst or come off in riding, and



STELFOX CUSHION TIRE.

no cement is required. The $1\frac{1}{4}$-inch and $1\frac{1}{2}$-inch are perfect cushion tires, the whole being of one uniform thickness throughout, so why ride imperfect cushions at the same price? The 2-inch is unsurpassed for life, resilience, comfort, durability, freedom from vibration, as easy riding as the pneumatic, and may be cut to ribbons and still ridden with comfort."

The Strauss patent pneumatic tire has as a feature "the method of fastening it to the rim. The importance of a proper fastening is not to be overlooked. There are a number of different styles of attaching tires, but in ours we have made it a point to attach it



STRAUSS PATENT PNEUMATIC TIRE.

A. Spoke. B. Nut on Spoke. C. Clamp which clamps the outer cover against the under side of the Rim D. D. Wheel Rim. E. Outer cover with enlarged ends. F. Inner Tube.

as firmly as possible, as the lateral strain on pneumatic tires is greater than is generally supposed. Our tire is fastened with a series of little clamps which are fitted at each spoke. In direct spokes the spoke is thickened and threaded just at the rim, so that a nut can be screwed on it. In tangent spokes the spoke is threaded so as to allow the nut to go on. The clamp is attached to the spoke, the length of which is determined by the distance of the spokes apart. The usual size of the clamp is about two inches, and it is fastened by the nut adjustment. The clamps for a 30-inch wheel weigh, entire, but five ounces. To prevent cutting, the tire about the rim is padded with either rubber or felt, our company preferring felt, as it is lighter and cheaper, although it answers the same purpose as rubber. The inner tube is made of two pieces of canvas and two coatings of rubber ; that is, practically a sandwich with an outer and inner rubber covering and a double ply of canvas in the center. The outer rubber covering has a thickened outside, which is shown in the cut to be of special construction. It will be noticed that this outside cover has thickened ends, which are marked E in the cut. In our tire the inner tube is made of one piece, and there is but one pneumatic tire which has this feature, and that we do not consider a true pneumatic. This tube is absolutely air-proof, because there is employed in the tire but one layer of rubber on the inside to separate the layers of canvas, and another also of rubber on the outside. All these parts are made separately, and in fact carefully prepared. They are vulcanized into one solid piece, in which it is impossible for there to be any air holes. While our tire is firmly attached to the rim, it can be readily attached and detached in case of puncture, and can be repaired in a short time. The company is prepared to furnish the clamps, so that manufacturers will only have to prepare the spoke and nut. The tire can be easily fitted.

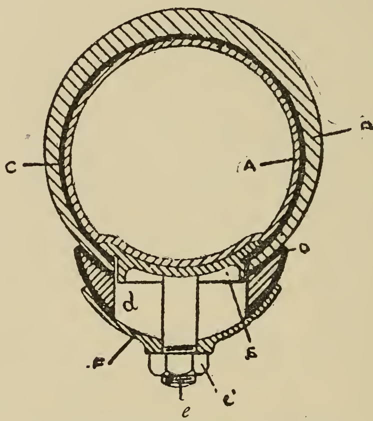
"In case of puncture, separate the protection strip from the inflated tube, patch it with a piece of rubber in the usual way, replace the protection strip, and the tire is ready for use. If the tire is punctured, and it is desirous of using at once, wrap adhesive tape around the punctured part after the patch is put on, which will enable the wheel to be used at once, and until it can be repaired permanently."

The Swindley pneumatic tire, sometimes called the Manhole, is said to have "the following combined advantages—essential to a perfect air tire—not possessed by any other tire: (1) Its outer cover is permanently fixed to the rim of the wheel and never requires to be removed. (2) The air tube or chamber can be removed from the cover and reinserted in a few seconds by purely mechanical means. (3) No cement, solution, tape, or needles and cotton are necessary in its repair. (4) The tire can be repaired when punctured without removing the wheel from the frame of the machine.

"The essential feature of the Swindley tire is a hole or slot in the rim of the wheel, through which the air tube, made with closed ends, can easily and readily be withdrawn and inserted, the hole being closed by suitable plates after the air tube is in place. Any rim may be used, providing it is strengthened where the hole is cut. There is nothing liable to get out of order, and the merest novice can withdraw and insert the air tube. The facility for repair is so great that the tires can be made considerably lighter than those at present in use, thereby materially increasing the speed.

"This is essentially the tire for the tourist, as by carrying a spare air tube a punctured tire can be put right within two minutes under the most adverse circumstances. For racing men this tire has no equal on account of its superior speed, due to its extreme lightness and resiliency. Wheels fitted with the Dunlop tire can be fitted *à la* Swindley at a small cost.

"The principle is exactly and precisely that employed in the construction of manholes in steam

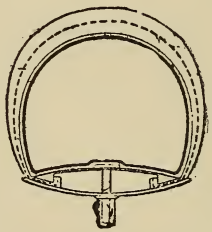


SWINDLEY PNEUMATIC TIRE.

A. Air Tube. B. Outer Cover. C. Canvas Lining to Cover. D. Rim of Wheel. *d*. Hole or Slot in Rim. E. Internal Closing Plate. *e*. Stud on Closing Plate. *e*[1]. Nut for Stud. F. External Closing Plate.

boilers, the external closing plate, F, answering the purpose of the 'dog' of the boiler manhole. The oval hole cut through the rim, D, does not weaken the latter in any respect, the same being strengthened by the introduction of the fillets shown. This mechanical refinement can be fitted with any description of inflated tire where an independent air tube is employed, and by its adoption the outer rubber cover, B, and the canvas lining or tube, C, are fixtures, and never need removal or cutting for the purpose of effecting a repair. The air tube used is butt-ended, the valve being fixed close to one end, and two pieces of strong tape, about eight inches long, secured for repair, or the introduction of a spare tube. The *modus operandi* is as follows: Any suitable mechanical valve being used, the tube is deflated. The nut (e^1) is then unscrewed, the external closing plate, F, dropping off into the hand. The internal closing plate, E, is then withdrawn by means of the stud, through the oval hole, and access to the interior of the tire is gained. A piece of strong whipcord is then tied to the tape fixed to the valveless end of the air tube, and the tube is withdrawn from the tire by the tape at the other with the greatest ease. Now the tube can be repaired, and reintroduced, or the spare tube aforesaid substituted. One end of the whipcord, which it is obvious has been drawn right round the wheel, is attached to the tape at the valveless end of the air tube, which is easily and quickly drawn once again into position round the wheel inside the tire. The tapes are then tied together closely and tucked inside. The internal closing plate is put back into its place, the external plate slipped on to the stud, the nut (e^1) screwed up, and nothing remains but to reinflate, which, with a good pump, is done in the shortest possible space of time. The rider, who without this attachment would be making tracks for the nearest railway station, miserably afoot, is now quite ready to resume his journey after a stoppage of (even in the case of an entire novice) certainly not more than ten minutes. The manhole and covers can be fitted to almost any rim. The extreme simplicity of this invention, and the ease with which the dreaded puncture, burst, etc., can be overcome, should open out a big future for the Swindley Manhole pneumatic."

The Tacagni patent pneumatic tire has the "outer casing held firmly on to the rim by a duplicate

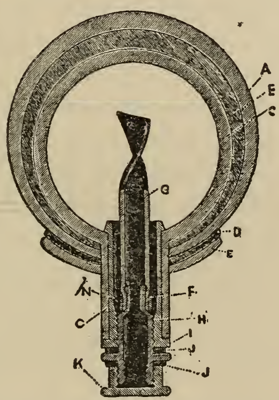


TACAGNI PNEUMATIC TIRE.

sectional rim and eyebolts," the "ease with which the inner tube can be got at being its special merit."

The Tillinghast pneumatic tire "is attached and detached as easily as a solid or cushion, and requires very little attention. Its durability and simplicity will commend itself to all riders. The features of this tire are: the manner of attaching to the rim; the cushion to prevent chafing against the rim; the braided covering for the air tube; the re-enforcing of the canvas in the tread, and the perfect valve, making an air-tight and exceptionally light, resilient, and strong tire, that will not puncture or burst, and will be free from internal chafing of the parts, so troublesome in other pneumatic tires.

"The construction of this tire is most simple, and combines simplicity, strength, durability, and elasticity —qualities not found in any other tire. In pneumatic tires, as heretofore made, the air tube is inclosed in canvas windings or wrappings, which are non-expansible both longitudinally and laterally. The air tube is made of pure rubber and inclosed in a seamless braided linen tube of special make, which is slightly expansible laterally, and will give life to the tire by



TILLINGHAST PNEUMATIC TIRE.

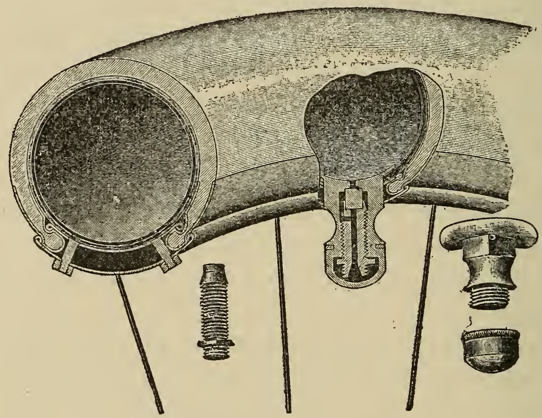
its longitudinal, expansible, and compressible qualities. It is more pliable than canvas and much stronger, and as yielding as pure rubber. The seamless braided tube which incloses the air tube has withstood a test of over 300 pounds; we have tested our complete tire to 80 pounds hydraulic pressure without injury, and every tire sent out by us will be tested and guaranteed to stand a pressure of 50 pounds per square inch, and will be air-tight.

"It has been found that from 15 to 25 lbs. is sufficient pressure for front tire and 25 to 30 lbs. for the rear, and the racing tire will never be pumped higher than 35 or 40 lbs., as it would then be so hard that no impression could be made on it; while it would be better than a solid or cushion, the rider would derive very little benefit from the tire, as it would be too hard to cushion properly, and would cause both machine and rider to bound into the air in striking uneven surfaces of the road. These tires will not weigh over $5\frac{3}{4}$ lbs. per pair, yet they have withstood the roughest usage possible to give them.

"The attachment is attached in a similar manner to a solid, and is described in detail: Drill $\frac{9}{16}$ inch hole in the rim to receive valve tube; coat rim with cement; lay on felt and apply cement to felt, taking care to keep cement from the felt for a distance of $\frac{1}{4}$ inch from its edges. Remove sulphur (with file or sandpaper) from surface of tire to be cemented. Put valve tube through opening and spring tire into place; inflate tire to round it out. Should the valve tube be to one side or the tire unevenly stretched, strike glancing blows on the tire, and 'creep' it into place. Cover valve tube with wet cloth, and heat rim with flame while wheel is revolving. If valve leaks take it out, and pump several drops of clean water through it; if air escapes around washer under plug, partly unscrew same and wash away grit, etc., and screw down while wet.

"Repairs are easily and quickly made. There is little danger of a puncture, even if the tire picks up a dozen tacks or pins, and in case of a tack or pin penetrating the air chamber, pull it out and the hole will close itself; this may seem strange, but it is nevertheless true, and is easily explained: the inner tube is not stretched as in most tires, but is compressed against the non-expansible cover, and the sides of a small hole such as made with a pin or tack will be forced together and prevent leakage. If the hole be made with a nail, it can be repaired in a very few minutes by using a small cement-injecting tool (patent applied for) similar to a woodscrew; fill the threads with rubber cement and force the tool straight through the hole, then unscrew it; the sides of the opening will remove the cement from the threads of the tool, leaving a quantity of cement in the air chamber, and all the way through the opening; place a small coin or other hard substance over opening to prevent the escape of cement; bind with tape, inflate, and your tire is ready for use. Tape can be removed as soon as cement is dry."

In the Union pneumatic tire, "the principal feature is the method of fastening the tire to the rim, which is entirely original and has been tested with gratifying results. The edges of the outer rubber covering are well protected by strips of canvas vulcanized on and reaching to a sufficient distance around both edges to preclude any liability of tearing. These edges are clamped between an inner rim of steel with beaded edges and the rim proper, which is also provided with a bead in order that no chafing or cutting may take place. Clamping screws around the rim draw both pieces together with a grip which no accident can release. In case of puncture, the outer covering can be removed in a very short space of time without interfering with the spokes or finish of the wheel in any way, by loosening the nuts sufficiently to allow of the enlarged edge of the outer covering to be withdrawn. This will expose the inner tube, which may be entirely removed if necessary. The valve, which has been designed to do away with all liability of leakage, is in three pieces, and its construction is simplicity itself; the joints are made tight by leather or rubber washers.

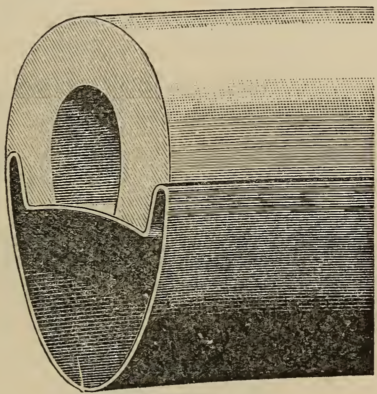


UNION PNEUMATIC TIRE.

It can be instantly deflated by half a turn on the closing valve, and is protected by a cap which fits over the opening after all has been secured, thus doubly locking it. Another point has been considered, namely, the protection of the inner air tubes against damage from coming in contact with the spoke heads or any unevenness caused by fitting spokes through the second rim. This is a feature the advantage of which will be readily seen and appreciated."

The Victor cushion tire differs from most cushions in design, being an arch of rubber. "Radial elasticity, lateral stiffness, toughness and wearing quality of rubber are three essential constituents of a good cycle tire. Under test, the Victor cushion far surpassed all others in these requirements.

"The Victor cushion tire is a simple arch of rubber extending from edge to edge of the rim. Its side

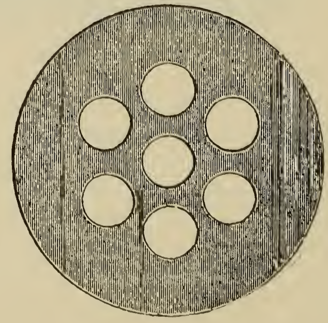


VICTOR CUSHION TIRE.

walls are held against spreading by side flanges having rounded edges, which also the tire is constructed to cover and protect. The bases of the tire rest upon a horizontal rim-bed which aids materially in giving lateral stiffness to the tire and strength to the hollow rim. It is evident that the rubber must displace inwardly under pressure. The movement of the rubber is therefore almost wholly radial, which fact accounts for the great elasticity of the Victor cushion tires, and, moreover, allows us to use rubber of the proper degree of toughness and density for cycle use."

The Victor pneumatic tire "is the Swindley invention which has been for months past experimented with and perfected by the Overman Wheel Co. It is in all practical points like the best pneumatic tires, but is so made that an inner tube made with closed ends can, by opening a small slide in rim, be instantly taken out and replaced in case of puncture. The tires are 2-inch, with thickened tread re-enforced by linen canvas, and the inner tube, slightly smaller, made of finest Para rubber.

"The work of opening the tire, removing the inner tube and replacing it with another, including the time of inflating, has been done in less than four minutes. The fittings to the opening in the rim are very neat and compact, and the whole operation of removing the inner tube is done with the fingers only, no tools being required. A rider using this tire may have an extra inner tube in his bag which can be used to re-

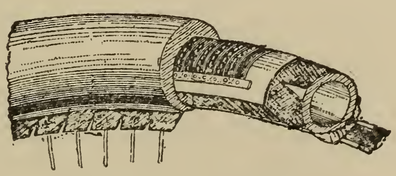


WEBB CUSHION TIRE.

place a punctured one without causing serious delay on the road."

The Webb cushion tire is here illustrated, "showing the webbing or spokes of rubber which support the outer walls of the tire, and as the holes formed by the webbing are not inflated with air, it will be a matter of no consequence whatever how often or how deep the tire becomes cut. The tires will be made endless and in two sizes, $1\frac{1}{4}$ and $1\frac{1}{2}$ inches in diameter, and will weigh about the same as $\frac{7}{8}$ and 1 inch tires respectively, and add but a very few pounds to the weight of the machine."

The Wright protector for pneumatic tires "consists of sheet steel and leather. The steel is extremely



WRIGHT PNEUMATIC TIRE PROTECTOR.

thin, as thin, indeed, as the finest watch springs, and beautifully tempered. It is cut up into round-cornered strips, some 2 inches long and $\frac{13}{16}$ inch wide, and then, each strip overlapping its neighbor, they are made up with leather binding and small brass rivets, like the laths of a Venetian blind, into bands sufficiently long to encircle the wheel. The finished article yields in every direction, the action of the strips much resembling, on a very sharp bend, that of a lobster's tail. On pressure being removed, the strips fly back instantly to their normal position, with far greater promptitude and certainty than even rubber itself, so that it rather helps than retards the resiliency of the tire. In actual use, however, it is not called upon to undergo any such sharp bendings, for, as it is placed just inside the outer covering of the tire, it is only slightly arched, while, when it is at the bottom of the wheel, and the weight on it, it is practically not bent at all, for the tire is flattened out, and forms almost an arch over it. The sides of the tire are perfectly free and unconfined, the width of the protectors being just sufficient to cover the 'tread' of the tire, *i. e.*, that portion of it which, when flattened out, will be in contact with the ground, and through which any punctures would have to be made. So far as we can see, it provides *absolute* protection from punctures from outside causes, and bits of glass, thorns, pins, nails, and such-like 'items' are powerless for harm to a machine so fitted; here we may note that on one occasion Mr. Wright had his attention called to a nail in his tire, and found that a long nail had entered it, turned on the protector, and come out at another place without harming the inner tube. Of course, when metal is spoken of in connection with a tire, the thought at once occurs as to its effect on resiliency. Our experience, however, leads us to conclude that resiliency is not affected in any way, while that of the inventor is even more conclusive. The only objection which a theoretical reasoning can urge against the use of the protectors is the possibility of damage to the tire by internal friction, but when the thing is looked at fairly and squarely, it will be seen that the movement is exceedingly slight."

OUR ADVERTISERS.

AVERY & JENNESS.

The firm of Avery & Jenness, of Chicago, are well known to the trade, and to wheelmen generally, as having put in the market that most excellent little article called the Chicago spoke grip. It has found a ready sale, owing to its good qualities, and is handled throughout the country by dealers and agents generally. There is hardly a more essential tool belonging to every cyclist's outfit than a spoke grip, and a good one is very necessary. The Chicago effectually grips all direct spokes, and the ordinary sizes of square, round, and hexagon nipples; it is made with a differential screw giving far greater power than the common grips; it is also made of hardened steel, polished and nickeled; it has round corners for convenience in carrying in the pocket; it will hold a spoke firmly without a monkey wrench to tighten it; and it is warranted to stand any legitimate use.

THE BICYCLING WORLD.

The Bicycling World is the oldest cycling paper in America, having been founded December 22, 1877, under the name of *The American Bicycling Journal*, with F. W. Weston ("Papa") as the sole editor and proprietor, and with Cunningham Heath & Co. as the first and only advertisers of cycles. Under the title *American Bicycling Journal* eighteen numbers were issued from December, 1877, to November, 1879, and shortly after this the paper was changed to the *Bicycling World*, edited and managed by Charles E. Pratt, and from being issued as the spirit moved it became a regular semi-monthly, and for a time took up archery. During 1880 Mr. E. C. Hodges became interested in the paper, and in November, 1880, the paper was changed to a weekly. In the issue of August 21, 1880, the *World* for the first time made its announcement that it was the official organ of the League of American Wheelmen—a position it held until May, 1883. In January, 1881, Louis Harrison's name appeared as co-editor with Mr. Pratt, and in February of the same year Mr. Pratt retired from the editorship, leaving Mr. Harrison as sole editor. Mr. Harrison only retained the editorship for a few months, retiring July, 1881, in favor of Mr. W. E. Gilman. On January 29, 1882, Mr. J. S. Dean's name appears for the first time as one of the editorial staff.

Mr. Gilman retired in February, 1883, and Mr. Dean took the chief editorial chair, and at the same time the name of Mr. C. W. Fourdrinier appeared on the *World's* staff. In the number of February 15, 1884, Mr. Abbot Bassett's name appeared as managing editor, with Mr. Dean as chief, and Mr. Fourdrinier as contributing editor. The latter's name was dropped from the editorial staff in January, 1885, and Mr. Dean's name was also dropped in May, 1885, thus leaving Mr. Bassett in sole control. On April 20, 1886, Mr.

Bassett retired from the editorship of the *World*, and Mr. C. W. Fourdrinier took the editorship and management, and associated with him J. S. Dean and F. W. Weston. The latter gentleman retired after a few months' valuable service. From that time until the present Mr. Fourdrinier has had charge, ably assisted by Mr. Dean and later by F. A. Egan and J. W. Cartwright, Jr.

On March 2, 1888, the *World* had appeared again as the official organ of the League, which position it has held ever since. This, briefly, is the history of the "Nestor" of cycling journalism in America.

GEO. R. BIDWELL CYCLE CO.

THE Geo. R. Bidwell Cycle Co. is one of the oldest houses in the trade. Mr. Bidwell began business at No. 4 East 60th Street, New York, in 1884, at which time there was only one other exclusive bicycle dealer in the city. The business grew rapidly and "Bidwell's" soon became the recognized depot, to which everyone in New York and vicinity resorted when in need of a bicycle or an accessory.

When the Citizens' Bicycle Club vacated its clubhouse at 313 West 58th Street, Mr. Bidwell took possession of it, and transferred his business to the west side of town, a location more convenient to the best drives and roads. Here the business again rapidly outgrew its accommodations, and in the spring of 1890 the present commodious structure on 59th Street was erected, the old building being retained as a shipping room and repair shop.

The new building, with its seventy-five feet of frontage and hundred of depth, affords fine warerooms for the display of bicycles, and the most complete renting, storage, and locker departments possessed by any dealer in the country, while the variety of wheels always in stock enables any taste or pocket to be readily supplied. By the end of 1890 the business had increased so greatly that Mr. Bidwell was unable to longer look after its details, and the Geo. R. Bidwell Cycle Co. was accordingly incorporated in January, 1891, with a capital stock of one hundred thousand dollars, A. C. D. Loucks, an old-time cycler, becoming secretary, and Geo. S. Adams, treasurer, with Mr. Bidwell holding the office of president.

The new company's first important move was to put on the market a new wheel called the Tourist, the plans of which were prepared by the company, the wheel being manufactured for them by Wm. Bown, of Birmingham, England. Its merits made it a ready seller, and purchasers had only words of praise for it.

The delays and annoyances attending the importation of the Tourist persuaded the company to consider the possibility of manufacturing an equally high grade wheel in this country. The result of their investigation and experimentation led to the making of a contract with the Colt Fire Arms Co., of Hartford, Conn., for the construction of a bicycle that both companies believe will be without an equal on either side of the ocean. The unsurpassed facilities of the Colt Arms Co., and its great experience in producing the most highly finished products in metal, together with new methods used in the treatment of the material entering into the construction of the bicycle, insure for the new 1892 Tourist a perfection in every part that few other manufacturers can hope to attain.

The company also put on the market in 1892 a moderate-priced wheel of excellent quality, called the Student, for which but one hundred dollars are asked, fitted with cushion tires.

Early in 1891 the Bidwell Co. obtained the exclusive right to manufacture pneumatic tires under the Thomas patents, and immediately began a series of tests and experiments that enabled them in the fall to put on the market a tire guaranteed against bursting and leakage, and possessing great resiliency and endurance. It was brought to the attention of the manufacturers throughout the country by Mr. F. N. White of the Bidwell Co., and its evident high quality secured for it orders so large as to be eminently satisfactory to its introducers.

In addition to its wheel business, the Bidwell Co. also carry a large line of bicycle accessories, and manufacture the well known Perfection Alarm, Bidwell Cyclometer, Perfection Tire Heater, and other standard specialties.

COVENTRY MACHINISTS CO., LTD.

Back in the early sixties there was a time of great commercial depression in Coventry, England, owing to the decline and failure of the trades located there, and many people were leaving the town, while many of those who remained were suffering for common necessities. It was proposed to raise a subscription for the benefit of these people, but some objected to this, and determined instead, in order to provide occupation for some of the sufferers, to start a business for the manufacture of sewing machines. They began in a modest way with the capital of £5000, and premises were ready at hand in a disused ribbon factory. This was in 1863, and some five or six years later they commenced, at the instigation of their manager, Mr. Turner, to construct a few wooden-wheeled bicycles, or velocipedes, after the manner of a machine which had been brought over from France. In these machines they, for a time, did a considerable business, until the introduction of the "spider" wheel, with steel spokes and rims, opened up a new development. They began the manufacture of the new-fashioned wheel and at once gained a place in the front rank with the Gentleman's Bicycle. Since then the company has progressed steadily. While not rushing after new-fangled notions, it has never been behindhand in inventing and adopting improvements likely to be of either service or use. It was among the first to recognize the importance of the American trade and to open here a depot of its own. They opened a branch in Boston, locating on Columbus Avenue, and to this street the other Boston houses have since generally moved, so that now it is the Holborn Viaduct of Boston, just as it is predicted Eighth Avenue will soon be of New York. They were also about the first to make in entirety the whole of their wheels, including balls and other minor parts, which many were for years content to buy ready-made elsewhere.

The works at Cheylesmore, Coventry, are conveniently situated close to the center of the town, and quite near to the railway station, and yet surrounded by fresh air and light. A very handsome frontage of red brick and stucco is emblazoned with the name of the firm in large gold letters, together with the Prince of Wales' feathers—a sign that the company have supplied their wheels to His Royal Highness and his family.

The machines of the Coventry Machinists Co., known as the Swift and Club, are of the best class and have the highest reputation. The Company have never catered for trade other than the very best, and have never put out cheap cycles.

At the end of 1891, recognizing the increase of the cycle business, the Company decided to open a branch house in Chicago, with Mr. A. J. Marrett as its manager, to supply the Western part of the country. The two branch houses work in harmony, Mr. Hill, of Boston, appointing agents throughout the Eastern and Southern States, and Mr. Marrett, of Chicago, throughout the Central and Western States.

GORMULLY & JEFFERY MANUFACTURING COMPANY.

In the year 1879, bicycles were manufactured in Chicago by one of the members of the present Gormully & Jeffery Mfg. Co., personally, and with his own employees, and his business developed into the immense concern of the present day. The company can thus claim to have been personally engaged in the manufacture of bicycles, directly, through the person of one of their own members, longer than any other concern in the country, though another house had begun to have bicycles built for them in 1878 by a manufacturing concern in Connecticut.

These early bicycles of 1879 were of the high-wheel pattern, containing the improvements of hollow forks, rubber tires, and ball bearings to both wheels, all of which have since proved essential in high-grade wheel construction.

Smaller and cheaper bicycles were manufactured by the same manufacturer at the same place, and in the succeeding year improved machines were being made, and another of the company's principal stockholders united with the first, and erected suitable factory buildings, further improvements being made in the machines and larger quantities of bicycles sold.

This brings us to the year in which the machines called the Ideal and Youth's Ideal bicycles were made for the critical youths of that age, and later years saw them manufacturing the Ideal Tricycle and the American Safety bicycle, in addition to the Youth's Ideal and the Ideal. The American Safety bicycle of those days was very popular, for it was the first machine that placed the rider somewhat nearer the ground than the position he occupied on the ordinary. The machine was built in a firstclass manner, having ball bearings not only in its wheels, but to the foot levers. It was built without hollow forks in 1885, in which year was issued the seventh annual price list, directing attention to the American Challenge, a novelty for that year, in which was first introduced the long bearing distance features at the neck axle bearing, the aim being in all cases to produce the longest distance between the bearings possible to be made in the limits of space allowed. In their catalogue of 1885 are shown various groups of handle bars that are interchangeable on the wheels, which are the first specimens of detachable handle bars shown in any catalogue, which detachable features proved later to be indispensable in all makes of ordinaries.

The year 1886 produced the then very popular bicycle called the American Champion, made on lines like the Challenge, but lightened somewhat, having the front forks hollow and the backbone of lighter gauge tubing. In this year was added to their general line of sundries (which was established almost at the outset) the manufacture of bicycle lanterns and cyclists' leather goods—saddles, belts, etc., so that they were pioneers not only in the construction of bicycles, but also in the construction of bicycle lanterns and cyclists' sundries. The manufacture of lanterns has been constantly improved and enlarged until, at the present time, what was a side industry is in itself a large established manufacturing business.

The beginning of the ensuing year saw the founders, with all their stock, machinery, and appliances, merge into a corporate firm, known as the Gormully & Jeffery Mfg. Co., with no substantial change of management or methods of doing business. The production continued, as in previous years, to improve. Greater knowledge was gained, and as the wants of the increasing army of cyclists became known and an increased output was needed, new buildings were erected and a greater number of employees provided with room and machinery. This year saw for the first time the

Ram's-Horn handle bar, the ratchet adjustment to ball bearings and the polygonal pedals held on an angular bar, to prevent their turning. It also saw the Perfect Fit handle, the style so very popular with the high machines.

In 1888 was produced the Challenge Tandem, a two-track, front-steering vehicle for two riders, introducing the novel feature of one rider being not exactly in line with the other, so that the rear rider could see in front of him, without leaning much sideways. The driving wheels, which were geared differentially, so that both could drive, and were free to turn corners, were placed wide enough apart to track with ordinary wagons and buggies; hence could be used to run along in ruts formed by heavier wheels, and could be seen scattered over the United States on tours through roads impassable for any other kind of tricycle or bicycle, and being made strong enough for use on the rough Western roads were used largely for picnic parties, and have been known to carry, besides two adult riders, two children, on seats extemporized, together with a substantial package of viands for a day's outing for an entire family. The owner of one of these machines, at least, was known to have rigged thereon, by means of two upright posts at each side, an awning, designed to shelter both drivers from the sun's rays. This Challenge Tandem was the first illustration of the use of an extended wheel base, the forward steering wheel being twelve inches in advance of the usual position. A smaller tandem for children was made this year with the same general features, and also the first rear-driven Safety, named the

American Rambler. Its general construction and form differed only in minor details from the preceding Safety. It had spring rear fork, the reduced front wheel, the long steering and bearing distances and the overhung chain wheel. The then popular solid tire has been superseded by the various hollow tires; but this is the principal change that time has shown necessary, proving that the thought expended in the production of this machine was rightly directed, and it is probably an instance of the longest duration of any one type or pattern through the years of rapid changes which succeeded the year 1887.

The year 1889 saw the Ideal Rambler substantially as made at this day, except that the tires were of smaller dimensions, and the American Rambler, with a new pattern of backbone, dropped to accommodate ladies, as now made. It also saw for the first time the drop-forged chains as now made, with the studs on which the strain of the chain is exerted and on which the links pivot, made in one piece with the sides, thus removing the strain from its rivets.

The year 1890 saw the Rambler improved and lightened, the main form and dimensions being substantially continued. The simple adjusting features of the head bearing appliances, and the methods of lap brazing, being then fully tested and approved of, were used wherever possible, and led to the abandonment, in every instance, of drop forgings, where the lap-joining principle could be adopted.

The next year saw the continuance of the Rambler line of wheels, and the discarding of the ordinary wheels. It also saw the adoption of hollow tires in a large degree, the former year having been a testing year to discover the merits and defects of this pattern. In the year 1891 the majority of tires sold were of the cushion pattern, whose merit over the solid tire consisted mainly in the greater dimensions they afforded with the same weight of material. The air that was contained in such tire, being uncompressed and free to move under the weight of the rider, added nothing to the tire's elasticity, and nothing to the ease of running on a road that was good for a solid tire. On dusty or sandy roads the cushion tire did not sink as deeply, and in such places showed an advantage over the solid rival.

Between the beginning of 1891 and 1892 vast strides were made in improving the construction of tires, the makers taking advantage of the well-known elasticity of air under pressure, and adapting the tires to stand considerable strain of air pressure, with a very light wall of rubber, practically discarding the rubber's elasticity, and making use of rubber only as a medium for retaining the compressed air, and it seems that the year 1892, just commenced, will be known as the first year in which air tires will be considered popular in the United States. The attempts in previous seasons have been somewhat misdirected, through a misunderstanding of the qualifications necessary for a pneumatic tire; as, for instance, no rapid repair for punctures had been considered, or self-healing of punctures thought of, and these the inventors of this year will produce.

Up to the present the introduction of aluminium in the parts of bicycles has not been commercially successful. Some attempts have been made and a degree of success attained on mud guards, but the want of a reliable solder and a misconception of the qualities of this material (which will, without doubt, in time be largely used) have operated to prevent the manufacturer from using the valuable element. Doubtless within a few years air and aluminium will be very largely employed in bicycles. Electricity has not been satisfactorily used as a bicycle motor, but the storage battery gives an indication of what is possible, and when its weight can be materially reduced electrically propelled bicycles will be the popular steeds of the day.

HULBERT BROS. & CO.

The firm of Merwin, Hulbert & Co. was changed on January 1, 1892, to Hulbert Bros. & Co., Mr. Merwin having died in 1879. The *personnel* of the new firm remains the same, with the exception of the admittance of Mr. Milon H. Hulbert, the firm heing composed of Milon Hulbert, W. A. Hulbert and Milon H. Hulbert. The firm for twenty years was located on Chambers Street, where they carried on their extensive business in firearms and ammunition. They have now been located at their present address, 26 West 23d St., for the past five years, having branched out into a general sporting goods house, and continuing their original business in connection with it. They carry the most complete line of bicycles and accessories in the city of New York, both in cheap and high grade. This branch of the business is not only a retail one, but they also do a very large wholesale business, they having exclusive agencies for New York State and New Jersey on the King of Scorchers, Swift, and Eagle; and also control the wheels manufactured by the Indiana Bicycle Mfg. Co., of Indianapolis, in Eastern New York State, Northern New Jersey, and New England. They also manufacture the Majestic Safety, which is a strictly high grade wheel, listing at ninety dollars with cushion, and one hundred and fifteen with pneumatics. They originally entered the bicycle business in a very small way, but it gradually increased until it now forms one of the leading departments in their establishment. The rapid growth and success of this department have been due to the fact of having such wheels and accessories as the public demanded, and catering to their wishes in every possible way. This department is in charge of George M. Hendee, who held the one mile championship of the United States five years in succession.

OVERMAN WHEEL COMPANY.

For the past ten years there has been no name better known to American wheelmen than that applied by the Overman Wheel Company to all the product of their works, and from the outset the designation of "Victor" has been synonymous with the best that could be procured in material, construction, finish, and design. This has become so generally known that the utmost confidence has long been felt in the entire output of the great works at Chicopee Falls.

The Overman Wheel Company began the manufacture of tricycles about 1883, and put on the market in that year a machine of excellent quality, and equal in all respects to anything that had then been produced. In 1884 the tricycle was improved in several respects, the frame being of better shape and the common rack and pinion replaced by their ribbon steering, which proved to be most delightful in action. In their catalogue for 1885 they said regarding this machine that "the experience of the past year has resulted in some improvements in the manner of making certain parts of the machine; notably the ribbon steering has been very much improved, and is now so made that it is impossible for it to break, the strain coming on the frame instead of the ribbon as heretofore. The tension of the steering handle may be regulated to anything required. The ribbons used are interchangeable so that there can be no mistake in putting them on. Every part of this device is adjustable for wear. The shake and rattle in the steering apparatus of a tricycle has been a source of endless annoyance and is caused by the rack and pinion construction. When rack and pinion steering is used there is necessarily lost motion, and as lost motion in the steering allows the little wheel to 'wobble' it is evident that the best results in speed cannot be attained under such conditions. The ribbon steering makes the steering of the Victor tricycle as rigid as bicycle steering."

The Victor tricycle thoroughly established the reputation of the company, so that when they came into the market in 1885 with a bicycle they were assured of a hearty reception, and their new machine met with an instantaneous and almost phenomenal success. Their catalogue first describing it announced that "the Victor bicycle is interchangeable throughout. The value of this feature cannot be overestimated when considering the economy of keeping the machine in repair, as it enables the rider to replace any part with absolutely no fitting, thus avoiding expensive repairs and unsatisfactory results. Hand work cannot compare with machine work for accuracy. Thumb measure guesses, while steel measure determines. In the manufacture of a machine of which so much is required, absolute precision of construction is indispensable. Recognizing these facts, we have during the past four years made extensive and elaborate preparation for the manufacture of the Victor bicycle.

"In order to avail ourselves of the experience of English riders, and to combine in our machine the latest and most improved devices of English manufacture, we have five times visited Europe. In making the Victor bicycle we have tried to include all features of known value to riders. The machine is made lighter than the usual roadster, but with no sacrifice of strength. It is of steel throughout, and is the first bicycle made in America (or abroad so far as we know) in which absolutely no cast metal is used. It is the first American bicycle made with hollow rims, hollow detachable handle bars and tangent spokes. We therefore believe that we are entitled to rank as first American makers of highest grade bicycles.

"The tires are *compressed*, of finest Para molded rubber, attached without cement, and cannot come loose; they are so firmly attached that it is impossible to *pull* them out, the rubber tearing before it will part with the steel. Many of the accidents which constantly happen on account of cemented tires coming loose are entirely prevented by our method. Our tires are made longer than the rim and compressed into it—not contractile, to tear open at every cut—and for this reason will wear twice as long as any other tire.

"The comfort of the rider is much increased by the greater elasticity of our tire, a seven-eighths being equal to a one-inch tire fastened with cement, more of the rubber being exposed by our method. Compressed tires possess the still further advantage of being quickly and surely removed and replaced for the purpose of renewing spokes. With no cement it is possible to make a wheel entirely true. If the rim is true and the rubber true, the wheel when made will be true. This is practically impossible with cemented tires, as the distribution of cement cannot be entirely equal throughout the rim nor the distribution of the stretch of the rubber ; therefore, when the cement is heated, the rubber will crawl about and, by forcing the cement out, will leave flat places in the wheel too small for the eye to detect, but readily found by placing the wheel upon centers. True wheels are better than untrue, be the variation ever so slight. The Victor is the only bicycle using this feature, as it is owned and controlled by us. After testing it for two years we pronounce it *absolutely perfect* and without any objection whatever.

"While the bearings of a machine are of vital importance, the world-wide reputation of Bown's Æolus ball bearings makes it unnecessary for us to call the attention of wheelmen to the fact that for perfect adjustment, simplicity of construction, and easy running, they take precedence over all others that have ever been used. This was the first adjustable ball bearing ever constructed, and more races have been won on machines having these bearings than on all other machines combined. They have been used for six years with unparalleled success, and, though imitated by makers in this country and England, have never been equaled. These bearings possess the following advantages: First, minimum friction; second, means of perfect adjustment; third, little attention; fourth, durability under use and abuse. The Victor Bicycle has Bown's Æolus ball bearing all around, including pedals."

In addition to these important features they used Warwick's hollow rims, tangent spokes, crossed and soldered, and square rubber pedals. In 1886 and 1887 the machine was lightened a little and improved in some matters of detail, such as substituting single tangent spokes for the double, the adoption of spade handles, and a tire with a hollow core was used. In this shape it came as near perfection as the ordinary ever could.

The popular favor with which the Rover pattern Safety was received abroad in 1886 presented an opportunity for the introduction of a similar machine in this country, and in 1887 the Overman Company brought out the Victor Safety. But this machine was by no means a mere copy of the foreign type, for it contained characteristic and important features of its own. In 1887 it had the usual cross frame of the time, but in 1888 there was adopted a sort of diamond frame, which proved so successful as to be retained as one of their principal types.

In the Safety the company embodied all the high-grade features of the ordinary bicycle. They also made the valuable improvement in Safeties of using their regular bicycle bearings at the ends of the driving wheel axle, and applied the power between the bearings. But probably the best known feature of the Victor Safety is its remarkable spring fork. The vibration on a Safety is very great, and the hands and arms especially suffer from it. To overcome this, the Overman Company introduced a spring fork of unique design and splendid construction, which absolutely destroys all vibration, and relieves the rider from the constantly recurring shocks, which are far more wearing than the physical exertion required to propel a machine.

A new tricycle of improved type, on something of Cripper lines, was brought out in 1887, and to its front wheel the new spring fork was also applied, thus greatly enhancing its value and the comfort of its rider. They also brought out, in 1888, the Victor Junior, a high grade ordinary bicycle for boys—a machine similar in character and design to their regular Victor, which fact constitutes an ample description of it. In 1890 their list was further increased by the production of the Victoria Safety—a drop frame machine designed especially for feminine use.

The absorbing topic in 1891 was the tire question, cushions of various sorts being generally used in preference to the earlier small solids, while here and there a pneumatic appeared. In tires, the hit of the year was the Victor cushion, which was composed of a simple arch of rubber extending from edge to edge of the rim, in contradistinction to the usual round tire with a hollow central core, commonly used.

The patterns of the Victor Safety were increased to six in 1891, two of them being furnished with rigid forks, and the other four with spring forks. The Victor ordinary was fitted with cushion tires and a twenty-two or twenty-four inch trailing wheel, and brought into line with "rational" ordinaries. For 1892 their list is further augmented, a novelty being the introduction of an egg-shape frame, something like that of the Euclidia shown elsewhere. In tires, they are bringing out a pneumatic which has the unusual feature of being provided with an opening in the rim through which the inner tube can be readily removed, and which promises to prove as successful as their cushion.

The Overman Company is distinguished as the only company in the world to make in their own plant everything which enters into the construction of a bicycle. They make their own tires, saddles, tool bags, balls, etc., in their factory, which is thoroughly adapted for the work. This is worthy of note, showing that in this age of progressiveness our manufacturers of high grade machines lead the world in the energy displayed.

POPE MANUFACTURING COMPANY.

The Pope Manufacturing Co. was organized in 1877, Colonel Albert A. Pope, its founder and the bicycle pioneer of America, about this time having learned to ride a wheel, which was made for him at a cost of over three hundred dollars. After examining the subject in all its bearings, both as a business and as a diversion, he was convinced that he could make a permanent industry of its manufacture. So strongly did the future of the wheel impress him that he took a trip abroad in order that he might study the methods of its construction and see in person just what hold it had taken on the English people. The company began the business of importing in 1877, and the very next season proceeded to manufacture on a large scale, and according to the best methods, on the interchangeable plan. The bicycles were made for them by the Weed Sewing Machine Co. of Hartford, Conn., a corporation in which the Pope Manufacturing Co. soon became largely interested, and which it finally absorbed in 1890, paying the former stockholders fifty per cent. premium for their holdings, a movement which was commended both for its shrewdness and liberality.

In 1878 this company produced and put on the market a wheel known as the Columbia, a larger office was opened at 87 Summer Street, Boston, and the first regular trade catalogue, of twenty pages, was issued. In starting out, the company adopted the principle of making always the best thing practicable with the available material and skill, and it therefore took, and has always kept a leading place in the manufacture of high grade bicycles. It is the only survivor of the first dozen concerns in the business ; it is the sole survivor of the first four or five years of the business. These are facts which show the elements of strength in the very beginning and, in a measure, account for its solid after-growth.

As this company was first to manufacture wheels in the United States, so also it was most influential and energetic in aiding in opening the highways and parks for the use of wheelmen. It aided in removing an almost prohibitory ordinance from the municipal laws of Boston. It expended many thousands of dollars in what was known as the Central Park case in New York, the South Park matter in Chicago, and the Fairmount Park contest in Philadelphia, and it spent over sixty thousand dollars in founding the magazine *Outing*, which became the finest existing exponent both of bicycling and general recreation. In point of fact, the Pope Manufacturing Co. assisted to educate the public first to the tolerance of the wheel, and then to its approval and general adoption—a result which was aided in no small degree by the free distribution of bicycle literature.

In 1879 the agency system, and the system of uniform prices, were established, the company buying up patents as fast as they were pressed upon them, thus obviating the difficulty which had already embarrassed them and the other importers, and threatened to wipe out this infant industry.

The wheel for the year 1879 is known as the Standard Columbia, and is deserving of particular mention. It is interesting to note just here that the first idea in constructing bicycles was to give a maximum amount of strength and durability. The trade naturally demanded a wheel suitable for beginners, something that would stand the strains and bruises of the riding school, be seldom broken and easily repaired. The Standard Columbia, for the functions demanded, was one of the most satisfactory wheels ever put on the market. It gave little or no trouble either to makers or wheelmen.

The output for the year 1880 included such machines as the Special Columbia, Youth's Columbia, Mustang and Youth's Mustang, but the great event of this year was the perfecting and production of the Columbia ball bearings, the first successful adjustable ball bearings made. Formerly, and for some little time after this, both in England and the United States, there were ball bearings made with two or more rows of balls in each bearing, but the only single row ball bearing was that known as the Bown, in which the box was made in four pieces, partly of gun metal and partly of steel.

In 1881 new and larger quarters were opened at 597 Washington Street, Boston, and the Columbia warrant or guarantee was instituted. In the next year, 1882, a branch house was opened in New York, and the Columbia Expert was launched on its successful career. This wheel was a marked improvement over the Standard Columbia, and soon became the favorite bicycle for long runs and cross-country riding, and was the first and only machine ridden around the world.

In 1883 appeared the Columbia Racer and the Columbia Three-Track tricycle. In 1884 the business had grown to such proportions that it became necessary to open a branch house in Chicago. The productions for 1885 were the Columbia Light Roadster bicycle, the Two-Track tricycle, and the notable Columbia double-grip pedals.

The Columbia Safety bicycle appeared in 1886.

It was a front driver, and, in its day and generation, was the best Safety in the market. There also appeared the Semi-Roadster and the Ladies' Columbia Two-Track tricycle. In that year also the company placed on the market the Columbia Kirkpatrick saddle, which became another favorite in bicycle construction, and on which most of the saddles of recent years have been modeled. During that season the Columbia cycles gained a good deal of notice by the records made upon them, two of which were the mile in 2.29$\frac{4}{5}$ and twenty-two miles within the hour. These and several others stood for a number of years as world's records.

In 1887 the company moved into the building at the corner of Franklin and Arch streets, Boston, and began the manufacture of Columbia Tandem bicycles and racing and light roadster tricycles. In 1888 the company put out its first rear-driving Safety under the name of the Veloce Columbia, and also the Volunteer Columbia and Surprise Columbia tricycle. The machines for 1889 were the Columbia Light Roadster Safety and Tandem Safety and the Rational Expert Columbia.

The Ladies' Safety and Racing Safety were introduced in 1890, while in 1891 the company put out a much improved machine, the double diamond Light Roadster Safety and pneumatic Racing Safety, on the latter of which the world's record of a mile in 2.15 was made. Although the company had from time to time remodeled and added to its factory, it was now found necessary to make a great enlargement of their plant, so that at present they have over five acres of flooring and employ about one thousand people, most of them being skilled laborers.

The experience of fourteen years in the manufacturing business and the knowledge gained by constant contact with the trade has resulted in the production of the finest bicycle ever made, and which the company put out this year (1892) under the name of the Century Columbia. It is a model of comfort and elegance, and it is as light as could be reasonably expected without sacrificing strength and durability. A valuable and distinctive feature of the Light Roadster Safety is retained in the double diamond frame, only the tubular guard being sacrificed for weight. For the same reason the wheels are reduced to twenty-eight and thirty inches, but an equally good proportion is preserved throughout.

The driving-gear has been improved, so far as the new methods of making the Elliott self-oiling chain can contribute to its perfection, and by the use of new and very graceful round cranks. The wheels are perhaps of greater interest than any other part of the machine, and to their production has been devoted the most careful study and attention. Columbia hubs, well tested double-butted spokes with adjustable nipples, sheet steel felloes of the utmost lightness, rolled to a form giving great rigidity and deep enough to hold the tire securely ; these are the features of the most perfect wheel that has ever been offered to the public.

Columbia pneumatic tires add materially to the comfort of the rider, and the company has succeeded in making a tire which will give most excellent service, resisting puncture and tested to a pressure of two-hundred and thirty-five pounds to the inch, while the usual riding pressure is not over fifty to sixty pounds to the inch. The Century Columbia with its modified form, the Century Road Racer, and the Ladies' Safety with pneumatic tires are the features for 1892.

Taking then a cursory review, the Pope Manufacturing Co.'s productions have always been marked by the highest excellence in quality, and have always kept pace with, or been in advance of, the times. Of the many machines produced and noticed above, the Standard Columbia, of 1879, was a wheel strong in construction, and satisfactory to the trade, the makers, and the actual users. The Expert Columbia, 1882, was received with great delight, because wheelmen at that time were thoroughly aroused to the pleasures of long runs and outings on the wheel, and this machine was particularly adapted to this purpose. In 1885 the Columbia Light Roadster's appearance marked a third step in the perfection of high wheels. It was lighter than the Expert, to which it held about the same relation that the Century Columbia does to the Columbia Light Roadster Safety of 1891. The Columbia Safety of 1886 was a front driver, and, though short-lived, was the best thing of its kind. It was the means to an end, which end was approximated in the Columbia Light Roadster Safety of 1889, and the double diamond Light Roadster Safety of 1891, but not thoroughly reached till the company put out the Century Columbia in 1892.

On January 1, 1892, the Pope Manufacturing Co. took possession of its fine new office building at 221

Columbus Avenue, Boston. The company owns the enormous plant in Hartford and this fine building in Boston. It has a paid in capital of $1,000,000 and a very large surplus.

PREMIER CYCLE COMPANY.

Away back in the spring of 1880, the head of this well-known house imported the first Humber bicycle brought into America. From this small beginning has grown a corporation with main office in New York, branch houses in Chicago, and Orange, N. J., and four hundred and fifty active representatives throughout the United States. This remarkable development is largely due to the reputation, interest, and energy shown by Mr. L. H. Johnson, to whose business the company succeeded in February, 1891. Mr. Johnson was amateur champion of America in 1879; again champion at both long and short distances, and of Canada, in 1880; and his practical experience on both road and path early convinced him of the great value of lightness and simplicity of construction in wheels. These qualities he advocated in the face of the popular craze for spring frames, and a persistent endeavor on the part of many Americans to decry light machines. Constantly on the lookout for novelties, Mr. Johnson imported into America the first double-driving tricycle, the first tandem tricycle, the first tandem (high) bicycle and, contemporaneously with a Philadelphia dealer, the original rear-driving Safety.

When the Premier Tandem Safety was brought out in the spring of 1888, and English riders were view-ing it askance, Mr. Johnson instantly realized its capabilities for American use and imported a number, which found ready sale, and paved the way to the great business in Premier Safeties that the company now handles.

Every fall Mr. Johnson makes a trip abroad, and spends from four to six weeks in the factories, designing and planning new and improved patterns for the coming season. Every Premier sent to America is specially and exclusively built for American roads and riders. Realizing that the former are a severer tax on strength and durability than European thoroughfares, mechanical perfection stands before cost in the construction of Premiers, and American riders have been quick to show their appreciation of this fact.

In November, 1890, Mr. Johnson obtained control of the famous King of the Road lamps and other Cyclealities manufactured by Jos. Lucas & Son; and, as his business had already outgrown the management of one man, formed on his return to America a corporation known as the Premier Cycle Company, to take over the business, agencies, and contracts owned by him. The wisdom of this step has been amply demonstrated during the eighteen months' existence of the company. With main office and warerooms in New York City, a Western branch in Chicago, and a retail store in the heart of the celebrated Orange riding district, the business of the company is doubling annually. With five hundred Premier agents, and over one thousand trade customers for Cyclealities, the Premier Cycle Company is assured of a Premier rank in the cycle trade.

THE REFEREE.

One of the most interesting and reliable trade journals in the country is the *Referee*, published in Chicago. The paper was originally devoted to various sports, but a little over two years ago it devoted all its space to cycling. Then it ran eight pages in all, while now it has never less than from fifty-six to sixty-four, cover included. This is certainly a remarkable growth for a weekly journal. Its Christmas, 1891, number contained ninety-two pages, and the Philadelphia cycle show number ninety-six pages. It is generous with its illustrations, which are of the finest half-tones possible to procure. The *Referee* is among the most entertaining of the journals devoted to the cycle trade.

A. G. SPALDING & BROS.

The house of A. G. Spalding & Bros., now one of the largest in existence in both its cycling and sporting goods departments, was founded at Chicago, in 1876, to deal in general sporting goods. Soon after it established a house in New York, and at a little later date one in Philadelphia, while in addition they have depots in the principal cities of the United States, England, and Australia.

In 1880 they included wheels in their business, first handling the Harvard and Yale, imported by Cunningham & Co., of Boston, and later importing themselves the Premier, Kangaroo, and Humber machines, and also having built for themselves an excellent ordinary called the Spalding.

In 1886 they formed a connection with the Overman Wheel Company, and became special agents for the Victor wheels, thus securing one of the finest makes to handle, and affording its makers splendid means of distribution. In 1890 they manufactured the Nonpareil—a very excellent Safety for boys, and sold at a moderate price. The next year, in connection with the Overman Wheel Co., they brought out the Credenda safety, made in patterns for both gentlemen and ladies, and being a very good wheel sold at a moderate price. In 1892 they brought out both the Nonpareil and Credenda on their own account, and these wheels, together with the large line of Victors now being brought out by the Overman Wheel Co., gives them one of the most complete and satisfactory lines to handle that can anywhere be found.

The growth of their business has recently made it necessary for them to take in New York a separate building for their offices and their wholesale and manufacturing departments, leaving the retail business in the old store.

STOVER BICYCLE MFG. CO.

In July, 1890, as the Safety bicycle was beginning to drive the ordinary from the field in this country, the Stover Bicycle Mfg. Co., of Freeport, Ill., was incorporated, with a capital of one hundred thousand dollars. The president of the company is D. C. Stover; the vice president, Fred Bartlett; the secretary, E. H. Wilcox; the treasurer, Chas. Neimann, and the superintendent, W. A. Hance.

The company undertook at the outset to build bicycles of the very highest possible grade only, and, as a result, soon acquired a reputation for turning out reliable and high-class work. The secretary and superintendent, especially, are practical men who understand the needs of wheelmen, as well as what constitutes a good wheel and how to make it; consequently, success has followed their efforts. Some three hundred machines were turned out during the first season; this was increased to twenty-two hundred the second season, and to twenty-seven hundred the third.

The machines produced are called the Iroquois, Paragon, and Phœnix, the two latter being made in patterns for both gentlemen and ladies. All are built on the most approved lines, of graceful design, and moderate weight, and in one case a practical spring frame is fitted. For 1892 they have also a specially light roadster finely adapted for fast work. This machine is one of the handsomest and most attractive in the market.

WARWICK CYCLE MANUFACTURING CO.

In the manufacturing of cycles, as in nearly all communities, there are two or more schools of thought. Whatever term may be applied to the others, that of "new" is distinctively applicable to the subject matter of this sketch.

The Warwick Cycle Manufacturing Co., of Springfield, Mass., was originally called into being with a limited capital, to apply certain patents in cycle construction, many of which were marked by great originality. The company determined to place upon the market, in 1888, an ordinary bicycle, the design, construction, and workmanship of which has rarely been equaled by any manufacturers in this country or England. The special features (aside from those usually possessed by high grade cycles) were a direct plunger brake ; a saddle of unique design, rendered unstretchable by the insertion of strips of sheet steel from peak to cantle; a spring attachment to front forks ; and, what perhaps attracted more attention from the critics than the rest of the machine, ball bearings with a vertical adjustment ; this latter was a decided departure from the general idea of a ball bearing. Their catalogue said that :

"In making our initial bow to the wheeling public as manufacturers of high-class cycles, solicitous of obtaining a fair proportion of its patronage, we are conscious that the standard demanded by the riding patrons of the wheel requires from a successful competitor workmanship, stock, design, and finish of the highest excellence.

"While fully aware that this desideratum is not easily reached, we are satisfied that in the Warwick Perfection we are presenting a perfectly made wheel which, embracing many valuable improvements over any other existing type of cycle, is confidently presented to the critical eye of the purchaser. No result that experience suggests, or capital can purchase, is wanting in the Warwick Perfection Cycles.

"We enter the market with no friends to regard, no enemies to punish, no old prejudices to sustain, and no improvements to decry. Safe in the knowledge that the product of our factory is of the highest order of cycle mechanism, we present on the following pages specifications and a comprehensive description of the Warwick Perfection Cycles."

The sudden change of the market about this time from the high ordinary wheel to the Safety type, determined the corporation to at once commence the manufacture of a rear driver. The first machine made its appearance at the Chicago show of 1889, when its unique design attracted much attention.

The fine mechanical workmanship of this wheel, like its fellow the ordinary, was specially noticed by the trade, and during the season of 1889, it was manufactured as rapidly as the limited plant of the corporation would permit. The special features of this machine were the duplex steering, the double frame, and the spring fork attachment; it was also the pioneer of convertible Safeties. The unmerciful test of practical use proved, by the expiration of the year, that the special features had very little to recommend them in preference to the simpler methods of others, and in the winter of 1889 the Perfection was designed in the shape it reached the market of 1890. Few machines have met with the satisfactory verdict that this wheel secured, and a large product was quickly taken up by purchasers.

About this period (1889-90) the ownership of the corporation changed hands, Messrs. Chamberlain, Brewer, Russell, Bill, Wallace, and Myrick, representative business men and large capitalists, taking the concern. They immediately took steps to extend its scope by adding to its capital, increasing its plant, and giving it efficient and capable management.

From this time on the growth of the company has approached the phenomenal. The product of 1891 was of the very highest grade, embracing every point of acknowledged excellence, and at once marked the concern as a leading and prominent factor in all future trade.

In summing up the mechanical side of the Warwick Cycle Mfg. Co's. productions, one is impressed by the fact that every detail, the workmanship, stock, design, and finish, is of the highest order. Everything is of the best, and the name of the company synonymous with reliable work and desirable design and finish.

Early in June of 1891 the company, having previously twice doubled their capacity, determined to build a factory capable of producing a high grade wheel in as large quantities as any shop in America. With this end in view, they purchased the site of their present factory, and commenced its erection. Very recently they took possession, and find that their expectations have been realized. The shop is fitted up throughout with machinery of highest excellence, much of it being specially designed for cycle work, and erected under the personal direction of Mr. Joel H. Hendrick, a mechanic of ripe experience, now vice president of the company.

Warwick Cycles go to every part of the country. The demand for their cycles forced them to decline a very large and lucrative export trade in 1891, though they managed to ship some few machines to Japan, Russia, and Australia.

WHEELMEN'S GAZETTE.

THE Wheelmen's Gazette was founded in 1883 at Springfield, Mass., and in 1887 moved to Indianapolis, Ind., where it still continues to flourish. Its present editor and publisher, Ben L. Darrow, is making a distinctive and very attractive paper of it, and that his efforts are appreciated is shown by the fact that the *Gazette* has a circulation of ten thousand copies a month.

The *Gazette* abounds in beautiful illustrations, readable stories, and poems of the wheel, and is a most readable and entertaining cycling publication.

CYCLE DIRECTORY.

An alphabetical list of the wheels which have been sold at any time in this country, including those of both domestic and foreign manufacture. Very many of the wheels named are not now manufactured or imported, and quite a number of the firms are no longer in the business, but both are included for the sake of making the list as complete as possible. It is not supposed that it is absolutely complete, for in the present growing state of the trade omissions could not be avoided; but it certainly includes a surprising number of names. In some few cases wheel names and firms have been announced, and have not yet materialized, but are included. In other cases wheels have been brought to this country from abroad by individual purchasers, but have never been imported regularly here, hence no firm name is given. In a few other cases names of wheels which have been announced are given, although it has not been possible to learn who was to make or import them. There are also instances in which one make of machine has been imported at different times by different firms; in such cases the house most recently engaged in handling it is given. Heretofore, also, one concern has usually controlled a sole American agency for the make it handled; but now the practice often is to divide the country among two, three, or even more, general agents, each of whom controls certain territory and deals directly with the foreign house. At the present writing it has not been possible to learn where all such arrangements exist, and consequently the name of but one house is usually given. During the past year there have appeared announcements of more new bicycle manufacturers and more new wheels than in the whole previous history of the trade in America. Some of the concerns, doubtless, will never be formed, and some of the machines will never be made, but they nevertheless form a portion of a Cycle Directory.

A

Acme.
Advance.
Advance Traveller, Luburg Mfg. Co., Philadelphia.
Æolus, Spooner-Peterson Co., Chicago.
Aerolite, John Thornton, Jr., New York.
Ajax, U. S. Cycle Mfg. Co., Philadelphia.
America, Peerless Mfg. Co., Cleveland, O.
American, Clark Cycle Co., Baltimore.
American Challenge, Gormully & Jeffery Mfg. Co., Chicago.
" Champion " " " " "
" Club, Coventry Machinists' Co., Boston.
" Dual, Cunningham & Co., Boston.
" Express, Latta Bros., Friendship, N.Y.
" Ideal, Gormully & Jeffery Mfg. Co., Chicago.
" Meteor, Cunningham & Co., Boston.
" Ormonde, Am. Ormonde Cycle Co., New York.
" Pilot, Latta Bros., Friendship, N. Y.
" Premier, A. G. Spalding & Bros., New York.
" Rambler, Gormully & Jeffery Mfg. Co., Chicago.
" Rudge, Stoddard, Lovering & Co., Boston.
" Safety, Gormully & Jeffery Mfg. Co., Chicago.
" Salvo, Cunningham & Co., Boston.
" Sanspareil, Clark Cycle Co., Baltimore.
" Star, H. B. Smith Machine Co., Smithville, N. J.
" Traveller, Luburg Mfg. Co., Philadelphia.
Apollo, Singer & Co., Boston.
Arab.
Ariel, Ariel Cycle Mfg. Co., Goshen, Ind.
Ariel, Standard Cycle Co., Buffalo, N. Y.
Arrow.
Auxiliary.
Avalanche, W. H. Jackson, Philadelphia.

B

Beacon, Beacon Cycle Co., Westboro, Mass.
Beacon, Standard Cycle Co., Buffalo, N. Y.
Beat All.
Belmont, Sweeting Cycle Co., Philadelphia.
Belsize, Hibbard, Spencer, Bartlett & Co., Chicago.
Bendigo.
Ben-Hur, Central Cycle Mfg. Co., Indianapolis.
Bicyclette, Stoddard, Lovering & Co., Boston.

Black Diamond, Capitol Cycle Co., Washington.
Black Hawk, Western Wheel Works, Chicago.
Bloomington, Harber Bros. Co., Bloomington, Ill.
Bodine.
Boston, W. W. Stall, Boston.
British Challenge, Singer & Co., Boston.
" Champion.
" Mail, Wm. Read & Sons, Boston.
Broncho, Livingston Cycle Co., Westboro, Mass.
Brookes, Wm. Trafford, Philadelphia.
Buckeye, Peerless Mfg. Co., Cleveland.
Buckingham & Adams, H. A. Smith & Co., Newark, N. J.
Buffalo, Buffalo Cycle Works, Buffalo, N. Y.

C

Capitol, Washington Cycle Co., Washington.
Captain, Wall & Boyer, Philadelphia.
Catford, Premier Cycle Co., New York.
Centaur, St. Nicholas Mfg. Co., Chicago.
Centaur, G. E. Lloyd & Co., Chicago.
Century, Pope Mfg. Co., Boston,
Chainless Telegram, Sercombe & Bolte Mfg. Co., Milwaukee.
Challenge, Singer & Co., Boston.
Cheylesmore, Coventry Machinists Co., Boston.
Cinch, Western Wheel Works, Chicago.
Cinderella.
Cleveland, H. A. Lozier & Co., Cleveland.
Climax, Wall & Boyer, Philadelphia.
Clipper, Grand Rapids Bicycle Co., Grand Rapids, Mich.
Club, Coventry Machinists Co., Boston.
Coaster, A. A. Bennett, Cincinnati.
Columbia, Pope Mfg. Co., Boston.
Comet, Keefe & Becannon, New York.
Common Sense, Common Sense Bicycle Mfg. Co., Phila.
Conquest, Geo. R. Bidwell Cycle Co., New York.
Cornell, Cunningham & Co., Boston.
Courier, Hibbard, Spencer, Bartlett & Co., Chicago.
Coventry Cross, Horton, Gilmore, McW. & Co., Chicago.
" Rival, Sweeting Cycle Co., Philadelphia.
" Rotary, Stoddard, Lovering & Co., Boston.
Credenda, A. G. Spalding & Bros., New York.
Crescent, Stoddard, Lovering & Co., Boston.
Crescent, Western Wheels Works, Chicago.

Crescent Sylph, Rouse-Duryea Cycle Co., Peoria, Ill.
Criterion, Sweeting Cycle Co., Philadelphia.
Cyclone.

D

Daisy, Indiana Bicycle Mfg. Co., Indianapolis.
Dandy, " " " "
Dart, Smith National Cycle Mfg. Co., Washington.
Dauntless, Toledo Bicycle Co., Toledo.
Derby, Derby Cycle Co., Chicago.
Dictator, Clark Cycle Co., Baltimore.
Duplex-Excelsior, Cunningham & Co., Boston.

E

Eagle, Eagle Bicycle Mfg. Co., Torrington, Ct.
Eclipse, Cunningham & Co., Boston.
Eclipse, Standard Cycle Co., Buffalo, N. Y.
Eclipse, Eclipse Bicycle Works, Indianapolis.
Electric, St. Nicholas Mfg. Co., Chicago.
Eli, Bloomington Mfg. Co., Bloomington, Ill.
Elliott, Elliott Hickory Cycle Co., Newton, Mass.
Emperor, Standard Cycle Co., Buffalo, N. Y.
Empire, Chicago Sewing Machine Co., Chicago.
Empire, Empire Bicycle Co., New York.
Empress.
Enchantress.
Englewood, Indiana Bicycle Mfg. Co., Indianapolis.
Envoy, Buffalo Tricycle Co., Buffalo, N. Y.
Escort, Western Wheel Works, Chicago.
Excelsior, Sweeting Cycle Co., Philadelphia.
Expert, Pope Mfg. Co., Boston.
Express, Latta Bros., Friendship, N. Y.
Express, Meacham Arms Co., St. Louis.

F

Facile, Julius Wilcox, New York.
Fashion, Fay Mfg. Co., Elyria, O.
Flash, " " " " "
Fleetwing, Buffalo Tricycle Co., Buffalo, N. Y.
Fly.
Forest City, Geo. Worthington Co., Cleveland.

G

Gales, Schoverling, Daly & Gales, New York.
Gazelle, Crawford Mfg. Co., Hagerstown, Md.
Gem.
Gendron, Gendron Iron Wheel Co., Toledo.
Ghost, Warwick Cycle Mfg. Co., Springfield, Mass.
Giant, H. A. Lozier & Co., Cleveland.
Giantess, " " "
Girder Star, Montgomery Ward & Co., Chicago.
Goddess of Liberty, Rockaway Mfg. Co., New York.
Gotham, Schoverling, Daly & Gales, New York.
Greyhound, Brown Bros. Mfg. Co., Chicago.
Guide, Fay Mfg. Co., Elyria, O.
Gypsy, Hibbard, Spencer, Bartlett & Co., Chicago.

H

Halladay-Temple Scorcher, Marion Cycle Co., Marion, Ind.
Hallamshire, Cunningham & Co., Boston.
Hartford, Hartford Cycle Co., Hartford, Ct.
Harvard, Cunningham & Co., Boston.
Hecla, A. G. Spalding & Bros., New York.
Hero.
Hickory, Elliott Hickory Cycle Co., Newton, Mass.
Holbein Swift, Coventry Machinists Co., Boston.
Horsman, E. J. Horsman, New York.
Humber, Humber-Rover Cycle Co., Chicago.

I

Ideal, Gormully & Jeffery Mfg. Co., Chicago.
Imperial, Ames & Frost Mfg. Co., Chicago.
Imperial Club, Coventry Machinists Co., Boston.
Intermediate, Singer & Co., Boston.
Invincible, Bretz & Curtis Mfg. Co., Philadelphia.
Invincible, Standard Cycle Co., Buffalo, N. Y.
Iroquois, Stover Bicycle Mfg. Co., Freeport, Ill.
Irwell, Sweeting Cycle Co., Philadelphia.
Ivanhoe.
Ivel, A. G. Spalding & Bros., New York.

J

James, Sweeting Cycle Co., Philadelphia.
Jewel, Geo. Worthington Co., Cleveland.

Joliet, Joliet Wheel Co., Joliet, Ill.
Junior, Western Wheels Works, Chicago.
Junior Traveller, Luburg Mfg. Co., Philadelphia.
Juno, Western Wheels Works, Chicago.
Juvenile Rival, Sweeting Cycle Co., Philadelphia.

K

Kangaroo, A. G. Spalding & Bros., New York.
Keating, Keating Wheel Co., Holyoke, Mass.
Kenwood, Kenwood Mfg. Co., Chicago.
King of Clubs, Coventry Machinists Co., Boston.
" " Diamonds, Capitol Cycle Co., Washington.
" " Racers.
" " Road, Indiana Bicycle Mfg. Co., Indianapolis.
" " Scorchers, Hulbert Bros. & Co., New York.
Kite, Kirkwood, Miller & Co., Peoria, Ill.
Kitten, Premier Cycle Co., New York.
Kohinoor, " " "

L

La Belle.
Leader, Fay Mfg. Co., Elyria, O.
League.
Liberty, Rockaway Mfg. Co., New York.
Lightning, Indiana Bicycle Mfg. Co., Indianapolis,
" Double Diamond, Western Wheel Works, Chicago.
" Messenger, Sercombe & Bolte Mfg. Co., Milwaukee,
Little Giant, H. A. Lozier & Co., Cleveland.
" Jewel, Hibbard, Spencer, Bartlett & Co., Chicago.
" Traveller, Luburg Mfg. Co., Philadelphia.
Lockport, Korf & Bunce, Lockport, N. Y.
London Triumph, J. B. Rich Cycle Co., Philadelphia.
Lovell Diamond, J. P. Lovell Arms Co., Boston.
Luburg Special, Luburg Mfg. Co., Philadelphia.
Lyndhurst, McKee & Harrington, New York.

M

Majestic, Hulbert Bros. & Co., New York.
Manhattan, Indiana Bicycle Mfg. Co., Indianapolis.
March, March-Davis Cycle Co., Chicago.
Marlboro' Club, Coventry Machinists Co., Boston.
Meacham, Meacham Arms Co., St. Louis.
Mercury, Winton Bicycle Co., Cleveland.

Meteor, Banker & Campbell Co., New York.
Midland.
Miniature, Singer & Co., Boston.
" Challenge, Singer & Co., Boston.
Minnehaha.
Moffat, Moffat Cycle Co., Chicago.
Monarch, Standard Cycle Co., Buffalo, N. Y.
Monarch, Monarch Cycle Co., Chicago.
Mustang, Pope Mfg, Co., Boston.

N

Narragansett, Whitten-Godding Cycle Co., Providence.
National, St. Nicholas Mfg. Co., Chicago.
New Era, New Era Bicycle Co., "
" Mail, Wm. Read & Sons, Boston.
" Mail Scorcher, " "
" Monarch, American Bicycle Co., Chicago.
" Rapid, Clark Cycle Co., Baltimore.
" York, New York Cycle Co., New York.
Newton Challenge, R. H. Hodgson, Newton Upper Falls, Mass.
Niagara, Buffalo Wheel Co., Buffalo, N. Y.
Nonpareil, A. G. Spalding & Bros., New York.

O

Orion.
Ormonde, Am. Ormonde Cycle Co., New York.
Otto, Western Wheel Works, Chicago.
Our Pet, " " " "
Outing, Premier Cycle Co., New York.
Overland, Rouse, Hazard & Co., Peoria, Ill.
Owl, Owl Cycle Co., Boston.
Oxford, Wm. Read & Sons, Boston.
Oxford, St. Nicholas Mfg. Co., Chicago.

P

Pacemaker, Kenyon Mfg. Co., Des Moines, Ia.
Pacer, Cunningham & Co., Boston.
Pacer.
Page, Page Steel Wheel Co., Toledo, O.
Parade, Dean & Rogers, Taunton, Mass.
Paragon, Stover Bicycle Mfg. Co., Freeport, Ill.
Parole.

Pathfinder, Indiana Bicycle Mfg. Co., Indianapolis.
Peerless, St. Nicholas Mfg. Co., Chicago.
" Rochester Cycle Mfg. Co., Rochester, N. Y.
Peoria, Kingman & Co., Peoria, Ill.
Peregrine, Von Leugorke and Detmold, New York.
Perfection, Warwick Cycle Mfg. Co., Springfield, Mass.
Pet, Western Wheel Works, Chicago.
Phantom, Campbell & Co., Providence.
Phœnix, Stover Bicycle Mfg. Co., Freeport, Ill.
Pilgrim, Warwick Cycle Mfg. Co., Springfield, Mass.
Pilot, Latta Bros., Friendship, N. Y.
Pilot, Indiana Bicycle Mfg. Co., Indianapolis.
Pioneer, Standard Cycle Co., Buffalo, N. Y.
Planet, Standard Mfg. Co., Indianapolis.
Popular, P. Tattersfield, Philadelphia.
Popular Premier, Premier Cycle Co., New York.
Premier, " " " "
Prince.
Princess, John Wilkinson Co., Chicago.
Psycho, Capitol Cycle Co., Washington.

Q

Quadrant, Sweeting Cycle Co., Philadelphia.
Queen.
Queen of Scorchers, Hulbert Bros. & Co., New York.
Quimby, Capitol Cycle Co., Washington.

R

Raglan, Janssen & Van Vleck, New York.
Raleigh, Peck & Snyder, New York.
Rapid, Indiana Bicycle Mfg. Co., Indianapolis.
Rapid Traveller, Luburg Mfg. Co., Philadelphia.
Record, St. Nicholas Mfg. Co., Chicago.
Recruit, Winslow Skate Mfg. Co., Worcester, Mass.
Referee, Bretz & Curtis Mfg. Co., Philadelphia.
Regent, Derby Cycle Co., Chicago.
Reindeer.
Reliable.
Reliance, Standard Cycle Co., Buffalo, N. Y.
Remington, Remington Arms Co., Ilion, N. Y.
Rex.
Ripley, Capitol Cycle Co., Washington.
Rival, Sweeting Cycle Co., Philadelphia.

Rival, Western Wheel Works, Chicago.
Road King, A. Featherstone, Chicago.
" Queen, " "
Robinson & Price, Sweeting Cycle Co., Philadelphia.
Rob Roy, Western Wheel Works, Chicago,
Rochester, Rochester Cycle Mfg. Co., Rochester, N. Y.
Rocket, Rocket Cycle Co., Chicago.
Roulette, D. McLean & Co., New York.
Rover, Humber-Rover Cycle Co., Chicago.
Royal, Marshall Cycle Works, Marshall, Mich.
Royal Mail, Wm. Read & Sons, Boston.
" Singer, Singer & Co., "
Ruby.
Rucker.
Rudge, Metropolitan Hardware Co., New York.
Rush, Western Wheel Works, Chicago.

S

St. Louis.
St. Nicholas.
Samson, Capitol Cycle Co., Washington.
Sanspareil, Clark Cycle Co., Baltimore.
Sanspareil, Luthy & Co., Peoria, Ill.
Scorcher, Geo. R. Bidwell Cycle Co., New York.
Scorcher, Bretz & Curtis Mfg. Co., Philadelphia.
Secure, Woodruff & Little Cycle Co., Towanda, Pa.
Semi-Roadster, Pope Mfg. Co., Boston.
Shadow.
Singer, Singer & Co., Boston.
Snowflake, Hirsch Aluminium Co., Chicago.
Spalding, A. G. Spalding & Bros., New York.
Sparkbrook, L. H. Johnson, Orange, N. J.
Special Columbia, Pope Mfg. Co., Boston.
" Premier, Premier Cycle Co., New York.
" Sparkbrook, L. H. Johnson, Orange, N. J.
Speedwell, Springfield Bicycle Mfg. Co., Boston.
Speedy, Speedy Cycle Co., Chicago.
Speedycycle, Singer & Co., Boston.
Springfield, Springfield Bicycle Mfg. Co., Boston.
Springfield, Singer & Co., Boston.
Sprinter, Luburg Mfg. Co., Philadelphia.
Stall Special, W. W. Stall, Boston.
Standard, Pope Mfg. Co., Boston.
Standard, Standard Mfg. Co., Martinsburg, W. Va.

Standard, Premier Cycle Co., New York.
Standard, Standard Cycle Co., Buffalo, N. Y.
Star, H. B. Smith Machine Co., Smithville, N. J.
Star, Spooner-Peterson Co., Chicago.
Stella.
Sterling, C. F. Stokes Mfg. Co., Chicago.
Straight Steerer, Singer & Co., Boston.
Strong, Strong & Green Cycle Co., Philadelphia.
Student, Geo. R. Bidwell Cycle Co., New York.
Sunbeam, Sweeting Cycle Co., Philadelphia.
Sunol, McIntosh-Huntington Co., Cleveland.
Superior, Keating Wheel Co., Westfield, Mass.
Surprise, Pope Mfg, Co., Boston.
Sweeting Diamond, Sweeting Cycle Co., Philadelphia.
Swift, Coventry Machinists Co., Boston.
Sylph, Rouse-Duryea Cycle Co., Peoria, Ill.

T

Telegram, Sercombe & Bolte Mfg. Co., Milwaukee.
Telephone, Kirkwood, Miller & Co., Peoria, Ill.
Thistle, Fulton Machine Works, Chicago.
Tiger, Stover Bicycle Mfg. Co., Freeport, Ill.
Titania, Ariel Cycle Mfg. Co., Goshen, Ind.
Tourist, Geo. R. Bidwell Cycle Co., New York.
Traveller, Singer & Co., Boston.
Traveller, Geo. R. Bidwell Cycle Co., New York.
Tremont, W. W. Stall, Boston.
Triumph, J. B. Rich Cycle Co., Philadelphia.
Tuxedo, Indiana Bicycle Mfg. Co., Indianapolis.
Twins, U. S. Cycle Mfg. Co., Philadelphia.
Two-Ten, Union Cycle Mfg. Co., Highlandville, Mass.
Typhoon, Fay Mfg. Co., Elyria, O.
Tyro.

U

Union, McKee & Harrington, New York.
Union, Union Cycle Mfg. Co., Highlandville, Mass.
Unique, Buffalo Tricycle Co., Buffalo, N. Y.
Universal Club, Coventry Machinists Co., Boston.
" Premier, Premier Cycle Co., New York.
" Rover, Humber-Rover Cycle Co., Chicago.

V

Veloce, Pope Mfg. Co., Boston.
Velociman, Singer & Co., "
Velocity, R. H. Hodgson, Newton Upper Falls, Mass.
Venus.
Victor, Overman Wheel Co., Chicopee Falls, Mass.
Victor Junior, Overman Wheel Co., Chicopee Falls, Mass.
Victoria, " " " " "
Victoria, Singer & Co., Boston.
Victory, Bretz & Curtis Cycle Co., Philadelphia.
Viking, John Shirley Cycle Co., "
Vineyard, Winslow Skate Mfg. Co., Worcester, Mass.
Violet.
Volant, Springfield Bicycle Mfg. Co., Boston.
Volunteer, Pope Mfg. Co. "
Vulcan, Whitten-Godding Cycle Co., Providence.

W

Wanderer, Hibbard, Spencer, Bartlett & Co., Chicago.
Wanderer, Geo. R. Bidwell Cycle Co., New York.
Warwick, Warwick Cycle Mfg. Co., Springfield, Mass.
Whirlwind, Bigelow & Dowse, Boston.
White Diamond, Capitol Cycle Co., Washington.
" Flyer, White Cycle Co., Westboro, Mass.
Worth, Chicago Bicycle Co., Chicago.
Wright & Ditson, Wright & Ditson, Boston.
Wulfruna, W. G. Schack, Buffalo, N. Y.

X

XL, Luburg Mfg. Co., Philadelphia.
Xtra, Singer & Co., Boston,
Xtraordinary Challenge, Singer & Co., Boston.

Y

Yale, Cunningham & Co., Boston.
Youth's Columbia, Pope Mfg. Co., Boston.
" Mustang, " "
" Premier, Winslow Skate Mfg. Co., Worcester, Mass.
" Premier, Premier Cycle Co., New York.

TABLES OF

Mile Records of the World.

American Path Records.

English Path Records.

American Road Records.

English Road Records.

Twenty-four Hour Record.

THE MILE RECORDS OF THE WORLD.

H. H. Griffin in "Cycling."

Time for 1 Mile. M. S.	Method of Progression.	Name of Record Holder.	Where Made.	Date.
0 39¼	Railway Train	N. J. Central R. R.	Bound Brook, N. J.	26 February, 1892
1 10	Yacht (Ice)	Dreadnought	Redbank, N. J.	26 January, 1884
1 35½	Horse (running)	Salvator	Monmouth Park, N. J.	28 August, 1890
1 50	Torpedo Boat (with tide)	Built for Brazilian Navy	Thames Estuary, Eng.	2 June, 1891
2 05⅕	Torpedo Boat (still water)	Ariete	Lower Hope, Eng.	8 July, 1887
2 08¼	Horse (trotting)	Sunol	Stockton, Cal.	20 October, 1891
2 12½	Yacht (steam)	Norwood	New York Bay	7 Nov., 1891
2 12⅗	Skating (ice, with wind)	Tim Donaghue*	Newburgh, N. Y.	1 February, 1887
2 15	Safety Bicycle	W. W. Windle*	Springfield, Mass.	17 October, 1891
2 20	Ocean Liner (steamship)	Teutonic	Atlantic Ocean	August, 1891
2 24⅕	Tandem Bicycle	A. A. Zimmerman* W. F. Murphy*	Peoria, Ill.	21 Sept., 1891
2 25⅗	High Bicycle	W. W. Windle*	Peoria, Ill.	15 Sept., 1890
2 28⅖	Single Tricycle	Cassignard	Courbervoie Track, France	18 October, 1891
2 31⅖	Tandem Tricycle	P. W. S. Beduin* B. W. Crump*	Herne Hill, London, Eng.	1891
2 50⅖	Skating (rollers)	Frank Delmont †	Olympia, London, Eng.	27 August, 1890
2 55⅗	Skating (ice)	O. Grunden †	Stockholm, Sweden	23 February, 1890
4 12¾	Running	W. G. George †	Lillie Bdg., London, Eng.	23 August, 1886
5 40	Rowing (single sculls)	Jos. Laing*	Lachine, Canada	19 August, 1882
5 42½	Snow Shoes (running)	J. G. Ross*	Montreal, Canada	7 March, 1885
6 23	Walking	W. Perkins †	Lillie Bdg., London, Eng.	1 June, 1874
9 29	Canoe (paddling)	A. F. Mackendrick*	Jessup's Neck, N. Y.	20 August, 1890
28 19¾	Swimming	J. J. Collier †	Hollingworth Lake, Eng.	23 August, 1891

* Amateur. † Professional.

AMERICAN PATH RECORDS—January 1, 1892.

	Safety.		*Ordinary.*		*Tricycle.*		*Tandem Safety.*	
MILES.	TIME.	NAME.	TIME.	NAME.	TIME.	NAME.	TIME.	NAME.
¼ fly.	29⅘	A. A. Zimmerman. G. M. Worden. J. W. Schaefer.	30⅘	A. A. Zimmerman.				
¼ stg.	33	W. C. Thorne.	32⅗	E. C. Anthony.	*39	H. G. Crocker.	37⅖	Banker and Brinker.
½	1.06	H. C. Tyler.	1.10⅗	A. A. Zimmerman.	1.21⅘	G. M. Hendee.	1.08	" "
¾	1.41	W. W. Windle.	1.49⅕	W. W. Windle.	*2.07	H. G. Crocker.	1.48	Zimmerman and Murphy.
1	2.15	"	2.25⅖	"	*2.49⅖	R. Howell.	2.24⅕	" "
2	4.48⅘	G. F. Taylor.	*5.11	W. A. Rowe.	*5.53⅘	H. G. Crocker.	5.04⅖	Banker and Brinker.
3	7.49⅖	A. A. Zimmerman.	*7.48⅘	"	*8.49⅕	"	8.10	Gassler and Ivens.
4	10.27	"	*10.41⅖	"	*11.50	"	11.12¼	Murphy and Murphy.
5	12.53⅘	"	*13.23⅘	"	*14.50⅕	"	14.05	" "
10	26.46⅗	C. W. Dorntge.	*27.07⅕	"	*29.54⅗	"		
15	40.33⅖	"	*40.41⅖	"	*52.16	T. W. Eck.		
20	53.56⅖	"	*54.25⅖	"	*1.10.25⅖	"		
25			*1.14.23⅕	F. F. Ives.	*1.28.26⅕	"		
50			*2.33.54	"				
100			*5.38.44⅕	F. E. Dingley.				

The Hour's Record, 22 miles 150 yards, W. A. Rowe, Ordinary Bicycle.

* Professional.

ENGLISH PATH RECORDS—January 1, 1892.

Miles.	Safety. Time.	Safety. Name.	Ordinary. Time.	Ordinary. Name.	Tricycle. Time.	Tricycle. Name.	Tandem Tricycle. Time.	Tandem Tricycle. Name.	Tandem Bicycle. Time.	Tandem Bicycle. Name.
$\frac{1}{4}$ fly.	30$\frac{3}{5}$	A. T. Mole.	32$\frac{4}{5}$	U. L. Lambley.	34	W. G. H. Bramson.	33$\frac{2}{5}$	Crump and Beduin.	37$\frac{4}{5}$	Glover and Williams.
$\frac{1}{4}$ stg.	33$\frac{4}{5}$	F. G. Bradbury.	35$\frac{4}{5}$	F. J. B. Archer.	37$\frac{1}{5}$	"	39$\frac{2}{5}$	"	40$\frac{2}{5}$	"
$\frac{1}{2}$	1.07$\frac{2}{5}$	F. T. Fletcher.	1.12$\frac{2}{5}$	U. L. Lambley.	1.16	"	1.15$\frac{4}{5}$	"	1.18$\frac{1}{5}$	"
$\frac{3}{4}$	1.42	F. J. Osmond.	1.51$\frac{4}{5}$	F. J. Osmond.	1.54$\frac{4}{5}$	"	1.54$\frac{3}{5}$	"	1.58$\frac{3}{5}$	"
1	2.16	"	2.28$\frac{4}{5}$	"	2.31$\frac{3}{5}$	"	2.31$\frac{2}{5}$	"	2.40	"
2	4.50$\frac{3}{5}$	"	5.12$\frac{1}{5}$	W. A. Illston.	5.24$\frac{2}{5}$	E. B. Turner.	5.33$\frac{2}{5}$	Wilson and Dangerfield.	5.41$\frac{3}{5}$	Glover and Lloyd.
3	7.17$\frac{2}{5}$	"	8.14$\frac{2}{5}$	F. J. Osmond.	8.06$\frac{2}{5}$	"	8.23	"	8.30$\frac{2}{5}$	"
4	9.47$\frac{1}{5}$	"	10.51$\frac{1}{5}$	U. L. Lambley.	11.06$\frac{1}{5}$	"	11.11$\frac{1}{5}$	"	11.16$\frac{1}{5}$	"
5	12.16$\frac{2}{5}$	"	13.44$\frac{1}{5}$	"	13.50$\frac{3}{5}$	"	13.54$\frac{1}{5}$	"	14.02$\frac{2}{5}$	"
10	24.50$\frac{1}{5}$	"	27.55$\frac{1}{5}$	B. W. Attlee.	28.13$\frac{1}{5}$	"	28.35$\frac{1}{5}$	Crump and Beduin.	28.24$\frac{4}{5}$	"
15	37.33	"	42.13$\frac{2}{5}$	"	42.27$\frac{1}{5}$	"	45.18$\frac{2}{5}$	"	46.43	Glover and Albone.
20	50.22$\frac{4}{5}$	"	56.51	"	56.49$\frac{3}{5}$	"	59.51$\frac{2}{5}$	"	1.02.16$\frac{3}{5}$	"
25	1.05.55$\frac{2}{5}$	R. L. Ede.	1.12.48$\frac{3}{5}$	"	1.11.15$\frac{4}{5}$	"	1.16.56$\frac{4}{5}$	Goulding and Bidlake.		
50	2.17.01$\frac{4}{5}$	"	2.33.37$\frac{2}{5}$	J. H. Adams.	2.38.44$\frac{4}{5}$	"				
100	5.30.12$\frac{2}{5}$	L. Newland.	5.50.05$\frac{2}{5}$	F. R. Fry.	6.09.26	A. L. Bower.				

Hour's Record: 23 miles 1246 yards, F. J. Osmond; 21 miles 180 yards, B. W. Attlee; 21 miles 226 yards, E. B. Turner.

24 Hours' Record: 361 miles 1446 yards, M. A. Holbein.

ENGLISH ROAD RECORDS—January 1, 1892.

	Safety.		*Ordinary.*		*Tricycle.*		*Tandem Tricycle.*		*Tandem Bicycle.*	
DIST.	TIME.	NAME.	TIME.	NAME.	TIME.	NAME.	TIME.	NAME.	TIME.	NAME.
50 m.	2.24.44	R. L. Ede.	2.45.55	S. C. Houghton.	2.35.17	S. D. Begbie.	2.36.45	Begbie and Arnold.	2.42.03	Browne and Crosbie.
100 m.	5.27.38	T. A. Edge.	6.22.15	J. F. Walsh.	6.10.08	T. A. Edge.	5.30.31	Edge and Bates.	6.25.39	"
TIME.	DISTANCE.	NAME.	DISTANCE.	NAME.	DISTANCE.	NAME.	DISTANCE.	NAME.	DISTANCE.	NAME.
12 hrs.	192½	F. W. Shorland.	175½	J. F. Walsh.	174½	M. A. Holbein.	164½	Wilson and McCarthy.	163	Holbein and Wilson.
24 hrs.	336½	M. A. Holbein.	312	"	311½	"	298½	Mills and Tingey.		

AMERICAN ROAD RECORDS—January 1, 1892.

15 Miles ....(Chicago-Pullman Course)........N. H. Van Sicklen........ 50.17 ....Safety.
25 " ... .(Detroit ")........ " " ....1.25.11........ "
25 " ....(Milburn-Irvington ")........A. W. Porter ....1.27.11........Ordinary.
25 " ....(Boston Athletic Club ")........Hoyland Smith ....1.19.13........Safety.

TWENTY-FOUR HOUR RIDES.

Year.	*Promoters.*	*Winner.*	*Machine.*	*Distance.*
1882 ...	Ellis & Co.	... W. Snook ..	... Safety	... *214½ miles.
1883 ...	"	... J. H. Adams	... "	... *221¼ "
1883 ...	London T. C.	... T. R. Marriott	... Tricycle	... *218¾ "
1884 ...	Rudge & Co.	... J. H. Adams	.. "	... 230 "
1886 ...	North Road C. C...	G. P. Mills	... Ordinary	... 227 "
		C. W. Brown	... Safety	... 217 "
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