clutch; in the same year, with Philo M. Beers, an improvement on a former invention of Beers' for polishing needle eyes. In 1878, a refrigerator. In 1883, a ventilating arrangement for railroad cars; also a system of heating and ventilating houses. In 1885, with Wilbur F. Dial, the eccentrically-centered loop taker; also the feed regulator for the No. 12 machine, two patents. In 1890, the barred hook used in the No. 2 machine, two patents for tension release, and one for combination of parts in the No. 9 machine. He also patented a design for cabinets.

We are indebted to the *Sewing Machine Times* for the engraving and for some of the data contained in the sketch.

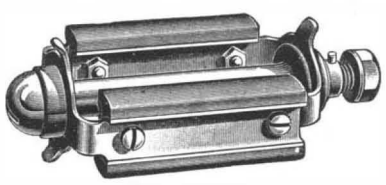
COLUMBIA BICYCLES FOR 1894.

The Pope Manufacturing Company announce a number of new wheels for 1894, and we illustrate model

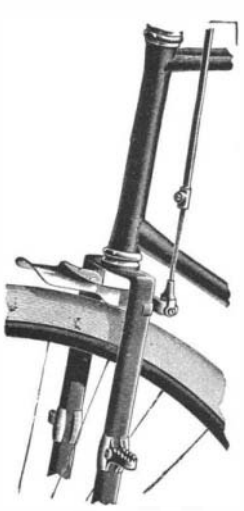
COLUMBIA BICYCLE, MODEL 34.

34. This, while a new machine in many important points of design and construction, retains also the best features of their former light wheels. It weighs 30 pounds with or 29 pounds without brake. It is made for expert and intelligent riders, who take good care of their cycles, and if used as any finely constructed piece of mechanism should be, will give the highest satisfaction. It is furnished with Columbia single tube pneumatic tire, but Hartford double tube tire will be supplied, without additional charge, when desired.

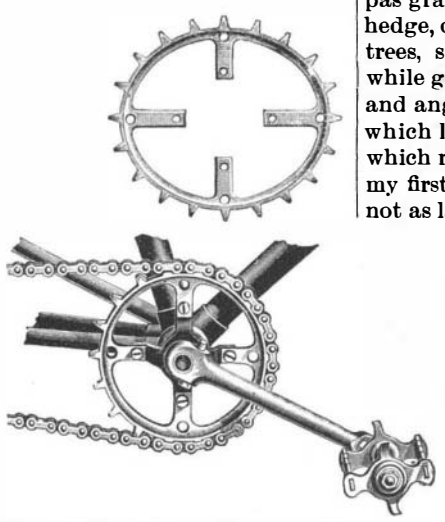
We show in this connection the new front wheel



NEW PEDAL.



FRONT WHEEL BRAKE.



SPROCKET WHEEL WITH DETACHABLE RIMS.

brake, which is used with this model. The newly designed forged spoon will be found strong and effective, while so acting on the tire as to reduce to a minimum any danger of wearing or cutting.

A novel feature of all models is the new front sprocket wheel, shown in illustration, the rim of which is easily and quickly detached without removing the pedal. By providing himself with one or more extra rims, either round or elliptical, and detachable chain links, any rider may effect a change of gear as required with little labor or delay.

A new pedal will also attract attention on account of a great saving in weight as well as additional neatness in appearance. These pedals are made in three widths, 3¼, 3⅝, and 4 inches. The great elasticity of the pneumatic tire admits of doing away with some of the rubber used in the old style pedal, making a saving in weight in this as well as in the frame.

Among other specialties announced for this year are the new Hartford double tube tire and the adoption of wood rims in some of the lighter wheels. The Columbia seamless tube is used in the construction of the frames. This is the strongest for its weight ever used by the Pope Company and the most uniform in gauge and tensile strength, as not only established by their own tests, but by those of the government testing department at Watertown, Mass.

The steady advance made by this company, the pioneer in the cycle industry in this country, is well known, and the great interest aroused on the subject of good roads is due to the persistent work of Col. A. A. Pope.

The reduction in price announced will be welcome intelligence to the great number interested in bicycling, and will cause these wheels to be used more widely than heretofore.

The forty-eight page catalogue issued by this company is profusely illustrated and beautifully printed. It will repay careful examination by any one interested in bicycling. All of the different wheels and parts are fully described. These catalogues may be had, free of charge, at any office or agency of the company, or will be mailed on receipt of four cents in stamps from their offices in Boston, New York, Chicago or Hartford.

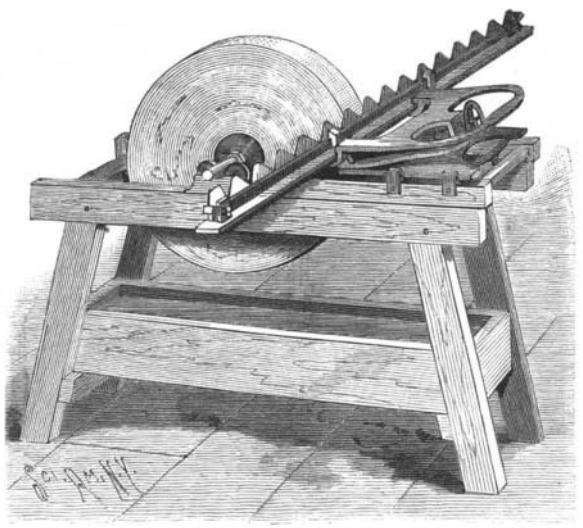
The Humming Bird at Home.

While spending the winter in California, I made my first acquaintance with Madam Hummingbird "at home." In the first place the location could not have been improved on. Just picture in your mind a lawn dotted with orange, lemon, fig, and palm trees, with here and there a giant century plant, or bunch of pampas grass and no end of flowers. While a cypress hedge, overshadowed by stately eucalyptus and pepper trees, separated the lawn from the street. One day while gathering oranges, I was startled by the rapid and angry darting of a humming bird near my face, which led me to look closely in that part of the tree, which resulted after a little search in the discovery of my first humming bird's nest. It was placed on a twig not as large as a lead pencil, on one of the lower limbs of the orange tree, and it was so covered with lichens the same color as the bark of the tree that it was difficult to find it again even after I knew about where it was. The nest is about the size of the burr oak acorn cup, built almost entirely of the feathery plumes of the pampas grass, covered with green lichens, and all held together, and to the limb, with something greatly resembling spider web. Within this "marvel of construction" were two semi-transparent eggs, almost too small to describe, and my efforts to use the blowpipe on them blew them all to smithereens.

Before taking the nest, I visited Madam Hummingbird several times, and nearly always found her at home. She never left the nest but a few minutes at a time.—*Frank Ford, Mag. of Nat. Sci.*

AN IMPROVED SICKLE GRINDER.

This is a device which may be attached to the frame of an ordinary grindstone, to support the sickle in the proper position against the stone in grinding, preserving each section of the sickle uniformly true from heel to top. The improvement has been patented by Mr. Thomas Gordon, of South Bend, Wyoming. The base plate of the adjusting frame slides in guide cleats secured upon the beams of the grindstone frame, and on the base plate is a bed adjustably connected with the plate by means of a set screw serving as a pivot and another set screw in a segmental slot, the slot having at one side a scale to indicate how far to the right or left the bed is to be moved to give the proper beveled settings to different sized sections of the sickles. Pivotally connected with the bed is an adjusting frame having an outer handle section and opposite extensions in which are slideways adapted to receive a sickle-carrying bar, for holding in position the sickle to be ground. Near each end of the carrying bar is a post with pivoted yokes

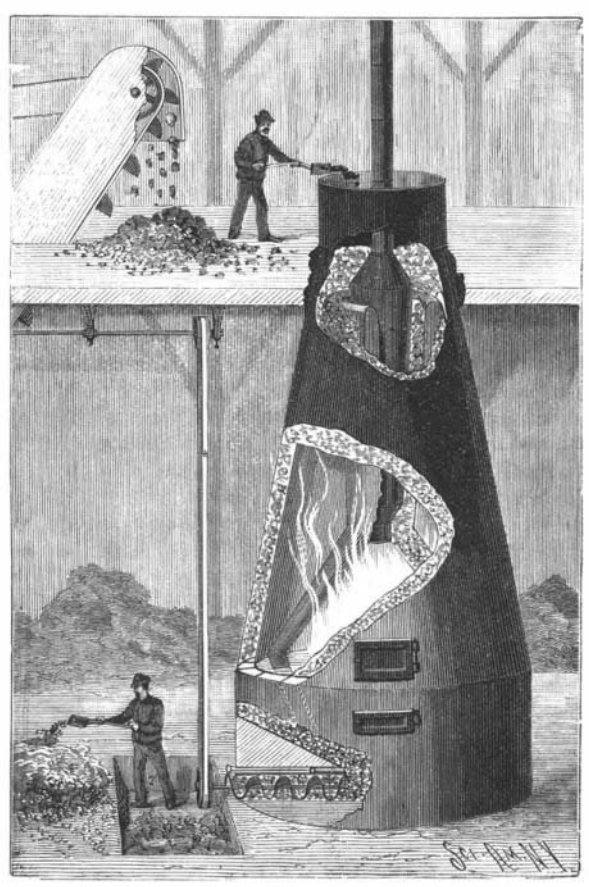


GORDON'S SICKLE GRINDER.

adapted to be clamped in any position they may be set, while intermediate posts are adapted to support the sickle bar to prevent its springing away from the stone during the process of grinding. The base is kept fed to the grindstone by a spring connected with a bracket, and the carrying bar may be manipulated by a shaft on whose outer end is a hand wheel, its inner end carrying a pinion meshing with teeth on the under face of the bar, the latter being carried either to the right or left by turning the hand wheel, it being designed that one revolution of the shaft shall carry the sickle to the right or left the length of one section. Instead of operating the sickle-carrying bar by means of this shaft, it is in many cases slid by hand either to the right or left. In use the stone is maintained perfectly square across its full face, the sickle sections passing over and across the entire face surface of the stone. The machine may also be adapted to the uses of an ordinary grindstone. Further information relative to this invention may be obtained of Mr. J. G. Pratte, Cheyenne, Wyoming.

AN EFFICIENT AND CONTINUOUS DRIER.

This improved drier, patented by Mr. William Harmon, of Bartow, Fla., is designed to save all the heat, the material to be dried being fed directly over the fire, while large quantities may be continuously treated, the material being carried down through the drier by gravity. Within the shell is a grate, beneath which is an ashpit, secured to a horizontal partition, suitable doors and air inlet apertures being provided, and within the conical part of the exterior shell is an interior concentric shell forming an outer annular space for the passage of part of the material to be dried, the lower end of this space being adapted to be closed by a series



HARMON'S DRIER.

of hinged segmental trap doors, which swing downward to discharge the material on the withdrawal of supporting pins. A suitable distance above the grate, and centrally in the drier, is a pipe leading to the funnel-shaped end of an inverted cone-shaped flue, and this flue is surrounded by a concentric shell, forming with the smoke flue an inner annular space for the passage of part of the material to be dried, another heating chamber being thus formed directly above the grate bars, and having cone-shaped discharge pipes under the ash pit. In the cylindrical lower end of the shell is an inverted cone-shaped bottom, over which the finally dried material passes through a central outlet, opened and closed by a horizontal gate adapted to be operated by a rod, the material being thence conveyed to the outside by a conveyer screw on a shaft actuated from any suitable source of power. In the smoke flue are openings through which may pass off steam or gases from the material being dried, and in the top of the exterior shell are gauges indicating the amount of material in the inlet portion of the drier. The construction may be durable without being expensive, and is not liable to get out of order in operation. It is designed for a wide variety of uses, as drying grain, phosphates, etc., a size which will hold twenty tons of rock presenting 700 feet of drying surface, and being designed to dry from twenty to thirty-five tons per hour. The ordinary cost of drying with this improvement is estimated at about five cents a ton.

Scientific Experts in Court.

One of the papers read before the American Chemical Society, at its recent meeting in this city, deserves special mention. It dealt with the subject of expert testimony in cases of capital crime, where the chemist is called in to analyze parts of the human body, with a view to ascertain the presence of poisons in the vital organs. The paper was prepared by a man of experience in such matters, and after citing numerous instances in which he had been summoned himself to give testimony, he advanced the theory that the chemical or medical expert engaged in murder trials should be summoned by the court rather than the lawyers on either side in the case. The wisdom of the proposed innovation turns upon the duty of an expert in a murder trial. Under existing circumstances he is expected to answer only the questions propounded, and the idea prevails among criminal lawyers that the expert belongs to the side which employs him, and that his testimony must fit into their theory of prosecution or defense.

The paper, however, showed the folly of pursuing such a course in the matter of expert testimony, and the writer citied an instance in which the analysis of a man's stomach showed the presence of both zinc and arsenic. The zinc was undoubtedly injected into the body in the process of embalming, and the supposition was that the arsenic was taken before death and was the cause thereof. But the chemist was not allowed to mention the presence of zinc during the trial, and the favorable doubt which its presence in the analysis involved was not allowed to go to the credit of the prisoner. In other words, the witness was not permitted to state the truth and the whole truth.

The most unsatisfactory results brought out in modern criminal trials center in expert testimony. Not only do learned chemists and physicians contradict each other, but their testimony serves to befog the jury and often leads to disagreement where no reasonable doubt would exist otherwise. The proposition that the expert in trials involving the death sentence should be summoned by the court and be answerable only to him, as the court stenographer is, is one which deserves thoughtful consideration on the part of the American people. A reliable chemist, brought into a murder trial by the court for the express purpose of finding out the truth, whoever might be affected, would serve to bring about a new state of affairs in ordinary criminal trials.—*Baltimore Herald.*

The Great Wall of China.

It would seem from the account of this extraordinary work that there was a time when the Chinese possessed a most remarkable persistence and were masters of what is even now one of the greatest wonders in existence.

This great wall was recently measured by Mr. Unthank, an American engineer engaged on a survey for a Chinese railway. His measurement gave the height eighteen feet. Every few hundred yards there is a tower twenty-five high. The foundation of the wall is of solid granite. Mr. Unthank brought with him a brick from the wall, which is supposed to have been made 200 years B. C. In building this immense stone fence to keep out the Tartars, the builders never attempted to avoid mountains or chasms to save labor or expense. For 1,300 miles the wall goes over plains and mountains, and every foot of the foundation is of solid granite, and the rest of the structure solid masonry. In some places the wall is built smooth up against the bank or crosses a precipice where there is a sheer descent of 1,000 feet.

Small streams are arched over; but on the larger streams the walls run to the water's edge and a tower is built on either side. On the top of the wall there are breastworks or defenses facing in and out, so that the defender's forces can pass one tower to another without being exposed to an enemy on either side.

To calculate time of building or cost of this wall is beyond human skill. So far as magnitude of the work is concerned, it surpasses everything in ancient or modern times of which there is any trace. The Pyramids of Egypt are nothing compared with it. I have heard Chinamen in California tell about it, but scarcely believed their stories. J. E. EMERSON.

A Method for Increasing the Contrast in Photographs.

If the negative is very weak, print until the shadows are darker than is desired in the finished picture. There is quite a little latitude in the printing, and experience will soon teach the right amount. Tone as usual, but bear in mind that under the following treatment the silver, not the gold, is dissolved, so that the finished print will have the appearance of having received further toning. If an absolutely black and white picture is desired, the toning should be carried tolerably far.

After toning immerse in the following, which should be made up fresh for each batch of prints:

Ferricyanide of potassium	1 gr.
Water	16 oz.
Nitric acid	30 minims.

Leave in this for from one to five minutes, according to the contrast needed. The time cannot be told accurately by the appearance of the prints, for they are reduced very little in this solution.

After removing, wash slightly and place in fixing bath, which is made as usual; and in the case of Solio paper, use the formula given by the makers. In the fixing bath the prints rapidly become lighter, and if they have remained long in the previous bath the contrast produced will be very great. Leave in the fixing bath perhaps a little longer than usual to insure the removal of all the silver salt. When fixed, wash as thoroughly as usual.

The reduction is due to the solution of the silver by the ferricyanide, and the increase of contrast may be easily explained as follows: Let the amount of deposit of silver per unit area on one part of the print be denoted by a and the deposit on a less dense part by b. Also let x denote the amount of silver per unit area dissolved by the solution. Then the ratio of the two deposits, that is the contrast, will be a / b.

After the solution of the silver this becomes $\frac{a-x}{b-x}$, which is greater than $\frac{a}{b}$, the original ratio. If the reduction is carried so far that $b = x$, then the ratio becomes $\frac{a-b}{a} = \infty$; that is, the high lights will be white, while the shadows will equal the difference between the original densities. If the solution is allowed to act after this point is reached, of course no change can take place in the high lights; but the shadows will be continually decreased.

It may also be shown algebraically that the deeper the pictures are printed, the greater the contrast will be after the treatment.

Assuming that the ratio of the densities between any two parts of the print remains constant, any further printing would multiply a and b by the same quantity, say r. This assumption is not rigorously true, for it has been shown that a certain amount of light acting for a certain time on a sensitive surface will have a greater effect than half the light acting for twice the time; that is, the action on the sensitive surface does not vary directly as the amount of light.

It does practically, however, so that for our purposes the densities become ra and rb respectively, which by the action of the ferricyanide become $ra - x$ and $rb - x$, the ratio of the densities becoming $\frac{r\,a-x}{rb-x}$, which is greater, r being positive, than $\frac{a-x}{b-x}$.

However, since there is only a limited amount of silver salt in the paper, there can be but a certain amount of silver deposited; so that by very long printing the contrast is diminished, the high lights catching up, as it were, with the shadows.

If, in the ferricyanide solution, the nitric acid be omitted, the print may be left in the solution until it assumes the desired shade; and it will not be reduced any further in the fixing bath. The objections to omitting the acid are: The print is almost sure to be discolored, the grain of the paper is liable to show, the coating of the paper is sometimes eaten off in places, and it is more difficult to get the required contrast.

The action of the ferricyanide of potassium, without the nitric acid present, is to form with the silver a soluble double cyanide; but when the acid is present, it probably breaks this up, forming an insoluble cyanide, which afterward dissolves in the hypo. solution.

Either under or over exposed negatives can be made to yield quite presentable pictures by this method, and it would be of value wherever pictures with great contrasts are required, as for wood engravings.

Whether such prints are permanent, the writer has not had time to determine; but a few made a year ago show no change whatever, and in the opinion of the writer there is no reason why they should not be as permanent as ordinary prints, if not more so.

F. H. V.

The Latest Determination of the Sun's Distance

An extensive series of observations was made in 1889 upon the planet Victoria (asteroid No. 12) for the purpose of ascertaining the distance of the sun, and incidentally also the mass of the moon—quantities which to the uninitiated would seem to bear no obvious relation to the motions of the little asteroid, though in fact the connection is close and positive.

The work was very thoroughgoing, involving the cooperation of no less than twenty-one different observatories in determining with their meridian circles the places of the stars which were used as reference points along the planet's track. Then all through the summer the position of the planet itself, with reference to these stars, was assiduously observed by Gill and Auwers at the Cape of Good Hope, by Elkin and Hall at New Haven, and in Germany by Hartwig at Gottingen and by Schur at Bamberg. The instruments employed in their observations were heliometers of the most perfect construction, and the measurements made with them rank among the most accurate and refined known in astronomy. Altogether, between June 15 and August 27, while the planet was near its opposition and for a time at a distance from the earth less than four-fifths the distance of the sun, over eight hundred complete sets of measures were secured, and only six nights were wholly missed.

The reduction of this mass of material has occupied nearly three years, and the result has only just been published. Dr. Gill, who originated the campaign and has reduced the observations, finds for the parallax of the sun 8·809″, corresponding to a distance of 92,800,000 miles; and he further finds that the hitherto accepted mass of the moon must be reduced somewhat more than one per cent to satisfy the observations; in other words, the earth's monthly swing, due to her motion around the common center of gravity of earth and moon, was found to be about one per cent less than had been assumed. It is interesting to note that this newest value of the solar parallax agrees to the very last decimal with that deduced two years ago by Professor Harkness in his elaborate "least square" discussion of all the then available data relating to the constants of the solar system. The still outstanding error in our knowledge of the astronomical unit can hardly be as great as one part in a thousand.—*Prof. C. A. Young, in the Cosmopolitan.*

Fermentative Dyspepsia.

In nearly every case of functional dyspepsia that has come under my observation within the last ten months I have begun the treatment by giving five grains of bismuth subgallate, either before or after each meal. In some cases it seems to act more favorably when given before meals, and in others its action is better if taken after eating. In studying my records and memoranda of cases, I find that the treatment by salicin has often been unsatisfactory. The proportion of unsuccessful cases was about 25 per cent, but in some cases the effects of this remedy given alone have been remarkable. I have full records of one case of severe dyspepsia of ten years' standing that was completely relieved in a week without any return, now for more than a year. The bismuth subgallate, however, is almost a specific in cases of purely functional dyspepsia with flatulence.—*Dr. Austin Flint, N. Y. Medical Jour.*

Propagation of Fish.

The annual report of the New York State Commissioners of Fisheries says that last year the commissioners succeeded in distributing over 80,000,000 of the best varieties of fish in the waters of the State. This exceeds by 50 per cent the production of any previous year. The commissioners have given their greatest energies to the artficial propagation of shad, pike, perch, whitefish, tomcods, smelts, lake trout, frostfish and lobsters. Owing to the liberal stocking done by the commission, tomcods and smelts were never so abundant in the streams as they have been during the last two seasons, and immense catches have been made in Long Island Sound and its tributaries.

The Poison of Influenza.

The ptomaine extracted from the urine in cases of influenza is a white substance crystallizing in prismatic needles, soluble in water, and of a slightly alkaline reaction. It forms a hydrochlorate, a chloroplatinate, and a chloraurate, all crystalline. It gives a brownish precipitate with phosphotungstic acid, a yellowish with phosphomolybdic acid, a yellow with picric acid, and a red with tannic acid. The composition of this base is $C_5H_9NO_4$. It is poisonous, inducing a strong fever and death in eight hours. It is not met with in normal urine.

The Cocoanut Tree.

This palm does not grow spontaneously on Key West or on any of the other Florida islands, as the violent north winds which often prevail in winter reduce the temperature of southern Florida too low for this heat-loving tree, although when planted and cared for while young it grows to a moderate size on the keys, and sometimes bears fruit; otherwise the nuts which are cast upon those shores by the Gulf Stream would have produced plants that would gradually have covered them, for it is in this way that the cocoanut has been able gradually to spread over all the sandy coral shores of the tropics of the two worlds. The place of its first home is uncertain. It was believed by the younger Candolle to have first appeared on some of the islands of the Indian Archipelago, whence it was carried either by ocean currents or by man to the southern coast of Asia, east tropical Africa, and to the islands and shores of Pacific tropical America. Undoubtedly it was brought by man to the West Indies and Brazil after the discovery of America by Europeans, although it has now so spread, through the action of ocean currents or by the agency of man, that it has every appearance of being indigenous on the shores of east tropical America.

The cocoanut palm is a magnificent plant, well named "a prince of the vegetable kingdom," with tall, slender columnar stem eighty or a hundred feet high, and rich pale yellow-green leaves which are thirty or forty feet long, and flutter and rustle with every breath of wind.

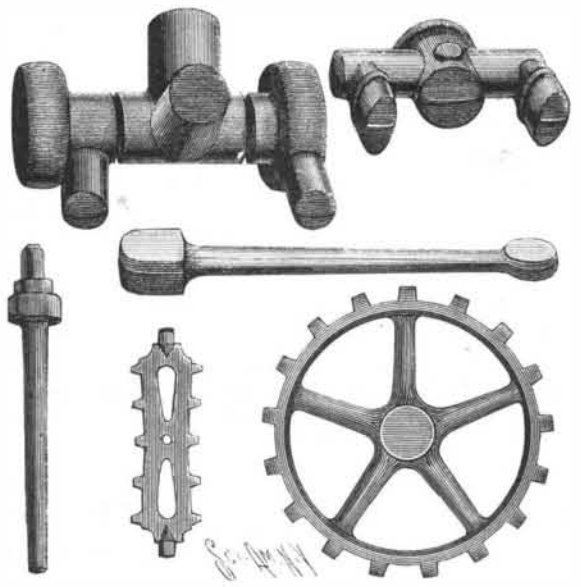
The cocoanut grows only near the shore, where its roots, penetrating the sandy soil, may drink freely from clear underground springs. Of all trees it is the most useful to man, furnishing food, shelter and employment to hundreds of thousands of the human race. In tropical countries, especially in southern India and Malaya, the cocoanut supplies to whole communities the chief necessities of life. Every part is useful; the roots are considered a remedy against fevers; from the trunk houses, boats and furniture are made; the leaves furnish the thatch for houses and the material from which baskets, hats, mats and innumerable other articles are made; the network of fibers at their base is used for sieves and is woven into cloth; from the young flower-stalks a palm wine, called toddy, is obtained, from which arrack, a fiery alcoholic drink, is distilled. The value of the fruit is well known. From the husk, which is called coir, commercially, cordage, bedding, mats, brushes and other articles are manufactured. In the tropics, lamps, drinking vessels and spoons are made from the hard shells. The albumen of the seed contains large quantities of oil, used in the East for cooking and in illuminating; in Europe and the United States it is often made into soap and candles, yielding, after the oil is extracted, a refuse valuable as food for cattle, or as a fertilizer. In some parts of the tropics the kernel of the seed forms the chief food of the inhabitants. The cool, milky fluid which fills the cavity of the fruit when the nut is young affords an agreeable beverage, and the albumen of the young nut, which is soft and jelly-like, is nutritious and of a delicate flavor.

As might be expected in the case of a plant of such value, it is often carefully and extensively cultivated in many countries, and numerous varieties, differing in the size, shape and quality of the fruit, are now known. The cocoanut is propagated by seeds; the nuts are sown in nursery beds, and at the end of six or eight months the seedlings are large enough to plant. The plants are usually set twenty-five feet apart each way in carefully prepared beds filled with rich surface soil. Once established, a plantation of cocoanuts requires little care beyond watering, which is necessary in its early years to insure a rapid and vigorous growth. In good soil the trees usually begin to flower at the end of five or six years, and may be expected to be in full bearing in from eight to twelve years. Thirty nuts from a tree is considered a fair average yield, although individual trees have been known to produce an average of three hundred nuts during a period of ten years. An application of manure increases the yield of the trees, although probably the value of the additional crop obtained in this way is hardly large enough to justify much expenditure.

In recent years the cocoanut has been cultivated on a very large scale in British Honduras, Jamaica and other parts of Central America, as well as on the northern coast of South America and the West Indies. The consumption of cocoanuts in the United States has become very large, as many as twenty millions being imported to this country every year. They are brought largely in steamers with other cargoes, although there are sailing vessels engaged in this trade exclusively, and last month two schooners discharged in this city, respectively, 170,000 and 260,000 nuts. Those which come from San Blas are considered the most desirable, since they shell more easily, while the meat is richer in oil and retains its flavor longer than others. Those from Baracoa are larger, but they lack oil and flavor, and cost less. After they are unloaded the nuts are sorted here and divided into three grades, according to size. The present price for select nuts from San Blas is $28.00 a thousand, from Jamaica $25.00, and from Baracoa $20.00, while the other grades are correspondingly lower; the lowest class, known to the trade as "eggs," brings only $10.00 a thousand. More than one-half of all the cocoanuts imported are bought by the confectioners, a single firm in New York using as many as forty thousand a month, and it is possible to fill this large standing order because importations are made all the year round. Of the remainder the larger portion goes to the desiccating establishments, while only a few are now sold in the stores in their natural condition.—*Garden and Forest.*

BICYCLE DROP FORGINGS AT THE CYCLE SHOW.

The production of drop forgings may be considered a distinctively modern development in metallurgy. Where a large number of pieces of identical shape have to be produced, such method becomes most available. The original dies are expensive, though their manufacture has been cheapened by utilization of the die-sinking machine, a tool which resembles a drill press, but which is provided with mechanism for feeding the die while it is being cut by a species of drill. In some cases a good deal of hand work is required to finish the die. For each forging operation a pair of dies are needed. One is mounted in the hammer head, the other on the anvil, and they are accurately adjusted so as to come together in the precise position required. Three classes of dies are used. The breaking-down dies are employed for the first attack upon the metal, to bring it to its approximate shape. These require special skill in their designing, the problems of approximating to the final shape being often very difficult. The finishing dies are the precise shape of the finished article with due allowance for shrinkage if required.



J. H. WILLIAMS & CO.'S BICYCLE DROP FORGINGS.

Finally, the trimming dies for removing surplus metal from the forgings may be applied.

It is not every forging which requires all three classes of dies. A single set may complete a simple shape. Where great accuracy is required, cold stamping is applied. This gives a finish to within 0·001 inch of the desired dimensions.

The testing of the finished dies before use is accomplished by pouring melted lead into their cavity, giving a casting which accurately represents the product they will give in steel.

At the recent bicycle exhibition held in this city, much attention was excited by the exhibit of drop forgings of the firm of J. H. Williams & Co., of Brooklyn, N. Y. This included a variety of bicycle parts aptly designated the "keystones of the wheel," so smoothly finished as to be almost ready for the nickel plater or enamel oven.

Some typical forms are shown in the accompanying cut. The sprocket wheel, pedal pin, pedal foot plate, crank arm, crank bracket, and front fork crown are shown. As they leave the dies, the pieces are almost perfect. On the round pieces, such as the pedal pin, no fin exists. A little polishing, boring out, turning and threading in places, completes these articles. It is clear that the day of castings in bicycles is gone forever.

Rustless Coating for Iron, Tinning and Enameling.

The following is a translation given in the *Journal of the Society of Arts*, by Mr. Frederic W. North, of a paper read before the Paris Societe d'Encouragement by M. Octave de Rochefort-Lucay, on the new Bertrand processes for coating with magnetic oxide and enameling iron and iron carburets, and on a new process of tinning for cast iron.

Messrs. Barff and Bower were the first to practically coat iron, steel, and cast iron with magnetic oxide, so as to form, at the cost of the metal itself, the protective layer that is obtained usually from paint, or from enameling, etc., with a thin coating of a metal that is not oxidizable.

The Bertrand processes are more simple than those of Bower and Barff, and are based on a new discovery in chemistry, and may be stated thus: If a thin adherent film of another metal is formed on the wrought iron or on the cast iron, and this iron or cast iron, heated to 1,000°, is exposed to a current of oxidizing gas, the oxygen penetrates through the film, oxidizes the iron or the cast iron, and under these conditions, magnetic oxide is the result. The formation of magnetic oxide, thus obtained, continues indefinitely, and the thickness of the coating of oxide increases according to the period of exposure to the oxidizing current, provided the temperature remains at about 1,000°.

As to the film of metal deposited in the first instance, it disappears in some obscure way, forming oxides which mingle with the magnetic oxide or volatilize according to the nature of the metal of which they are composed. M. Bertrand had then to find the best metal and the best method for depositing it on the article to be coated, and he has found that bronze, a mixture of copper and tin, gives, from a practical point of view, every satisfaction. For depositing this bronze on the wrought iron and cast iron, M. Bertrand uses electricity or wet baths, and uses sulphophenolic acid.

The following is the method adopted in the Bertrand manufactory for an oxidation: The article is cleansed (the cleansing is not indispensable), then dipped a few moments in a bath containing a solution of sulphophenate of copper and tin. The coating of bronze being formed, the article is immediately washed with cold water and dried with sawdust. The article dried is put into a furnace. Oxide forms, and at the end of fifteen to thirty minutes (according to the articles) the article is taken out, sufficiently oxidized. The coating produced varies from $\frac{1}{10}$ to $\frac{1}{2}$ of a millimeter.

M. Bertrand uses electricity to ascertain if the coating is of sufficient and uniform thickness, and in doing so he makes use of bells. If in putting the two wires in contact with the oxidized article the bells ring, the current passes—the oxidation is insufficient; if it remains silent, the oxide formed is of sufficient practical thickness, because it prevents the electric current from passing.

Process for Tinning Cast Iron.—M. Bertrand has also used sulphophenolic acid to obtain tinning on iron. He dissolves salts of tin in a mixture of water and sulphophenolic acid at the rate of 1 per cent of tin salt and 5 per cent of sulphophenolic acid. In this mixture the article, which is previously cleaned, is dipped; and is at once covered with an adherent coating of tin, and afterward by the means of rotating brushes in wire and cloth, the coating of tin is polished, and a result obtained which is both effective and cheap.

Process for Enameling.—There are not more than two processes for enameling cast iron. In the first, called hot, the iron, heated to a vivid red, is powdered with a flux powder (borosilicate of lead), distributed with a sieve, then it is heated, and when the flux fuses, it is powdered afresh with glass more soluble, forming the glaze of the enamel. This process, the only direct enameling, is dangerous to the operator, and even impossible for large articles, nor does it allow of decorations. The second process consists of dressing the cast iron either by three distinct and successive operations in the furnace with a kind of pottery. In the Bertrand enameling, the article is first coated with magnetic oxide, then dipped in borosilicates of lead, colored by metallic oxides, in which is added a little pipe-clay in order to give rather more body. The article thus covered cold, by dipping or with brushes, is put into the furnace; the enamel adheres and vitrifies at the usual furnace temperatures used by enamelers. By putting a coating of colored enamel with a brush on a first coat simply plain, it is possible to make any decorations desired, which may be burnt in at one operation for outdoor vases, etc. These results, due to the first oxidation with magnetic oxide, are remarkable, as much for the color as for the tenacity of the enamel and its resistance to rough usage.

Chemical Method of Engraving on Wood.

M. Delaurier, in the course of his business, employed wooden agitators to dissolve the bichromate of potash or other salts, which he put into a mixture of sulphuric acid and water. These agitators gradually dissolved, without being carbonized, as would be the case with sulphuric acid alone, especially if at all concentrated; and without softening, either, as with nitric acid. M. Delaurier has not endeavored to ascertain why this should be so, although he has no doubt that the investigation would be of scientific importance and of interest to trade, but he suggests that his observation be utilized for a method of engraving on wood, the block being coated with a resist varnish, the design being drawn in with a point as when engraving on metal, then to etch away the wood by immersion in the following mixture:

Sulphuric acid	4 parts.
Soda bichromate	1 part.
Water	6 parts.

M. Delaurier made the experiment with perfect success.—*British Lithographer.*