er), $2.00; two teams (drivers), $10.00; fourteen shovelers at $2.00, $28.00; four shovelers (piling) at $2.00, $8.00; two men with brooms, $4.00; sundries, oil, waste, etc., $1.00; total, $81.50.

The Beet Sugar Industry.

Nearly a century and a half has passed since Maggraf, a German scholar, announced in 1747 to the Berlin Academy of Sciences his discovery of a method of producing sugar from the beet, says the New York Sun. Half a century later, his pupil, Achard, explained to the same academy his improvements in that process. Then the industry began to grow steadily, and under the encouragement of Napoleon it made considerable progress in France. Indeed, during the wars of Napoleon, when the sugar-laden merchantmen of France and of Germany, coming from the West Indies, were so harassed as to be nearly driven from the seas, the times were favorable to beet sugar production in Europe. The decade following 1815 saw a great reaction, with the beet fields of France and Germany largely turned to other uses, and the beet sugar factories mostly closed. Then came a revival that lasted. The beet sugar industry was destined, however, to remain still a long time a target for the humorists, and one grave statesman compared it with the project of Swift's famous philosopher who sought to extract sunbeams from cucumbers. But it grew in spite of ridicule. Mr. E. Sowers, who, in the North American Review, urges a wider field for it in America, says that the production of beet sugar in France for the year ending July 31, 1830, was 4,380 tons; in 1840 it was 22,784, in 1850 it was 62,165, in 1860 it was 126,479, in 1870 it was 282,136, in 1890 it had reached 750,000 tons. Again, in 1830, the consumption per person in France was two pounds; in 1865, fourteen pounds; in 1890, twenty-six pounds.

A like growth in Germany is noted during a period of about fifty years.

	Sugar, tons.	Molasses, tons.
For 1840	13,445	8,955
For 1850	52,586	19,877
For 1860	126,526	35,224
For 1865	180,000	50,544
For 1871-72	186,442	63,892
For 1881-82	599,722	150,813
For 1889-90	1,213,689	240,797

Indeed, beet sugar has for Germany become an important article of export. In the year 1877 the amount sent out of the country was 57,753 tons. Ten years later it had increased more than tenfold, to 643,340 tons, while in 1890 it had reached 718,985 tons. In 1890 our country paid Germany $16,000,000 for about 200,000 tons of beet sugar, and Mr. Sowers observes that this was "nearly three times more than it paid for any other article" imported from that land.

How does this industry stand in the United States? Mr. Sowers tells us that in 1891 the production here was 12,004,838 pounds; in 1892 it was 27,003,322 pounds; in 1893 it was 44,836,527 pounds. He has no figures for 1894 and 1895, but if the increase has continued at anything like the rate just noted, the product by this time must be very large.

Parts of Kansas, Nebraska, the Dakotas, California, and Utah have already been devoted to sugar beet culture, with most promising results. The rich soils and warm and even climate of California and Utah, especially when aided by irrigation, are suited to an abundant and excellent yield. In 1892 California alone produced about 20,000,000 pounds of beet sugar. Nebraska and the Dakotas add to a natural richness of soil sufficient rainfall in the season of rapid growth. The farmers of Nebraska find that the temperature for June, July, August, and September is so high and even as to bring the beet to full maturity early in October. That State produced 5,835,900 pounds of beet sugar in 1893, or more than double the amount of two years before, and it also has one of the most successful beet sugar factories. Improvements in making the sugar go on, and a better knowledge is steadily gained of the conditions which tend to increase the yield.

A summary of facts given by Mr. Sowers in regard to this industry will be of interest:

"The yield of sugar beets varies from twelve to forty tons per acre. The best land, with good cultivation and a favorable season, will yield from twenty to thirty-five tons per acre, but the crop would be hardly profitable at a yield of less than twelve tons per acre. In California the greatest production from a single acre of land was a little more than forty tons of beets; but this is an unusual yield. The estimated cost of production per acre is about fifty dollars. In the present condition of the methods of manufacture, from eight to twelve pounds of beets are required in the making of one pound of sugar; the quantity varies according to the greater or lesser richness of the beets in sugar. The price changes with the conditions of the market. About four years ago beet sugar from Germany was landed on the wharves of New York at a cost of three dollars and eighty-one cents a hundred pounds. It rarely costs now above five cents a pound."

During the last sixty years such improvements have been made in the process of manufacture that, instead of converting from 4 to 5 per cent of the beet into sugar, 12 to 16 per cent are converted now, and the cost of production per pound, which was once from 8 to 12 cents, is now only from 2 to 4. The average cost here in 1893 was 3 cents, and 24,000 acres were used for growing sugar beets, which brought to the farmer an average price of $4.50 a ton. An acre produced 3,661 to 4,620 pounds of sugar. In that year there were seven factories in the country, with a capital of about $2,000,000.

If the figures of Mr. Sowers are correct, the annual consumption of sugar per capita in Germany is 18 pounds; in France and Switzerland, 26; in the United States, 44, and in England, 60. These are extraordinary differences, and England appears as having the sweet tooth. We are further assured that France, Germany, and Austria produce beet sugar enough for home consumption, and import little sugar, while Germany and France export large quantities. In 1892 Germany sold to English purchasers alone nearly 600,000 tons of beet sugar, the product of their factories and fields.

As to our country, it is declared that we "spent annually about $135,000,000 for sugar, of which more than eight-tenths goes to foreign countries. We consume one-fourth of the exported sugar product of the world. Fifty years ago, 94 per cent of the annual sugar product of Cuba found a market in Europe; now that proportion of its production is sold in the United States." This last extraordinary statement suggests the vast commercial interest which we have in that island, and its growth in fifty years.

CONTRACTION OF THE FACE IN JUMPING.

In a jump, says Longet, the entire body detaches itself from the ground and floats in the air after the manner of a projectile. The photograph that we reproduce, and which was taken by a photographer of Saint-Die, shows the justness of this comparison perfectly. The stress of impulsion causes a contraction of the entire body. The trunk and limbs at the moment of rising form a rigid and undulated rod.

CONTRACTION OF THE FACE IN A JUMP.

The photograph in question gives the image of a very high jump at the moment that the impulsion is given. It reproduces the body in full stress and in entire contraction. The violence of the stress may be seen from the aspect of the young man's countenance. The nose, eyebrows, eyelids, forehead and neck are violently contracted. The effect is so much the more marked in that the energy of the stress has congested the face.

One might say, from an inspection of the figure, that the jumper was suddenly experiencing a severe pain, and that he was about to burst into tears.—La Nature.

TH. GUILLOZ (Medical Week, June 5, 1896) says that he first successfully employed photography of the retina for clinical purposes in the year 1893. His procedure is based on the following principle: When the pupil is dilated, the fundus of the eye may be illuminated, so as to permit of examination of the retina with a lens, without the necessity of any ophthalmoscopic mirror. The observation is thus made on the reversed image, and it is this image which is fixed by means of a photographic objective. Moreover, as the time of exposure, however short, is an inconvenience, he has constructed a special apparatus for instantaneous photography of the retina. The photographs obtained in this manner show the ophthalmological image reversed, as it appears on examination, with the reflection from the optic disk and cornea; but since then the author, by a new method of illumination has succeeded in getting rid of this reflection.

ECHOES OF THE ANNUAL BICYCLE EXHIBITION.

Although there have been no radical changes in the 1897 model, it is undeniable that this year's bicycle is a much handsomer machine than its predecessor. This is due to the great care and the good taste with which every detail has been designed and finished off. Larger tubing, particularly in the stays and rear forks, the shapely arched fork crown, the compact adjustments of handle bar and seat post, the increased diameter of crank hanger and hubs, have given to the 1897 bicycle an appearance of greater strength and durability without detracting from the general grace and beauty of its proportions.

This was the first impression on taking a rapid survey of the magnificent display shown on the second floor of the Grand Central Palace, where most of the leading and older firms were represented. It was fitting that the first name to greet the eye should be that of the Pope Manufacturing Company, whose senior member is justly entitled to be called the father of the bicycle industry in this country. In speaking of such a progressive firm no higher compliment can be paid to its 1896 wheel than to say that this year's pattern varies from it in few essential particulars, the chief change being in the introduction of direct tangent spoke-studs on the hubs, box fork crowns with a name plate attached (placed there as a protection against the bicycle thief), and improvements in the divided crank shaft, a device which this firm was the first to introduce.

E. C. Stearns & Company had a full display of the famous "Yellow Fellow" wheels, conspicuous among which was the many-triangled truss of the famous septuplet, which had already done duty at the great London and Chicago shows. Another curiosity was the wheel on which Anderson recently reeled off a mile in 1 minute and 3 seconds behind the friendly shelter of a shield attached to a moving train. The gear was one hundred and twenty, and if, as the Stearns Company asserts, the timing was accurate, the feat proves that atmospheric resistance is by long odds the most serious that the bicyclist has to contend with.

The adjoining exhibit of the Remington Arms Company showed the beauty of finish and the close attention to detail which the long experience of the firm in the manufacture of high grade material would lead one to expect. Every part of the machine is made at the works, even to the chain. The bayonet cranks of triangular cross section were suggested, as the name implies, by the bayonets which are made by the firm, and they are certainly adapted to resist the strains to which the crank is subject.

The Lovell Arms Company showed several improvements, including a divided crank axle which is locked by a screw passing through the crank hub. The crank axle is made by rolling up a strip of Swedish plate steel into a hollow tube and welding the longitudinal joint. The bearings are oiled through the axle. In place of a cup they use a two-point bearing cone with the object of diminishing friction.

The Sterling Cycle Works are justly proud of the fact that many of this year's improvements in other wheels had been anticipated in their earlier machines. The Sterling oval fork has been changed very little, if at all, from the original design. They still favor tubing and, relatively to other 1897 wheels, small diameter bearings. The wheel is the lightest appearing machine in the show, and reveals careful work and high finish. It is claimed that the company was the first to use the direct tangent spokes and corrugated hubs. Other new features are the use of cup bearings screwed into the crank hanger, the Morse roller bearing chain and the use of large sprockets.

The Indiana Bicycle Company has turned out an extremely handsome wheel in the 1897 Waverley. The most novel feature is the design of cranks and crank axle. The latter is hollow, and the crank, which is squared at its large end, is let into a slot cut across the end of the axle and held in place by a bolt which passes through the axle. This enables the bearings to be removed from the hanger without altering their adjustment.

The Eagle Manufacturing Company has made a great advance over last year's wheel in the matter of details. It still offers the justly celebrated aluminum rims, which for many years have been the distinguishing feature of the Eagle wheels, but in deference to the popular taste the manufacturers furnish their high grade wheel with wood rims, substituting the aluminum rims if preferred. The changes in the new wheel include a double drop-forged crown, a narrower tread (4⅝ inches), the cantilever front sprocket (a handsome design which has attracted much attention), D forks for the rear wheel, ball retainers for all bearings and a large diameter tapered handle bar, the size at the head being 1⅛ inches. The ladies' wheel, with its elegant and mechanically designed tritubular frame and its aluminum dress shield and rims, is one of the handsomest machines in the exhibition.

The Keating Wheel Company retain the characteristic "curve" in the main tube, put there with the object of resisting more effectually the twisting strains in the crank hanger. The corrugated hubs are cut from the

solid bar, the recesses being milled out with a special tool, leaving the studs for attaching the tangent spokes as an integral part of the hub. They are a curiosity of manufacture, showing the infinite work that is expended in the production of a first-class wheel. Perhaps the strongest recommendation of this wheel is the double roller chain, in which each pin is encircled with an accurately fitted steel roller. In taking the sprocket the chain rolls, instead of sliding onto the teeth—an obvious advantage.

The Tribune bicycle is shown with the cycloidal sprocket, which is designed to secure a perfectly tangential pull, the center line of the chain being normal to the face of the teeth as they come into engagement. The Black Manufacturing Company believes that the best method of "dustproofing" bearings is to make them with flush exterior faces, where the dust and dirt will find no projections to lodge in. A novelty in crank fastening is shown in cutting fine V shaped longitudinal corrugations on the axle and crank of the wheel, which take up all the rotary thrust of the crank.

Adjoining the last exhibit was the really superb display of "White Fliers" by the Barnes Cycle Company. These were the first machines to use the internal wedge adjustment on seat post and handle bar. This wheel has both cranks, the axle, and the sprocket flange in one solid forging.

Close at hand were two other wheels of special finish and great beauty, the Fenton and the Fowler. In the former the Fenton Metallic Manufacturing Company has adhered to large tubing, using for this year's wheel 1¼ inch in the frame and 1½ inch in the head, and the machine is rendered very attractive by its beautiful translucent finish. The Fowler Cycle Company retains in this year's wheel the characteristic truss frame, and has adopted a neat arched fork crown, a two-piece crank axle and a special design of seat post clamp.

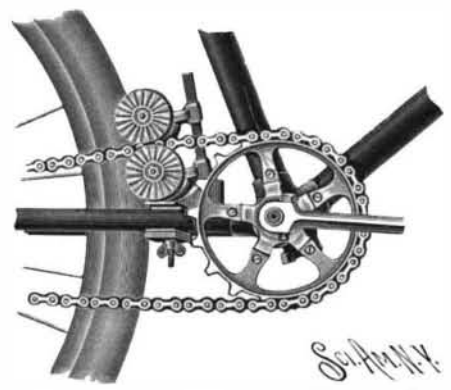
Of the Eclipse bicycle shown on the same floor it is sufficient to say that it is even more shapely than last year, with its D tubing, dropped crank hanger and arched double crown. The Monarch Cycle Manufacturing Company are also thoroughly up to date in its new wheel. It is built with 1¼ inch tubing in the frame, ⅞ inch D tubing in the rear forks, laminated wood rims with nickel plated eyelets in the spoke holes, and compact seat and handle bar clamping devices.

Conspicuous among the veteran makers was the Overman Wheel Company, which exhibited every separate detail of a modern Victor, as well as several finished machines of great beauty. This is one of the firms that has not followed the fashion of barrel hubs. The rear hub, turned from a solid piece of steel and oil hardened, is a piece of work which will commend itself to the mechanical eye. The new wheel shows the characteristic large diameter hollow crank shaft, improved, with detachable cranks. The arched fork crown is a solid steel forging and there is less curve in the forks than in the earlier models.

The Western Wheel Works have greatly improved the appearance of the Crescent wheel, which is one of the most shapely of the 1897 models. A noticeable feature is the use of the D tubing in both rear forks and stays, and the peculiar construction of the plate steel sprocket. The outer edge of the latter is bent over to give a double thickness, out of which the teeth are cut. The worm adjustment for the chain will be appreciated by the unskilled mechanical fingers of the majority of riders.

The curious exhibit of 126 diminutive Trump cyclometers by the Waterbury Watch Company was intended to show the correctness of the reading. The cyclometers were arranged in rows and rotated by an endless chain of "strikers," which was run by an electric motor. But undoubtedly the most unique exhibit in the show was a skeleton built up entirely of drop forgings made by Billings & Spencer. Never was such an anatomy seen before. Bicycle cranks jointed into nut crackers and sewing machine shuttles formed the toes to feet, above which were skeleton legs composed of engine cranks and piston rods.

The Johnston two-speed gear shown in the engraving is placed on the rear axle. When the high gear is in use, the sprocket is concentric with the wheel hub and



THE NEWPORT BICYCLE CHAIN CLEANER.

the speed of wheel hub and sprocket is the same. The change to low gear is effected by lifting a small rod attached to the rear stays, which at once unlocks the sprocket from the wheel hub and by means of a cam wedge, shown in the drawing immediately above the axle, lifts the sprocket hub with its interior sleeve and bearings into engagement with the gear on the main hub of the wheel. In addition to the high and low gear positions, there is a third position in which the sprocket rotates quite independently of the wheel—an arrangement which enables the rider to stop the pedals and keep his feet upon them when coasting down a hill.

An invention which will be welcomed by those riders who object to a brake because it spoils the general symmetry of the wheel is the Spencer invisible coil brake, of which we give an illustration. The whole of the mechanism is placed within the frame of the bicycle and is, therefore, completely out of sight. The brake proper consists of a spiral coil of flat spring steel, which is tapered in breadth and thickness and wrapped around the crank axle in the direction in which it rotates. To the small outer end of the coil are attached a few links of chain, to which is fastened a length of steel rope which passes up through the lower tube to the head. Here connection is made with a vertical rod at whose upper end are a short length of chain and another piece of steel rope, which latter passes through the handle bar to the right hand grip. Here it is attached to a pin which travels in the direction of the axis of the grip by the action of a worm cut in a metal cylinder on the inside of the grip. By turning the grip to the right, the rope is drawn taut and tightens the coil upon the axle, the action being assisted by the rotation of the axle. There seems to be unlimited power in this brake, and as a mechanical ingenuity it is highly creditable.

We also give illustrations of the Wizard Bicycle Chain and the Brown Roller Sprocket, both of which are designed to reduce the friction of the driving mechanism. The Whitney Manufacturing Company, the makers of the chain, claims that links of this triangular form are lighter than ordinary ¼ inch chains and about 300 pounds stronger. In the common form of chain the blocks are weaker than the side links, as the latter are made of sheet steel, which is of a higher grade material than the drawn steel of the center blocks. This chain has both center and side links of high grade sheet steel. The sprocket is made with a double rim, the projections on the chain engaging rollers carried on pins which are riveted in between the rims.

The Brown roller sprocket is also made with a double rim, between which are carried a series of disk wheels, which take the place of the teeth in an ordinary sprocket. Both of these devices are designed to avoid the friction which results from the "climbing" of the chain on the teeth of the common form of sprocket.

The Newport bicycle chain cleaner forms the subject of another illustration. It consists of two small rotary brushes, which are operated by friction rollers bearing on the tire of the rear wheel. The device is clamped to the rear forks back of the crank hanger, as shown, and the action of the brushes is so rapid that the chain is thoroughly cleaned with a few turns of the cranks.

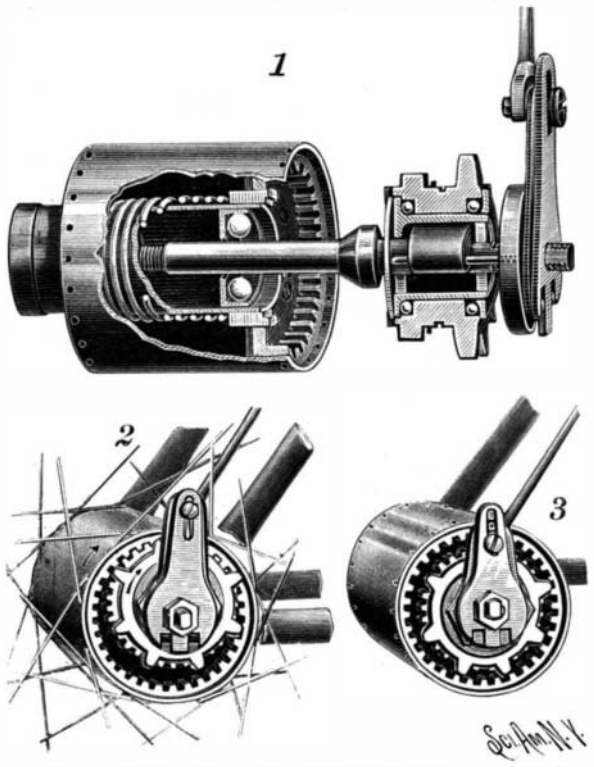
Our notice of the general advance which is seen in the bicycle of 1897 may well close with a reference to a remarkable wheel shown at the Spalding stand as an exhibition of the endurance of their 1896 model. This was a bicycle which had been ridden for 1,500 miles over the rough roads of the Rocky Mountains by one of a company of United States soldiers, who made the trip to test the value of the bicycle for military purposes. The weight of machine and equipment was over eighty pounds, and, although the wheel showed many outward signs of its rough treatment, every essential part of it was in good working order.

Transmission of Earthquake Motion.

In a recent lecture delivered by Professor John Milne, formerly of the Imperial University, Tokio, to the members of the Edinburgh Philosophical Institution, on "Earthquakes and Volcanic Disturbances," the author stated that the chief feature of the lecture was the announcement of the fact that an earthquake occurring in any portion of the earth could be recorded in any other part by means of suitable instruments. He showed diagrams of earthquakes recorded in England which had originated in Japan. The motion came from Japan to England in sixteen minutes, and therefore in all probability traveled through the earth rather than around its surface. This high velocity with which motion was propagated indicated that the earth had a higher rigidity than had hitherto been supposed; in fact, the globe transmitted motion more quickly than a ball of glass and steel. In order to learn more about the nature of the interior of the earth, he suggested that there should be placed on its surface at intervals of from 1,000 to 2,000 miles instruments for picking up the unfelt earthquake motion. The cost of these installations would be about $250 each, and twenty of them would be sufficient. With such an equipment we might learn more about the nature of the earth on which we live in a period of three years than we should by a hundred years of speculation.

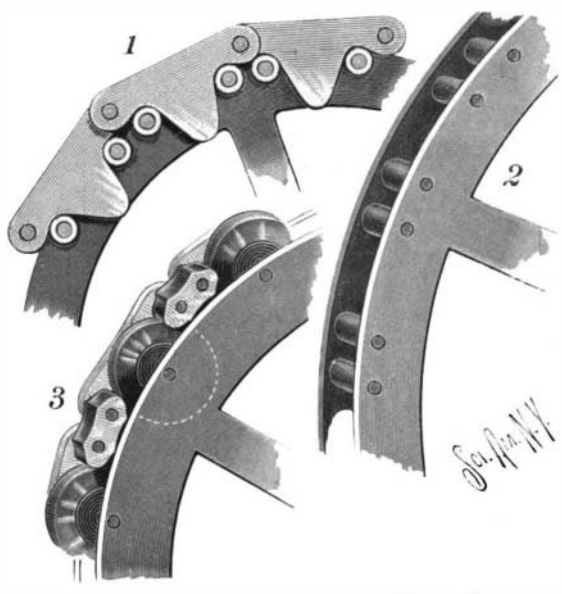
1. Detail view of coil. 2. Connections between coil and handle bar.

THE SPENCER INVISIBLE COIL BRAKE.



1. Sectional view of gear. 2. Gear in low speed position. 3. Gear in high speed position.

THE JOHNSTON TWO SPEED GEAR.



1 and 2. Wizard bicycle chain and sprocket. 3. Brown roller sprocket.

THE WIZARD CHAIN AND BROWN SPROCKET.

NOVELTIES AT THE NEW YORK BICYCLE SHOW.