A PUNCH CENTERING DEVICE.

BY THOMAS C. HARRIS.

Every mechanic who has occasion to punch holes in iron with a hammer and hand-punch, realizes how difficult a matter it is to place the punch in the exact position that it should be, over the hole in the die or punch-block.

The piece to be perforated is necessarily between his eye and the hole in the die, and, of course, conceals the exact spot where the point of the punch should start.

As usually done, a blow or two on the punch will show him *about* where the proper place is, but the iron is bruised and a clean punched hole not often secured.

In the regulation punching press, where the punch rises and falls with the thrust of the machine, its point exactly entering the hole in the die or block to receive it, the result is often as good as a drilled hole, with clean and sharp edges when the disk of metal has been accurately sheared out.

A simple device to center a hand-punch over a punching block or die, and thereby secure accurate work, is shown in the sketch.

The forked casting has sharp points on its lower extremities, where they rest on the bench or floor. At its upper end the fork is expanded into a disk and carries a short piece of pipe or sleeve, which is swiveled to it and secured by a wing nut. This allows the sleeve to swing in any vertical angle and may be fixed by the wing nut.

A short rod passes through the sleeve and is secured in any desired position by a thumb-screw.

At its free end the rod terminates in a disk, with a ring bolt and wing nut, to embrace the hand-punch. As shown, the punch is held vertically, but it may be inclined at any angle to suit the work.

It is readily seen that with this device the point of the punch may be instantly placed in position, to exactly register over the hole in the die, and while in that position the free end of the apparatus may be lifted and the piece to be perforated placed in position.

The lifting of the punch causes the device to rise or swing on its two sharp extremities, without slipping, and the punch returns to its exact position as predetermined on. A blow or two of the hammer drives out a disk in the metal and a clean-cut hole is the result.

This arrangement may be used to punch holes in any stock not too heavy for a hammer and punch method, either in the shop or the field, and the system allows a very accurate spacing of holes.

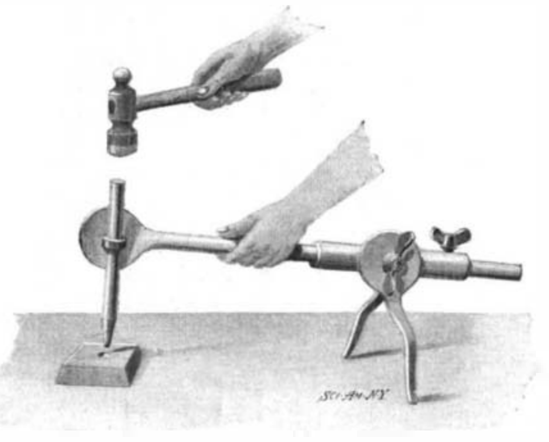
In shops or places where a regular punching press is not available this device will be found practical and useful.

It was designed by the writer for his own use and is not patented.

THE INCLINED PLANE OF THE MORRIS CANAL.

One of the most interesting historical transportation routes of this country is the old Morris Canal, in New Jersey, with its curious inclined plane for raising canalboats over considerable elevations. In the era before the introduction of railroads, considerations of the cost of construction and time of operation of locks naturally led engineers to seek for some more expeditious and cheaper means of overcoming elevations. This led to the occasional adoption, as in the Great Western Canal, England, of perpendicular lifts, and to the more extended use of inclined lifts or planes, the latter having proved to be at all times the more economical. Inclined planes seem to have been first used by the Chinese, but their modern application to canal systems is due to Mr. William Reynolds, who used them in 1792 on the Shropshire Canal, England. Subsequently, the system was carried into extended use throughout the canal system of England.

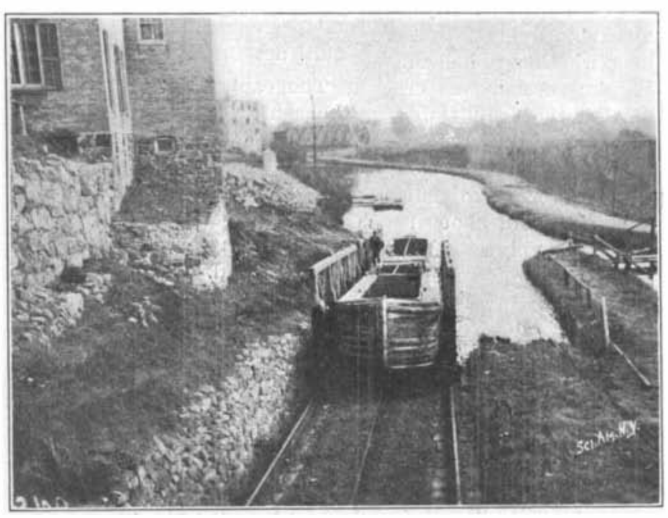
The Morris Canal was chartered in 1825; begun



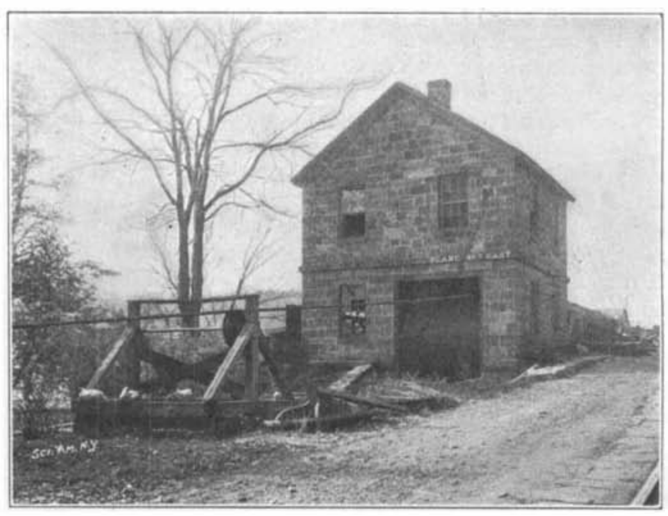
A PUNCH CENTERING DEVICE.

July, 1825; completed from the Delaware River to Newark in 1831; extended to Jersey City in 1836, and its planes and lock chambers were enlarged in 1841. Originally the dimensions of the canal were: bottom width, 20 feet; top width, 32 feet; depth of water, 4 feet; locks, 9 feet wide by 75 feet long. The planes were constructed on various plans, there being twenty summit and three lock planes in all. In 1845 the canal was enlarged to a bottom width of 25 feet, top width of 40 feet, and the depth was increased to 5 feet. The section boats, jointed in the middle, were first introduced in 1845. They carried cargoes of 45 gross tons. In 1850 and 1860 all the planes were altered to summit planes and adapted to wire rope haulage. The most remarkable of these is the one near Washington, New Jersey, which has a rise of 100 feet in a length of 1,600 feet. The summit of the canal is at Fort Morris, 41.34 miles from the Delaware River, and 60.80 miles from the Hudson River. The whole length of the canal is 102.14 miles. The boats, which are constructed in two sections to accommodate them to the changes of level of the planes and the canal levels, are jointed together by latches and steadying pins, the ends bearing against each other. Transverse bulkheads separate the two compartments of the boat, each of which is actually a boat in itself. While the average tonnage is about 65 tons, the planes can transfer boats of 100 tons weight. The trucks, like the boats, are divided into two sections, each section having eight wheels with double flanges on the wheels. They are provided with strong stanchions to which the boats are fastened with hawsers. The tracks on which the trucks travel are carried a short distance under the water of the lower bay and rise up the incline above the water level of the upper reach, then descend into the upper reach and run a few feet along the bottom. The grade of the inclines is in general about one to eleven. The planes are worked by reaction waterwheels, and the levers for regulating the supply of water and for the control of the brakes are in charge of a man who is located where he can see the whole of the plane. He is stationed in a building containing the waterwheels and other machinery, which is usually located midway between the top and bottom of the plane, and at the end of the flume. As indicating the relative economy of this system, it should be mentioned that the quantity of water needed for these wheels is less than one-twentieth of the amount expended in a series of locks of the same total height or lift. The wire cables are so arranged that as one winds upon the drum the other unwinds. The two ropes pass around submerged horizontal sheaves at the bottom and top of the plane. The car has a wire rope attached at both ends, the back rope to one section and the main rope to the other. To draw a car out of the lower reach and up the plane into the upper bay, the engineer turns the tubwheel, which lets the water into the reaction waterwheel, and the drum winds up the cable at one end and unwinds at the other, drawing the car up. In descending, the water is shut off from the wheel, and the car is allowed to descend by its own weight.

Although the system is an exceedingly old one, there is no doubt that this method of transfer was well adapted to the needs of the canal at the time it was built. There are certain undoubted advantages in the system as compared with the system of locks; for although one lock is more economical than a short plane, a single plane is more economical than a series of locks of the same total lift, the economy being chiefly in the items of water and time. While a plane entails more machinery, etc., it does not involve so much as to make it more expensive than five or six locks in series. In conclusion it must be remembered that what has been said applies merely to canals of small capacity such as this old Morris Canal. The system would not be applicable to a modern canal of large size and capacity.



Commencing the Ascent of a Plane.



Building Containing Waterwheel and Winding Drum.

At the Summit of an Inclined Plane—Car and Boat Entering Upper Reach.

THE INCLINED PLANES OF THE OLD MORRIS CANAL.

MAKING A PHOTOGRAPHIC LENS

Photography as a pastime holds the infatuated attention of thousands of people, old as well as young, to whom the possession of a camera is a necessity, awakening, as it does, a higher sense of the beautiful in nature and a growing love for the artistic as well as useful phases of photographic work. To take good pictures is a delight; to understand the chemistry of photography makes it fascinating; to watch the comparatively simple yet wonderfully interesting processes through which a piece of glass must pass before it is useful as a high-grade photographic lens


FIG. 1.


FIG. 2.


FIG. 3.


FIG. 4.

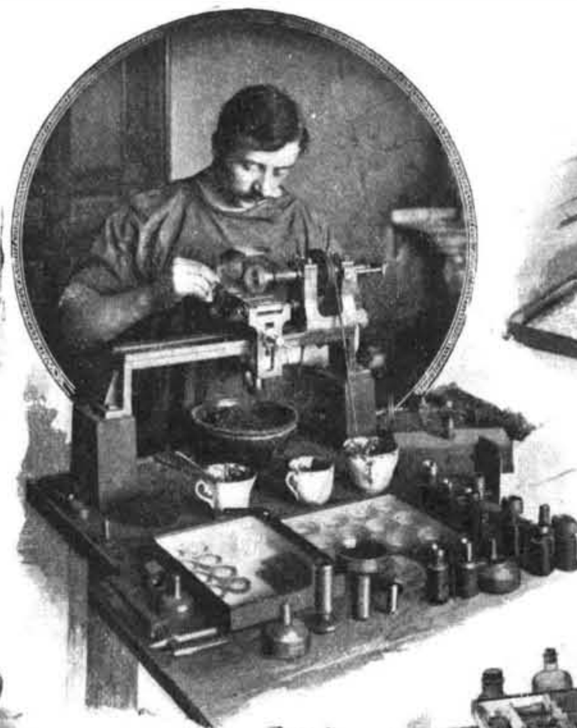


FIG. 5.


FIG. 6.


FIG. 7.


FIG. 8.


FIG. 9.


FIG. 10.


FIG. 11.


FIG. 12.


FIG. 13.


FIG. 14.

VARIOUS PROCESSES IN THE MANUFACTURE OF A PHOTOGRAPHIC LENS.

—the most important element of one's whole outfit—is an education, giving a clearer idea of the value of a first-class lens, establishing the fact that science is required in lens making. In fact, to the uninitiated the precision required in manufacturing high-grade lenses is astonishing, the greatest possible accuracy of calculation, to say nothing of care in grinding, polishing, etc., being necessary before a lens is ready for use in the camera.

Nowhere else in the world is there so large a manufactory of photographic lenses as that illustrated by the accompanying engravings from views taken in the works of C. P. Goerz, at Friedenau, near Berlin, Germany. The pictures herewith give no idea of the extent of the factory, which is four and a half stories in height, but they do clearly illustrate the various lens-making processes.

Few manufacturers of photographic supplies have made more rapid strides than the optical institute of C. P. Goerz, which was founded in 1888 as a small shop with three workmen. Four years later the number of workmen had increased to seventy, and a rapid growth in the business followed the introduction in 1893 of the double anastigmat lens, constructed according to the calculations of Herr v. Höegh, the scientific assistant of the firm. Eight years after founding the business, in 1896, the number of workmen employed had risen to 350, necessitating the building of the factory mentioned above, accommodating a force of 700 men. The output has steadily increased, making extensions necessary, and branch factories have been established in Winterstein (Thuringia) as well as in New York city.

The glass from which some of the smaller, as well as some of the larger, sizes of lenses are made is obtained in the shape of blocks such as are shown by one of the accompanying engravings (Fig. 14), the intermediate sizes being made from glass which was roughly moulded into shape while in a hot, semi-plastic state. At one time all sizes were made from square blocks of plate glass, in the use of which there was of necessity considerable waste of material in that the corners had to be chipped or cut off, causing a waste of time as well as labor. The glass must be of the very best quality, free from spots and strains, and as transparent and colorless as possible. What are termed the "optical constants" of the glass are ascertained, and the blocks are properly marked and cut up into slabs of varying lengths and thicknesses by means of thin galvanized iron disks whose cutting edges are set with diamonds. This operation is clearly illustrated by Fig. 9, where two workmen are shown, one cutting off the corners of a block of glass, the other having a block in the machine and measuring the thickness of another in his hand.

The corners of the glass blocks are broken away by means of flat pliers called shanks, this operation being known as shanking or nibbling, giving a rough approximation to the required circular form of the lens. This having been done, the glass is ready for the various grinding operations. First the "blank" is reduced to the required thickness by grinding with wet sand on flat rotating cast-iron disks in the manner indicated by Fig. 12. The edges of the glass blanks are smoothed by rotating disks in the edge or face of which are recesses for that purpose. Then follows the rough working of the curved surfaces or rough grinding, which is done in the shop, shown by Fig. 2.

In the rough grinding process the workman holds the glass with both hands and presses it against the rapidly rotating grinding shell, as indicated by Fig. 1, the grinding shell being kept covered with wet grinding sand, the operator being careful to have the grinding action continuous and evenly distributed over the entire surface to be ground or shaped. The cast-iron grinding shells, of which several types are shown in the foreground of Fig. 8, are either concave or convex, according to the shape of the lens to be made. Upon the uniform exactness of the shape or curve of the grinding surface depends the quality of the lens, and for this reason the shells are frequently examined for imperfections due to uneven wear, being discarded when they are found to be inaccurate. Skillful grinders, by exerting uniform pressure, preserve the proper shape of the shell until it is entirely worn out, which occurs when about a hundred of the medium size lenses have been ground.

From time to time during the rough grinding process the lens is tested with calipers and gages or templates, the latter consisting of brass plates the edge of which is given the same degree of curvature as the lens being ground, but in the opposite direction. In other words, a convex template is necessary in testing the curvature of a concave lens and vice versa. The workman places the template vertically on the lens and ascertains whether the edge of the template touches the lens at all points. The calipers, of which several are shown in the views herewith (see Figs. 1, 8, 11, and 12), consist of two aligning rods between the points of which the thickness of the lens is measured. The rods may be moved toward or from one another, one of them being graduated, a vernier indicating the distance between the points of the two rods and hence the thickness of the lens within one-twentieth of a millimeter.

Having been rough-ground to its approximate shape and thickness the lens is ready for the final grinding operations, the truing or figuring, and polishing. The truing or figuring is accomplished by using shells similar to those employed in the rough-grinding process, but the grinding materials are of finer quality, and the shells are mounted in machines or "mills" driven by foot pedals, the object of this arrangement being to secure greater accuracy. An enlarged view of one of these "mills," showing an operator engaged in "figuring," is presented in Fig. 11. The operation of figuring requires a degree of accuracy of which the uninitiated can have no adequate conception, for mechanical measuring instruments such as one would think might be employed fail to meet the requirements of accurate testing, and resort is therefore had to the observation of a physical phenomenon known as Newton's interference rings, which make their appearance with the prismatic colors of the rainbow, when the lens being ground is pressed closely upon a testing glass, of which several are shown in the extreme foreground of Fig. 14. The color, location, and regularity or irregularity of the rings indicate any departure from the correct surface, the test being so delicate as to clearly reveal the existence of an error as small as one ten-thousandth of a millimeter.

In order that the lens may be pressed evenly upon the rotating grinding shell the workman by means of a special sealing wax fastens it to a handle such as may be seen in the operator's hand (Fig. 11). Several of these handles, with lenses attached, are shown in Fig. 8, which also shows types of "common" holders to which several lenses are secured when they are of small size. Figuring is done exclusively with wet emery, progressively finer as the lens nears completion, the finest serving to give the lens surface its final mathematically correct shape, a most careful supervision of the results secured during the several stages of the work being effected by means of the testing glasses referred to above.

Polishing is the final operation of the lens-forming process, and this is done with rouge on automatic polishing mills such as are shown in Fig. 2. The operator covers the polishing shell with pitch into which he presses the lens, to the shape of which the pitch is thus carefully moulded. The polishing powder is then applied and the shell rotated. This operation of polishing is also constantly watched by the aid of the test glass, the average time required for the completion of the process being one day for a lens of five centimeters diameter. The finished lenses are again measured with an instrument called the spherometer, as illustrated in Fig. 10, and at the same time they are examined as to flaws in the glass. Small air bubbles are not detrimental, but lenses with spots or strains, the latter causing irregular refraction, are discarded, and the percentage of rejected lenses, or waste, is quite considerable, lack of skill on the part of the workman also often spoiling valuable lenses.

Bearing in mind that the modern anastigmat lenses contain from six to ten lenses in combination, and that the above-mentioned waste must of necessity increase the cost of production, it becomes apparent that such lenses must be high-priced because of the difficulties encountered in making a single perfect lens. Another factor which increases the cost of manufacture is the variation in the optical properties of the material furnished by the glass makers. Glass blocks forming part of different shipments from the glass works are almost never absolutely alike in their optical constants, and owing to this fact it becomes necessary to frequently repeat the calculations of the proper shape of the lenses, necessitating new grinding and polishing shells, new testing glasses, etc.

Putting the single lenses together to form systems or groups is the next operation. After being cemented together the lenses are centered by means of lathes of great precision, the lens being fastened to the end of the lathe spindle by means of putty. Looking into the lens, the operator then ascertains whether the images or reflections of any bright body therein remain stationary while the spindle is rotated. If necessary in order to fulfill this requirement he shifts the lens in the soft putty, and by means of a testing lever on the tool-rest of the lathe, as indicated by Fig. 6, the axis of rotation of the spindle is brought into coincidence with the optical axis of the lens. Then follows the grinding of the edge of the lens in the manner indicated by Fig. 5, and as soon as the proper diameter is attained the lens is removed from the spindle and combined in the joining room with a mating lens that has been treated in a similar manner. The Goerz double anastigmat lens consists of two equal halves or combinations, each containing three lenses, which are joined or cemented together with very thin layers of Canada balsam.

After carefully cleaning the lenses and coating them with warm balsam the operator presses them well together, as indicated by Fig. 7, placing them upon the joining plate of the leveling apparatus illustrated by Fig. 4, in order to center them, a balanced testing lever being used to reveal even the slightest inaccuracy in the position of the lenses. Having thus been combined the completed systems of single lenses are thoroughly examined as to their optical qualities by means of testing apparatus such as is shown in Fig. 13, located in a room from which light is excluded. A piece of ground glass ruled horizontally and vertically by equally spaced lines, and lighted from behind by a small incandescent electric lamp, serves as a testing object, which may be shifted to the right or left at will by the operator as he looks through the lens. The images of the lines as formed by the lenses must be clearly defined in the optical axis and also at a distance from it, and when the objective is turned about its axis the image of the object should remain stationary. The best or most favorable distance between the two lens combinations, that is, the interval with which the clearest definition is obtained, is also determined by the above apparatus within one-twentieth of a millimeter. Though this distance may have been determined beforehand by calculation, small corrections, of which careful memoranda are taken, are always necessary.

This having been done the lens systems are sent to the mechanical workshops, where they are mounted, and upon the character of the mounting almost as much depends as upon the perfection of the lenses, the greatest possible mechanical accuracy being necessary to assure the proper fitting of all the parts. The blanks for the mounts are turned, the tubes are sawed apart, and the flanges soldered in position in large shops, the threading and turning being done on specially designed automatic screw-cutting lathes like that shown by Fig. 3. Being assembled, the objective is now ready to be placed in the testing apparatus for examination as to its working as a whole. If the definition is as good within an angle of sixty degrees as at the axis, the objective is pronounced satisfactory, and is finally passed through the engraving machine to receive the proper inscription, etc.

As a concluding test, the objectives are examined in a testing studio to determine their photographic efficiency by taking pictures of large testing plates, the preceding tests being of a purely optical character. By these repeated tests for accuracy the buyer of such a lens as has been described in the processes of its manufacture is assured of getting only first-class goods and correspondingly satisfactory photographic results.

The Current Supplement.

Mr. Perkins concludes his interesting illustrated description of the new Berlin underground and elevated railway in the current SUPPLEMENT, No. 1402. The utilization of wastes and by-products in manufactures is a subject which has been admirably handled by Henry G. Kittredge. Sir William Crookes recently read a paper before the Royal Society on "Radio-Activity and the Electron Theory." The paper is reproduced in full in the current SUPPLEMENT. As a matter of comparative value, Professor J. J. Thomson's theories of radio-activity are likewise published. Readers will doubtless contrast these two papers with no little interest. The Report of the Bureau of Steam Engineering on "Liquid Fuel for Naval Purposes" is concluded. Among the minor articles may be mentioned those on the "World's Coal Production and Consumption;" "Oil and Grease Separator;" "Temperatures at Great Altitudes;" "A New Process for Treating Fine Iron Ores for Blast Furnaces;" "The Development of the German Chemical Industry," and "The Texas-Louisiana Oil Field."

H. L. Russell and E. G. Hastings describe a micrococcus, isolated from milk, the thermal death point of which is 76 deg. C. for an exposure of ten minutes. As the temperature is raised to about 70 deg. C. some of the cells begin to succumb, but a small residuum retain their vitality until 76 deg. C. is reached (Centr. f. Bakt., Zweit Abt., 8, 339). Using this organism, the investigators Russell and Hastings have carried out some interesting observations upon the increased resistance of bacteria in milk pasteurized in contact with the air. Heated in bouillon and in milk in closed vessels (sealed tubes) the thermal death point is approximately the same, viz., 76 deg. C., but in milk heated in an open vessel the organism survived a temperature of 80 deg. C. It was found that this resistance is due to the protection afforded by the membrane which forms when milk is heated while freely exposed to the air. for in samples of sterile milk which were "seeded" with the organism and heated in an open beaker to 80 deg. C., numerous colonies were obtained from the membrane on sub-culturing, while the milk below the membrane was sterile.—Nature.

Electrical Notes.

Connections have been made on the new telephone cable across Vineyard Sound between Vineyard Haven and the mainland, and communication by telephone has been established. The cable is four miles long, with terminals at Nobscot Lighthouse and Lamberton Cove, near Vineyard Haven, opening on the Atlantic.

The filament of an incandescent lamp is thrown into rapid vibrations in the cold state by the slightest disturbance. When the lamp is burning the oscillations readily die away. This is not due to a loss of elasticity, but is probably due to a magnetic damping effect. The incandescent filament may be kept in a state of vibration by the simple device of bringing a magnet into its neighborhood, provided that either the lamp or the magnet is fed by an alternating current.

Absolutely pure silver is produced in the United States mint by electrolysis of fine silver, using an electrolyte of silver nitrate with 1 per cent free nitric acid. From the bar of silver 0.999 electrolytic action throws the silver down in the form of crystals, which are washed. In melting these crystals the flux used is three parts fused borax and one part pure niter. The bar's second melting is made without a flux to remove the oxygen introduced by the niter of the flux. When the silver is thus melted it is stirred with a piece of dry wood as long as the action due to the presence of oxygen continues, then poured into a chalk-lined mold, the bar cleaned with a brush and dilute sulphuric acid, and after being rolled out is ready for use.—Mining and Scientific Press.

One advantage that often comes from the use of the electric motor for machine driving is the comparative ease with which it may be ascertained whether a particular piece of machinery thus driven is operating at its highest efficiency. This can be done by comparing the power consumed by the motor in driving it with the power used in driving another similar machine. For example, it has more than once been found that certain printing presses of a given make have been consuming from one to two horse power more than another similar press, notwithstanding that the makers pronounced their apparatus in perfect running order, and in consequence placed the cause of this discrepancy on the electric motor. A brake test of the motors or an exchange of motors quickly showed the fallacy of this contention, and an easing up of the bearings of the press in different places has usually sufficed to get rid of this waste of power. Increase of output of machinery driven by electric motors is, however, after all, the great desideratum which is achieved, and far outweighs in importance the several other advantages incidental to electric driving—the saving of head room, for example, the absence of long lines of shafting, and the avoidance of power wastes. Indeed, the value of the power, whether furnished by shafting or by the electric motor, as compared with the importance of increased product, is nearly negligible.—Cassier's Magazine.

The Centralblatt für Accumulatoren und Elemententkunde publishes details of tests carried out by order of the French Minister of the Marine with secondary cells of French manufacture—presumably for use on submarines.. The method of testing the durability of the cells was as follows: The cells submitted by the various manufacturers were connected up in series to form one battery, and were charged and discharged 250 times. A current of 330 amperes was used for the first charging operation for a period of four hours, and subsequent chargings were carried out with the same current for a period equivalent in ampere hours to a 50 per cent increase on the previous discharge from the battery. The discharge was carried out at 660 amperes, and was continued until the E.M.F. of any cell had fallen to 1.65 volts. Two chargings and dischargings were completed daily, and Sunday was observed as a rest day. The level of liquid in each cell was preserved constant by addition of water or acid during the period of the test. The cells which fell below 1.65 volts in less than half an hour from the commencement of any period of discharge were withdrawn from the series, and the plates submitted to a final examination in presence of a representative of the makers. The number of cells entered for the test was 21, these being submitted by thirteen manufacturers. The experiment continued from October 10 to March 17, and on the latter date only fiv[illegible] [illegible]lls were left as survivors of the durability test. [illegible] [illegible]llowing are the trade names and final E.M.F.'s [illegible] [illegible]se five cells: Heinz (1.860 volts), Union (1 [illegible] [illegible]olts), Metaux (1.772 volts), Max (1.714 volts [illegible] [illegible]lmend'Arsonval (1.650 volts). Of the above fiv[illegible] [illegible]s of secondary cells, the first four are manufactu[illegible] [illegible]clusively with pasted plates. The maximum [illegible] of accumulators for the French navy is fixed by [illegible] inistry at 225 kg. The Heinz cell had a total w[illegible] of 181 kg., of which 106 kg. represented the we[illegible] of the plates.

Santos-Dumont's New Balloons.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Santos-Dumont is constructing a new airship at the Lachambre establishment, which will be the smallest dirigible on record. With this minute airship he proposes to make the trip across Paris and land at the window of his apartment in the Champs Elysées. For this purpose he is having a special balustrade constructed of copper tubes. The balloon measures 18 feet in largest diameter and has a capacity of 260 cubic yards. It is somewhat egg-shaped, with a long point, and the length is about three times the diameter. This shape has been adopted in order to prevent the pitching movement of the airship. The framework of light pine will be suspended about 6½ feet below the balloon by 44 steel piano-wires. In the center of the frame is a Clement gasoline motor of three horse power, weighing but 26 pounds. The flywheel of the motor is a bicycle wheel of only 1.8 pounds weight. The screw has 10 feet diameter and makes 200 revolutions per minute. It is to give the airship a speed of 16 feet per second. The basket is made of wicker-work and measures but 16 inches square and 35 inches high, weighing only 12 pounds. The envelope of the balloon is of varnished silk and weighs 66 pounds, while the total weight of the airship when afloat is 460 pounds. The balloon will contain an air-bag of 60 cubic yards provided with a fan, to keep it swelled out. The balloon is to be first filled with illuminating gas in order to place the suspension wires and make the adjustments; finally it will be filled with hydrogen. The airship is to advance with the large end first, like Capt. Renard's balloon "La France," which was constructed in 1884.

This airship, the "No. 9," has the same general form as the large airship, the "Santos-Dumont No. 10," which is also in construction at the Vaugirard workshops; the latter is to carry 10 persons. As to his proposed trip across the Channel from Paris to London, the aeronaut stated that he had received two propositions, each from a well known person who wished his name kept secret for the present, offering him a prize of $50,000 for such a performance. One of these persons allows the aeronaut only three trials, while the other allows him five. In view of these restrictions, Santos-Dumont is not inclined to consider the offers, and remarks that M. Henri Deutsch allowed a period of five years for the Tour Eiffel trip, a distance of but 7 miles. The persons offering the prize stipulate that as a means of precaution no other aeronaut than Santos-Dumont is to make the attempt.

In a conversation lately held at Paris between Mr. James D. Phelan, former Mayor of San Francisco, and Santos-Dumont, the question turned upon long voyages, such as that from Paris to San Francisco. The aeronaut said that he was prepared to make such a voyage, and that if a number of San Francisco gentlemen could be found to put up a prize of $200,000, he would construct an airship at his own expense and make the entire trip on board of her, completing the undertaking within a year.

Another French Airship.

Among the new airships is that of Messrs. Paul and Pierre Lebaudy, which is being constructed near Mantes, and the trials are soon to be carried out above the Seine, so as to avoid accidents. The balloon is 192 feet long and 36 feet in largest diameter, containing 3,250 cubic yards. It is of peculiar shape, being flat on the under side so that it acts to some extent as an aeroplane. During the trials the car will be provided with a guide-rope 160 feet long, which will be attached below to a float in the river, this to be heavy enough to prevent the balloon from rising. As the ascensional force is often very suddenly increased by the sun's rays falling on the balloon, it is designed to prevent a sudden rising due to this cause. It has been found that when the dispersion of a cloud allows the sun's rays to strike the balloon, this may increase its temperature as much as 40 degrees C. above the surrounding air. In a balloon as large as the present one the rise of temperature would cause an expansion representing cubic yards, suddenly increasing the lifting power by 1,050 pounds. It is estimated that a float weighing half a ton will be sufficient to provide for this emergency. The envelope of the balloon, which weighs 0.6 pound per square yard or a total of 976 pounds, is formed of a layer of stout cotton cloth pasted on each side of a sheet of light rubber. The outside is coated with a yellow protecting substance, recently discovered and known as "ballonnine." It is found that this increases the tightness and also gives protection from the sun's rays. The fabric thus constituted is very resistant and a piece a yard wide will stand a test of 3,500 pounds tension. Its impermeability is unusual, as tests show a leakage of hydrogen of but 8 cubic inches per square yard in 24 hours, or practically nothing. Below the balloon is suspended a frame 68 feet long made of steel plates and tubes braced with piano wire. It carries a 45 horse power gasoline motor which operates two propellers placed on the right and left of the frame, thrown on by friction clutches. These two propellers answer for the driving as well as the steering.

Automobile News.

Insuring against automobile accidents is a new business enterprise which has had its origin in the accidents arising from the use of horseless carriages. The policies are issued to cover losses in a single instance, and are made out either for $5,000 or $10,000. It is said that steam-propelled vehicles have been barred, not because they are more dangerous to drivers or less easily controlled, but because records have proven that horses are more easily frightened by escaping steam than by any other cause.

Dr. Robert Hessler, of Logansport, Indiana, recently made a thousand-mile journey in a gasoline automobile. What is of more interest, he kept a detailed record each day of the number of miles traveled, the amount of oil consumed, and the cost of repairs on the road. On figuring up he found that he had used up seventy-five gallons of gasoline, worth $8, and that 85 cents had been spent on lubricants. That was all that was actually spent in operating the machine. During the journey one of the wheels was sprung, a tire was punctured, and a few bolts were lost. The repairs thus necessitated involved an expenditure of $10. It is no doubt likely that a similar outlay would have been incurred with any vehicle on a thousand mile trip.

Word has just been received from Paris that Henri Fournier has once more accomplished the feat of breaking the world's record for the mile and the kilometer. The trial was made on a new testing course between Ablis and St. Arnoult, near Dourdan, and the official figures are 47 2-5 and 29 1-5 seconds, respectively, for the two distances. This beats the mile record of Mr. W. K. Vanderbilt, Jr., made in France last August, by one second, and his kilometer record by one-fifth of a second, and is better by four and two-fifths seconds than Fournier's record-breaking mile made a year ago on the Coney Island boulevard, during the Automobile Club of America's speed trials. The record is equivalent to a speed of 75.9 miles per hour, which is scarcely exceeded by the new "Twentieth Century Limited" when spurting to make up lost time between New York and Chicago. At the present rate of increase it will be a very short time before the automobile capable of developing a speed of one hundred miles an hour will be an actual fact. Both of Fournier's records, as well as Mr. Vanderbilt's, were made on Mors racers.

Artificial Graphite.

Mr. E. G. Acheson, of caborundum fame, has recently taken out a United States patent for a process of making artificial graphite. In carrying out his experiments Mr. Acheson had observed that by the direct passage of a heating current through a mass of coke, it was possible to free the coke of many of its impurities and to increase its conductivity to a marked degree. Later he discovered that carborundum and many other carbides might be directly transformed into graphite simply by volatilizing the non-carbon element. It followed almost as a matter of course that the conversion of carbon to graphite by any method of electrical heating, depended upon the presence in the carbon of carbide-producing elements. It likewise followed that the impurities should be present only in such quantities as to permit the progressive transformation of the mass of coke into graphite, carbides being formed and decomposed, the volatilized non-carbon element combining with adjacent portions of the carbon. Mr. Acheson found that an artificial mixture of carbon with impurities was unnecessary, since non-coking coals and certain varieties of charcoal contain the proper minerals. As the present patent states, the original distribution of volatile impurities is important. For example, petroleum coke in the form of lumps and in rough admixtures of iron or iron ore, can be suitably heated in an electrical furnace, thereby causing the vapors of the metal so to permeate the entire mass as to determine its complete transformation into graphite.

Work on the Canadian Niagara power plant is progressing rapidly. The tunnel will have a length of 2,200 feet from the wheel pit to the base of the Horseshoe Fall, where it will discharge into the lower Niagara River. From the shaft to the pit the distance is about 900 feet, and of this length there remains only 48 feet to be blown out. From the shaft to the portal the length is about 1,300 feet, and of this distance about 200 feet remain to be taken out. For the entire length the bottom bench remains to be taken out, but this can be removed quite rapidly. When this bench is removed the stone will be used for concrete work and backing.