SCIENTIFIC AMERICAN

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NEW ELEVATED CABLE STREET RAILWAY, JERSEY CITY.

The North Hudson County Railway Company, of New Jersey, started the first elevated cable road in the State about four years ago. Beginning at Hoboken Ferry, it runs in a westerly direction to Jersey City Heights, where the old elevator now stands. From here the company are extending their new road in a southerly direction to the Hudson County Court House, a distance of 1⅛ miles. The foundations for the upright columns are made of brick, 5 ft. in height, 6 ft. square at the base, and tapering up to 3 ft. square at the top. Running through these brick piers at each corner are 1¾ in. bolts, which are fastened on the under side of piers. The bolt is first run through an iron washer 10 inches square, the under side of which has a square sunken socket, which the head of the bolt rests in. The brick work is then built over the upper side of the washers and around the bolts up to the template, which is the height of pier. A 1,550 lb. iron cap is then placed on the pier. The ends of the bolts are left far enough above the brick work to pass through the ends of the cap. This is fastened to the brick work securely by means of heavy nuts. On top of the cap are three narrow openings about 1 ft. in length. The columns are lowered into these openings about 1 ft. and molten lead is poured in, which makes cap and column solid. The iron columns are 12 inches square, and about 13 ft. in height. The width of the road is 20 ft. The distance between each section is 30 ft. The average weight of columns is 1,230 lb. The girders are placed on the columns by means of a steam derrick on top of structure, and bolted securely to a plate on top of the columns. There are four long girders to each section from column to column. Across from one column to another are short girders. These are bolted to the same plate. The two long center girders are bolted to this cross piece at both ends. They are also braced by laterals and buck braces. The average weight of the long girders is 5,000 lb. The short ones, 2,600 lb. Width of girders, 2 ft. 3 in. Across top, 12 in. A six-strand wire cable will be used, 19 wires to the strand. The weight of cable about 25 tons. The cable will run on 24 in. pulleys 12 ft. apart. The cost of cable will be between $4,000 and $5,000. The heart of cable will be of rope. The cost of road will be about $300,000 a mile. Will be run by a Corliss engine, 500 horse power. The cable runs about 10¼ miles an hour. In the busy part of the day they calculate to run from 14 to 18 cars, 2½ minutes apart. The cost of the old and new road will be about $900,000. Length of cable for whole road 4½ miles, weight 51 tons. The Passaic Rolling Mill Company, of Paterson, N. J., furnish the material.

The Electric Light vs. Insects.

Prof. Lintner, State Entomologist, has made a microscopic examination of the insect collections of a single electric light, and estimates that the debris which he inspected represented 33,000 insects. As many of the smaller forms of insect life probably constituted the larger portion of those attracted to destruction by the light, he believes that the average number of insects destroyed in a night by a single electric light is nearly 100,000.

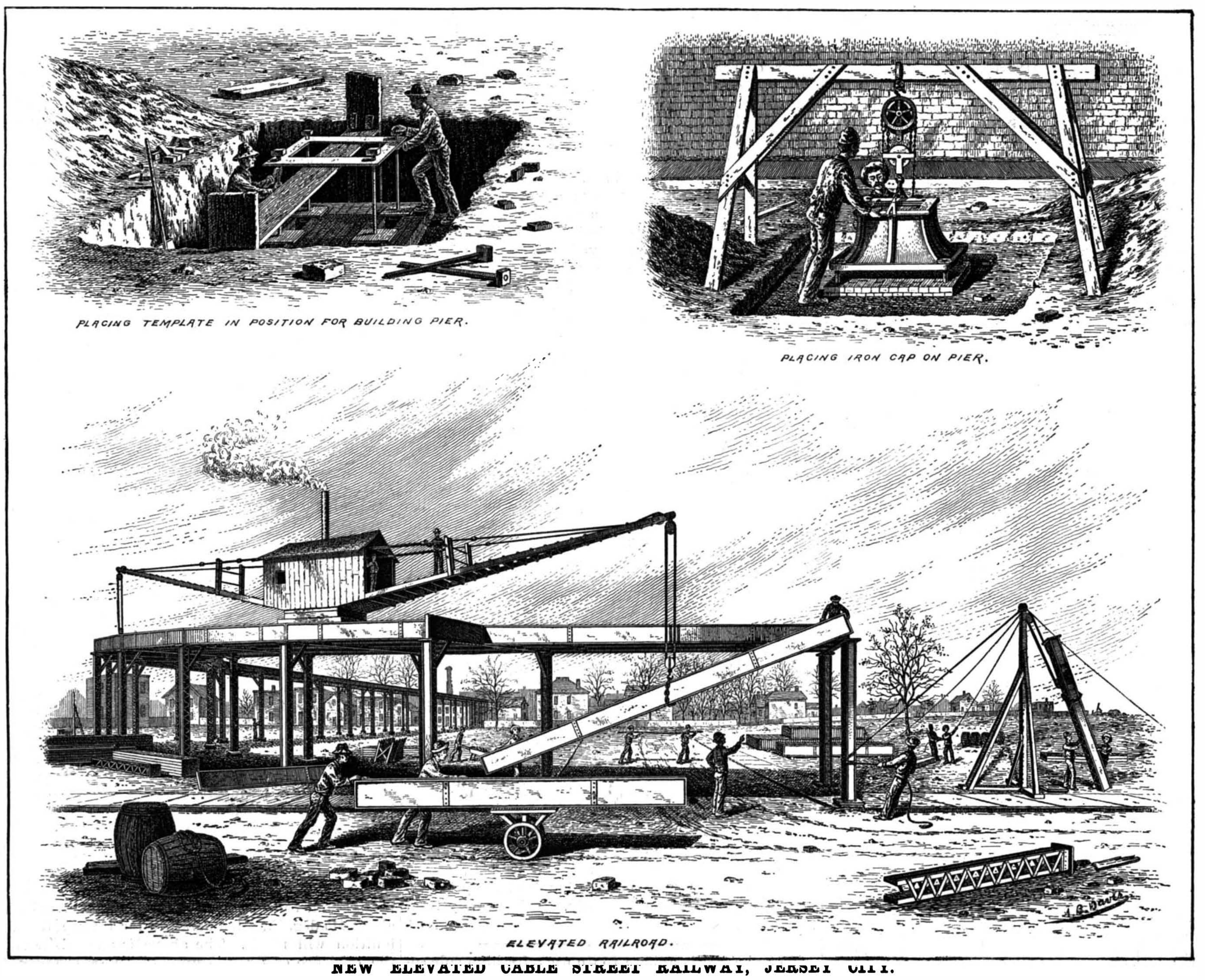
The larger portion of Prof. Lintner's specimen collection from one light consisted of minute gnats, midges, crane flies, and similar small two-winged insects. No mosquitoes were discovered among the victims, as they are not attracted to the lights. There were, however, large numbers of plant bugs, which are injurious to vegetation, particularly of one small species of a handsome green gassid, which feeds upon our grasses. A number of the moths, and one of the leaf rollers which have made such havoc in our fruit trees this season, were found, as well as other species of the same family. Prof. Lintner in speaking of his examination said:

"I was sorry to see quite a number of the beautiful gauze wings among the heaps of the slain, as their larvæ are the aphis lions, which aid in keeping down phides or plant lice."

"The electric light," to quote Prof. Lintner, "will undoubtedly prove an active agent in the reduction of insect pests, and also furnish entomologists with many rare specimens and with many species never before seen."

Shrinkage of Castings.

In locomotive cylinder, one-tenth of an inch in a foot; pipes, one-third of an inch in a foot; girders, beams, etc., one-third of an inch in fifteen inches; engine beams, connecting rods, etc., one-third of an inch in sixteen inches; large cylinders, say seventy inches diameter, ten feet stroke, the contraction of diameter, three-eighths of an inch at top; ditto, one-half inch at bottom; ditto, in length, one-third of an inch in sixteen inches; thin brass, one-third of an inch in eight inches; thick brass, one-third of an inch in ten inches; zinc, five-sixteenths of an inch in a foot; lead, the same; copper, three-sixteenths of an inch in a foot; bismuth, five-thirty-seconds of an inch in a foot; tin, one-quarter of an inch in a foot.



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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 763.

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THE FIRST ELECTRICAL EXECUTION.

In January, 1889, the new law of the State of New York went into effect, whereby electricity was substituted for the rope in the execution of criminals; but it was not until the 6th inst. that the prison authorities at Auburn, N. Y., had occasion to make actual trial of the new method upon the body of a convict.

A wretch named Kemmler, whose crime had been the atrocious murder of a woman, was appointed to be the first to suffer electrical death. No sooner was this announced than a number of persons interested in electricity and electrical apparatus set themselves to work to prevent the execution of the law, first by appealing to public sentiment through the newspapers, and next by interposing legal obstacles through the courts. It was set forth by these electrical partisans, first, that it would be a degradation of the noble science of electricity if it were brought down to so base a use as the killing of criminals; and second, no electrical apparatus known was capable of generating a current that would kill a human being with as much certainty and regard for humanity as the gallows.

Strange to relate, at the very time when these electrical discussions were filling the daily papers, when numbers of professors and electrical experts were striving, by might and main, to convince the public, through their learned disquisitions, that the alternating currents, the wires of which ramified in all directions through the city, were innocent and harmless, at this very time there occurred a series of deplorable incidents, whereby persons who accidentally touched the electric wires in the streets were instantly killed. The solemn essays of the learned-in-their-own-conceit experts would appear in the morning papers, proving beyond all question that the wires were perfectly safe, they could not extinguish life, and therefore the attempt to use electricity as provided by the new law was absurd. But perhaps the next morning, in the same newspapers, there would be given to the public the shocking details of loss of life occasioned by the deadly alternating currents in the overhead wires. These dreadful tragedies came in such frequent succession that all argument and talk against the law promptly ceased, and the city authorities hastened and cut down the dangerous wires.

The opponents of the law thereafter took a different tack. They obtained a postponement of the sentence of the condemned man on account of alleged legal errors in his conviction and the unconstitutionality of the new law. An appeal was taken to the highest court of the State, but the conviction and the law was sustained. An appeal was then taken to the Supreme Court of the United States, which held that the new law was not in conflict with the constitutional law. Further applications were made to the State court, but were dismissed, and on the 6th instant the doomed man suffered the statute penalty. He was strapped to a stout chair, electrodes were placed so as to make contact with top of head and base of spine, an alternating electrical current from a powerful Westinghouse machine was joined, a switch was moved, and the criminal was struck dead—instantly killed by lightning. The apparatus employed was sure and effective.

The law requires the presence of witnesses; among those brought in were several doctors, electricians, foes and friends of the new law, lawyers, and newspaper reporters.

The most intelligent of the witnesses, disinterested persons, also the warden of the prison, declare that as a mode of execution the electrical plan is far preferable to the scaffold.

It is rumored the Westinghouse Company or some of its adherents spent many thousands of dollars in fruitless efforts to nullify and obstruct the operation of the new law. The ablest lawyers and experts, who ordinarily receive large fees, were employed.

The execution of a criminal, whether by the guillotine, the garrote, the gallows, the gun, or the dynamo, is a ghastly business; and it is not surprising that the sensational newspapers, aided by the electrical opponents of the law, should have made the most of such an occasion to fill their columns with revolting details.

The foes of the law dwell upon the fact that the muscular contractions of the victim after the switch was turned prove the correctness of their original position—that Kemmler lingered a few seconds in life, that he was not instantaneously killed, therefore that electricity is a failure for this purpose, and the law should be repealed.

We have only to say, if they are not satisfied with the electrical apparatus used at Auburn, if, as they claim, it is not effective, then let us employ the deadly devices which the complainants themselves use, own, and control, with which they fill our streets and slay our innocent citizens. Let them bring the culprit to our city prison, place him on a conducting floor, introduce one of their street light wires, and with it, at the moment of execution, touch the hands of the prisoner. It will extinguish life instantly. It has rarely been known to fail.

To make labels adhere to tin use a freshly made solution of gum tragacanth in water.

WIRE AND ELECTRICITY.

Electrically heated flat irons are now made which are very serviceable. The flat iron is of the usual form, but made hollow. The interior contains a lot of coiled wires, through which the electrical current passes and heats the wires red hot. The latter are arranged between protecting sheets of mica and asbestos. You turn a switch, and the flat iron at once heats up ready for use. The street wires supply the electrical current.

In the same way all kinds of domestic utensils may be heated, such as cake bakers, meat broilers, coffee pots, etc. Electrical platters for keeping food warm when on the table may be had. Electrical heaters for warming apartments are also made. There is, indeed, no end to the useful applications of wire and electricity.

The Star Mizar.

Every observer of the heavens, who knows by name some of the brightest stars, is familiar with the constellation called the Great Dipper, visible in the northern sky through the whole night and throughout the year. It consists of seven stars, four in the bowl and three in the handle. An interesting discovery has recently been made by Professor Pickering, of the Harvard University observatory, concerning one of the stars of this beautiful group. Mizar is the name of the star. It is the middle star in the handle, is of the second magnitude, and has attracted much attention ever since men began to study the stars, because even to the naked eye it is double. It has a companion, Alcor, plainly visible to observers endowed with good visual power. Alcor is of the fifth magnitude, and is about 11′ distant from Mizar. The tiny star seems to be growing brighter, for the Arabians considered it a severe naked eye test, and it is now comparatively easy to detect. The telescope shows plainly that Mizar is a double star, its components being of the third and fifth magnitudes, the one a brilliant white, the other a pale emerald. The marvelous discovery is now made that the larger star of the pair is also double, the two stars that compose it being so close together that the telescope cannot separate them. The spectrum of a star, like the solar spectrum, consists of the seven primary colors, crossed by dark lines. These lines form a kind of astronomical alphabet. If the star is coming toward us, they shift toward the violet end of the spectrum. If the star is receding, they shift toward the red end. Two stars very near together, having the same spectrum, cannot be distinguished from a single star as long as they are at rest. If they revolve round each other in a plane inclined to the line of sight, the lines of their spectra will be single when the stars are in conjunction, and double when they are at elongation. This is the case with Mizar, and the doubling occurs at intervals of fifty-two days. Professor Pickering, therefore, infers that these two stars are immense suns revolving round each other. He estimates that the period of revolution of each sun about the common center of gravity is one hundred and four days, and that the maximum velocity is one hundred miles a second. These conclusions are the result of measurements of almost inconceivable delicacy.—*Youth's Companion.*

Bisulphide of Carbon.

A correspondent writes: An interest of a very practical kind attaches to this compound. Carbon bisulphide (Fr. sulphure de carbone) is a colorless, heavy, very mobile and volatile liquid. It is made by the action of sulphur vapor on red hot charcoal, and is used in the manufacture of waterproof materials, the extraction of oils from seeds, etc. It has a specific gravity of 1·29, and boils at 114·8 deg. F., but volatilizes very quickly at ordinary temperatures. The specific gravity of the vapor is rather more than 2½ times that of atmospheric air, and the vapor not only readily collects near the bottom of any space in which it is produced, but flows along almost like a fluid, and the vapor may thus reach a fire and be inflamed at some distance from its source of production. One of the most striking characteristics of this vapor is the extremely low temperature at which, when mixed with air, it takes fire. According to experiments, this temperature is about 415 deg. F. (some authorities give it considerably lower). If it is borne in mine that the lowest visible red heat corresponds to a temperature of about 1,200 deg. F., while a bright red heat, such as is necessary to inflame a mixture of benzoline vapor and air, corresponds to about 2,100 deg. F., it will be seen how very low, relatively speaking, the temperature of ignition is in the case of bisulphide vapor. The smallest spark from iron, a fire, a cinder after it has lost all appearance of fire, an even moderately heated stove, etc., are hot enought to set it on fire. The mere striking together of two pieces of iron within the inflammable atmosphere is sufficient to ignite it. It is not essential that an actual spark should be produced in order to bring about this result, but if the particle struck off is about 415 deg. F., a temperature far below a red heat, ignition will result. The above is an abridgment of the evidence of Dr. A. Dupré, taken for the purposes of a recent Board of Trade inquiry into the burning of the Livadia, a Liverpool steamer, which was laden with 150 tons of sulphure de carbone, and with other cargo, at Marseilles, and had to be abandoned by her crew off Cape Cette on May 11 last. The inspector appointed by the board thought the casualty due to the leakage of one of the drums in which the sulphure was stored, to the formation of vapor, and to its being drawn up the drain pipes through the scuppers, so that it came into contact with a light in the forecastle.

PHOTOGRAPHIC NOTES.

Silver Intensifier for Gelatine Negatives.—A modified formula, originally devised by Mr. J. B. B. Wellington, is recommended by a Mr. Richmond, as follows, in the *Photo. News:*

A

Silver nitrate	100 grs.
Water	7 oz.

B

Ammonium sulphocyanide	240 grs.
Water	7 oz.

C

Hyposulphite of soda	240 grs.
Water	7 oz.

For use, take one drachm of the three solutions in the order named, mix, and apply to the plate.

Uniform Standard for Lens Mounts.—A very worthy effort is being made among the leading opticians in England to establish a uniform system of screw threads and of lens mounts, so that the lens of one maker will fit in a lens flange of another make. When such uniformity is decided upon, it will be comparatively easy to use different manufacturers' lenses and different kinds of lenses in one screw flange, instead of requiring a separate lens board for each lens.

A Good Mountant. — The following mountant is strongly recommended by Mr. W. Willis for delicate prints: Weigh out two ounces of the best arrowroot, mix it into a thick paste with two ounces of hot water, and then add 18 ounces of boiling water, stirring briskly. Soak half an ounce of gelatine in water until it is thoroughly soft and swollen. Stir this swollen gelatine into the hot arrowroot, with which it will quickly incorporate itself. Add ten or twelve drops of pure carbolic acid. This forms a stiff jelly when cold, and it should be used cold, being brushed on to the back of the prints or applied to them with a sponge. —*Photo. News.*

Slag Cement.

In a recent article on slag cements, *Le Genie Civil* states these cements are made by finely grinding blast furnace slag, and mixing it with a suitable proportion of fat lime. The grinding has to be very fine, because as the cement is made by a simple mixture it is necessary that the surface on which the two constituents, the lime and the slag, react on each other should be as large as possible, if proper chemical combination is to ensue. As manufactured in France, the cement leaves only 20 per cent on a sieve containing upward of 25,000 meshes per square inch, and only 8 to 10 per cent on a sieve with 4,500 meshes per square inch. The density of slag cements is much less than that of Portland, weighing, bulk for bulk, but from 0·8 to 0·88 time as much. In general, this cement also sets somewhat more slowly than Portland, but when hardened has, in many cases, a greater strength, particularly at early dates after setting. In some experiments still unfinished the following results were attained with a slag cement from the Department of Isere:

Age	1 week.	1 month.	3 months.
Breaking load, lb. per square inch.	473·5	568·8	678·3

These figures are higher than any attained in tests made on Portland cements for the new Croton aqueduct. Experiments have also been made with slag cement mortar mixed with, and allowed to harden in, sea water, and gave the following results; the mortar consisted of six parts by weight of cement to ten of sand:

Age.	Breaking weight, lb. per square inch.				
8 days....	252 0	319·9	275·1	273·0	285·8
28 "	375·4	327·0	327·0	248·4	341·2

The main objection to slag cement seems to be that if it is allowed to harden in dry air, its strength is very materially reduced, and it is then liable to crack. In the town of Villefranche-sur-Saone (Rhone) it has been largely used for paving footpaths, some 4,800 square yards having been laid there with the most satisfactory results.

Electrical Notes.

One of the regular items of expense in operating an arc station is that of lamp trimming. As a general rule, and perhaps universally, the carbon trimmers are paid at the rate of about $2 per day, and each man has so many lamps assigned to his care. The general manager of a large plant in the Southwest informs us, however, that he has tried the performance of trimming duty on a piece work basis. At first they paid their trimmers 2½ cents per lamp, so that the men made as much as $75 to $90 per month, although the circuits are very long. Since the middle of May they have reduced the rate to 2 cents per lamp, the men still making as much as $65 per month. Each man, it will be seen, looks after more than 100 lamps per day.

A disadvantage of this method is that the men are hardly likely to take time to give the lamps the care they require, the trimmer being more anxious as to the number of the lamps than as to their efficient burning. On the other hand, the men, since they get so much for each lamp on their "beat," are anxious to secure new customers, and will readily go out of their way to secure additional business for the station.

Cheap and dishonest competition has cut much of the interior wiring business into pieces, so that reputable contractors often do not care to bid on work. In ordinary work for bells, annunciators, alarms, etc., where conscience is not kept on the alert even by fear of the inspector, the work is frequently disgraceful. If it were plumbing, the architect knows that he would have to deal with a board of health, or with a nervous buyer whose sense of smell had been abnormally developed by the reading of sensational hygienic literature. But wiring—the lowest bid will win the day. This is not as it should be, and until architects are themselves able to judge of the quality of the work and of the goods used in the installation, they should call in a trustworthy expert or engineer, whose modest fee for examination will be recouped many times over in the solid satisfaction enjoyed by the occupants of the property.

While at the outset arc lamps were employed to a considerable extent for interior illumination, their use is at the present time confined almost exclusively to outdoor illumination, except in cases where large interior spaces are to be lighted, and where the height of the ceiling permits of the even distribution of the light. It has often been remarked, however, that an arc lamp of small candle power ought to find a large field for application for interior illumination, and it is indeed strange that efforts in the past have not been made or have not been successful, if made, to produce a lamp of this nature. We believe that some attempts, with fair success, have been made abroad, but up to the present this field seems to have been entirely neglected in this country. We are glad to note, therefore, the appearance of a lamp designed for such a purpose. With a good mechanism and good carbons, so as to insure a steady light equivalent to 150 or 200 candle power illumination, there is no reason why such a lamp should not come into extensive use, especially on the score of economy.

Now that electric welding, pure and simple, has attained a firm foothold in the arts, we see springing up around it, and as a direct result of it, a variety of most valuable and interesting processes worked out by Prof. Thomson and his associates. Among these we describe in this issue a process for case-hardening, devised by Prof. Thomson, in which the high heat produced by the current is employed to effect the deposition of carbon from a hydrocarbon gas surrounding the piece to be treated. This process will be recognized at once as analogous to that employed for the flashing of incandescent lamps in order to obtain uniformity in the filament. In the present instance, however, the body upon which it is deposited combines with the carbon to form a steel coating. Mr. Lemp's process of electric swaging seems also destined to a wide application, not only on account of the nicety with which the operation can be performed, but equally on the score of its economy. It is safe to say that we have by no means reached the end in this work, which indeed seems without limit.

As a method of protection from abnormal currents, fusible cut-outs have found wide application, probably as much on account of their simplicity as for any other reason. When applied to the protection of delicate instruments, however, the difficulties encountered in drawing down a fusible metal, on account of its lack of tenacity, and also from its extreme fragility, limit its use. To avoid this, Mr. Stephen D. Field has applied the mercury cut-out in an ingenious manner, by which not only is uniformity and strength obtained, but the cut-out is saved from destruction, and, upon the cessation of the abnormal current, immediately assumes its former guarding functions. The cut-out shows itself to be quite satisfactory in its operation under severe conditions.

In the system of electrically increasing traction as developed and practiced by Mr. Ries, a low tension quantity current is made to flow through a local circuit of almost negligible resistance, of which circuit the driving wheels and that portion of the track rails immediately below and between them form the principal part. This current produces a slight local heating or incipient welding effect at the points of contact between the wheels and rails, which is practically instantaneous in its action, and brings about a decided increase in the coefficient of friction between the opposing metallic surfaces.

Models exhibited show an increase in traction due to the current of over 200 per cent. Preliminary tests of the invention, as applied to steam locomotives in regular service, have been very successful.

The traction-increasing current is generated by a small alternating current dynamo, driven by a rotary engine supplied with steam from the locomotive boiler. The engine and dynamo are mounted upon a common base secured to the boiler in the position formerly occupied by the sand box. One or both pairs of driving wheels are electrically insulated from the body of the locomotive and from each other by the use of special insulation surrounding the driving box and side rod brasses. The insulation so far employed has proved itself fully capable of withstanding the exceptionally severe strain to which it is subjected, and tests made after several months of continuous service have led to its permanent adoption for this class of work.

Experiments already made upon a large scale have shown that by this method it is possible to increase the tractive adhesion of locomotives fully 25 per cent, thus enabling them, with a saving of fuel, to haul a largely increased load, to mount heavier grades, and to descend the same under perfect control and without the skidding of wheels. Besides this, it will enable railroads to haul, with their present engines, much longer trains than they can now do, thus not only increasing the carrying capacity of the road, but saving largely the wear and tear upon tracks and bridges that the use of heavier engines for this purpose would entail. It will likewise enable both passenger and freight locomotives to make better speed and to maintain schedule time notwithstanding ordinary unfavorable conditions of the track due to the weather.—*Electrical Engineer.*

Alexander Parkes.

Mr. Alexander Parkes, one of the most prolific inventors that has ever been produced by this or any other country, died on June 29, at his residence, Penrhyn Villa, Rosendale Road, West Dulwich. Born at Birmingham in the year 1813, Mr. Parkes was apprenticed in the year 1827 to the firm of Messrs. Samuel Messenger & Co., as a modeler and designer, but having practically the run of the factory, his education as a practical metallurgist may be said to have commenced at the same time. In 1840 he was engaged by Messrs. Elkington to superintend the casting department of the electro-plating works they were then on the point of organizing, and while with them, in 1841, he took out his first patent, which in the course of his long life has been followed by what, considering their quality, must be considered as an enormous number of others. The best known of these are the Parkes process for desilverizing lead by means of zinc, and the invention of "parkesine," which has, however, been since renamed celluloid or xylonite. Another important patent was one for the construction of weldless tubing by "drawing" flat plates in a press. This process has been largely adopted, though we believe the inventor's name is known comparatively to few. Of his numerous patents, which must be quite forty in number, a very large proportion have proved valuable, though as Mr. Parkes was but poorly up in the modern art of self-advertisement, as practiced more particularly by American inventors, his name has been but little known to the general public. His most recent inventions, the last of which was patented at the end of 1887, relate to the separation of gold from its gangue, by fusing the quartz by suitable fluxes, and this process has been put into operation at the Champion silver mines, New Zealand. Mr. Parkes' death, though occurring at a ripe old age, is a distinct loss to the metallurgic world.—*Engineering.*

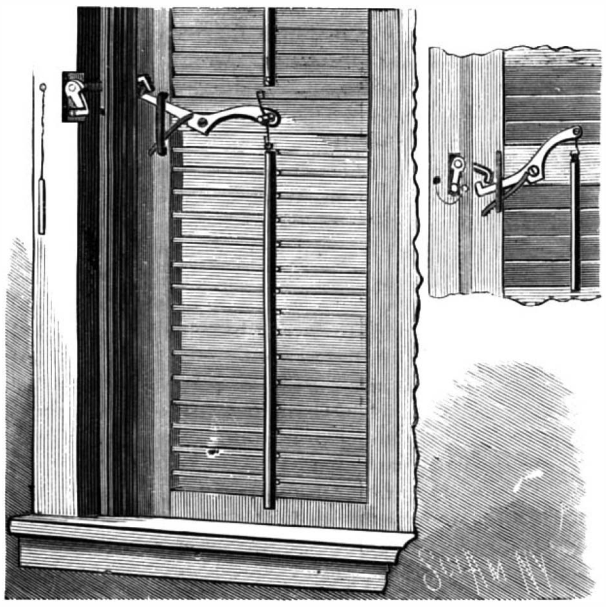
Pumice Stone.

A mine of pumice stone exists on the Teneriffe Peak, of which the working was only started in 1888. The stone is found in that part of the peak called the "Canadas," at about 2,000 feet above sea level, which has an area of some 6,000 hectares, out of the middle of which rises the highest part of the peak. The Russian consul at St. Croix bought this property of the Spanish government in consideration of an annual payment for the pumice stone working. The Russian consul has associated himself with a Belgian, and they, under the firm styled Aguilar & Valcke, commenced operations in 1888, but it was only last year exportation was really started. At the Paris exhibition, the consul-general states that this stone obtained a silver medal, and in view of the requirements of England, France, and America, he believes it will develop a trade of great importance before many years. So far, the Lipari Islands have practically furnished the world's supply of this product, exporting about 100,000 tons per annum. The Teneriffe stone being recognized as of excellent quality, and its extraction being a much more simple matter than in the Lipari Islands, it follows that the price is much less.

SIX years ago there were scarcely a hundred electric motors in operation in the United States for any purpose; to-day there are not less than 15,000 motors in use, applied to not less than two hundred different industries, and an industrial revolution is taking place equaling, if not surpassing, in importance that attending the introduction of the steam engine, and marvelous in the rapidity of its growth.—*Sprague.*

NOVEL BLIND STOP

The engraving represents a device for operating and fastening blind slats which is the invention of Mr. Abraham Pugsley of Jamestown, R. I. This device is intended for operating all of the slats of a blind sim-



PUGSLEY'S BLIND STOP.

ultaneously, or for operating a portion of the blind slats independently of the others.

The blind to which this improvement is applied is of the ordinary construction, and is hinged to the window frame in the usual way. To the central rail of the blind is pivoted a lever which extends to a point opposite the rods which work the slats. These rods are provided with staples, and the end of the lever is furnished with hooks, which may be brought into engagement with the staples. If the hooks enter the staples of both the rods, the upper and lower sections of the blind will be operated when the lever is moved. A rock shaft is journaled in the window casing and provided at the end adjoining the blind with a curved arm, which extends over the lever pivoted to the blind. The rod is furnished on its inner end with a thumb piece or handle, by means of which it may be turned so as to operate the blind without the necessity of opening the window. A spiral spring surrounds the rock shaft, and tends to hold the curved arm out of engagement with the slat-operating lever, so that the slats may be freely operated by hand when desirable. The casing is bored to receive a pin which serves to hold the thumb piece of the rock shaft in the position it must take when the blind slats are closed.

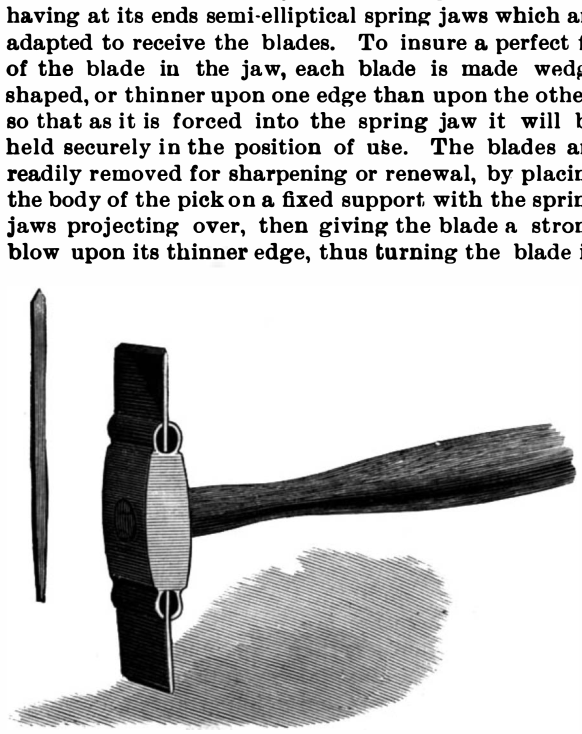
This device locks the slats so that they cannot be opened from the outside of a building. It thus acts as a safety guard to the window, preventing burglars from inserting implements for unlocking the blinds or opening windows. The slat-operating lever, as will be seen in the engraving, is provided with a spring for holding the blind slats normally open.

NEW FORM OF MILLSTONE PICK.

In the millstone pick shown in the annexed engraving, provision is made for conveniently inserting or removing the blades as occasion may require. The body of the pick is formed of a single piece of steel, furnished with a central eye for receiving a handle, and having at its ends semi-elliptical spring jaws which are adapted to receive the blades. To insure a perfect fit of the blade in the jaw, each blade is made wedge shaped, or thinner upon one edge than upon the other, so that as it is forced into the spring jaw it will be held securely in the position of use. The blades are readily removed for sharpening or renewal, by placing the body of the pick on a fixed support with the spring jaws projecting over, then giving the blade a strong blow upon its thinner edge, thus turning the blade in the jaw. A wedge inserted behind the blade, and driven in, readily forces the blade out.

Although the inventor has described this useful tool as a millstone pick, he proposes to modify it slightly to adapt it for other uses, such, for example, as the loosening of boiler scale, and similar purposes.

This invention has been patented by Mr. Jacob W. Truax, of Essex Junction, Vt.



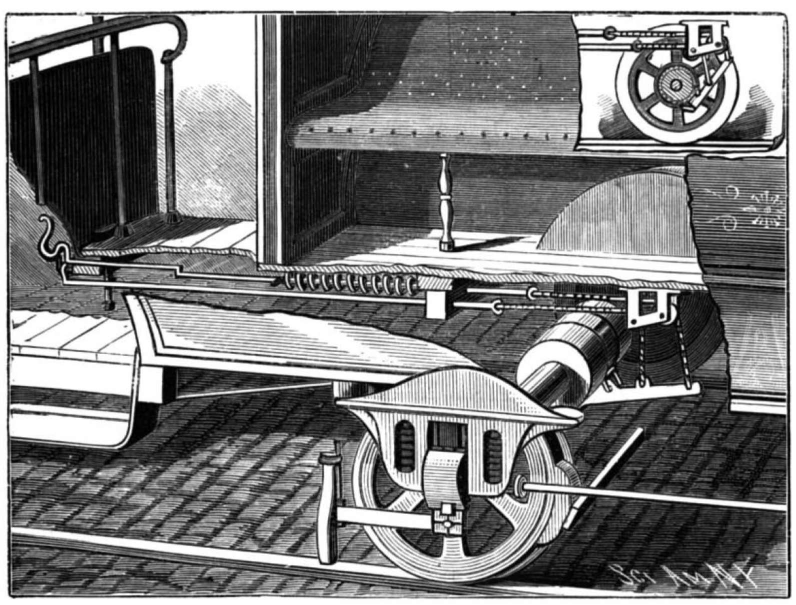
TRUAX'S MILLSTONE PICK.

A NEW CAR STARTER.

In the annexed engraving is illustrated a new car starter designed for application to ordinary street cars, the object of the invention being to relieve the horses from the great strain usually put upon them while starting a car. This invention not only serves to facilitate the starting of the car, but it answers as an efficient brake for holding the car while stopping upon a down grade.

Upon each axle of the car is arranged a friction drum surrounded by a metal strap, the ends of which are connected with a lever which is capable of tightening the strap upon a drum. To the lever are attached two chains, one at its free extremity, the other about midway between the extremity and the point of connection with the metal strap. The chain at the outer end of the lever extends over a pulley attached to the car bottom, and forward to the drawbar, to which it is attached. The other chain extends over a pulley, then forward, where it is attached to a rod extending toward the end of the car. The arrangement is the same for both axles and for both ends of the car.

As only one set of apparatus is brought into action at a time, the other is thrown out of gear by drawing the rod connected with the middle part of the lever forward, so as to lift the lever bodily, thereby allowing the metal strap to expand so that the drum will turn freely therein. When, however, the apparatus is in use this rod is released from its fastening at the end of the car, and the drawbar alone acts upon the strap brake. When the car is stopped, the drawbar is retracted, and the lever of the starting apparatus drops. As the horses pull to start the car, the first operation is the



AN IMPROVED CAR STARTER.

tightening of the metal strap on the friction drum, and the second the turning of the drum and the axle to which it is applied, by the movement of the lever. The forward pull of the horses in this manner, in addition to drawing the car forward bodily, causes the axle to turn, and thus renders the operation of starting the car very light and easy.

This useful invention was recently patented by Messrs. Louis Seebach, Conrad George, and Lewis Bush, of Listowel, Ontario, Canada.

AN IMPROVED EDUCATIONAL APPLIANCE.

A combined spelling case and numeral frame, in portable form, adapted to be hung on the walls of the school room, is shown in the accompanying illustration. It has been patented by the Rev. Reinhard Wobus, of St. Charles, Mo. The interior of the case is divided into large and small compartments, adapted to receive card tablets on which are printed letters and figures, and all signs employed in reading and writing. The case has a front-closing sliding lid, on one side of which is strung a series of wires with wooden balls for the conducting of a numeral lesson, while on the reverse side of the lid are shelves to hold the printed card tablets as placed by the teacher in conducting a spelling lesson, these shelves being metal strips held in place by screws. The top piece of the case does not extend forward flush with the sides, room being left to permit a seating piece attached to the front-closing sliding lid to close this portion of the top when the case is closed. When the lid is withdrawn and mounted to conduct a lesson, as shown in the illustration, the seating piece of the lid is placed in this front top recess, and there firmly held by means of laterally swinging angle clasps pivoted to the top of the case, each of these clasps having a flange on its outer side to embrace the outer edge of the case, and a front flange passing into a slot in each vertical side of the front

WOBUS' TEACHER'S ASSISTANT.

edge, the inner side of each clasp also passing into a slot in the side of the sliding lid. When the case is closed these clasps hold the sliding lid in its position. With this appliance the teacher may explain by comparison, by contrast, and by analysis, and bring the powers and uses of letters and marks vividly before the mind of the pupil.

NEW TUBULAR PACKING FOR STEAM CONDENSER TUBES.

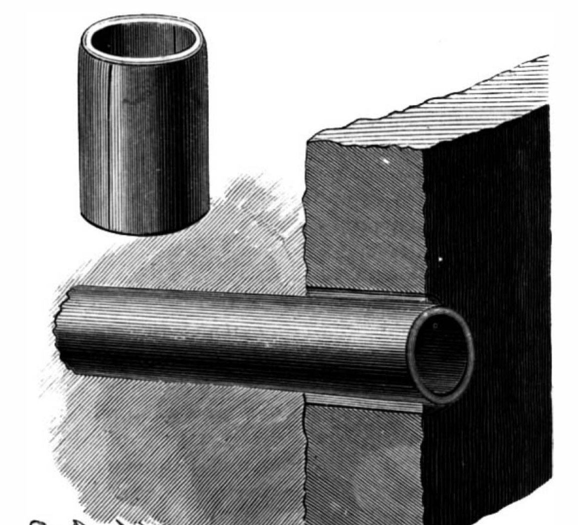
Considerable trouble has been experienced in the construction of steam condensers, in making the joints between the condenser tubes and the head sheet air tight under the varying conditions to which the joint is subjected.

Mr. Terrence P. Ford, of 95 and 97 Liberty Street, New York City, has recently patented a simple but effective device that overcomes this difficulty.

This improvement, which is shown in the engraving, consists of a tubular packing formed of a strip of fibrous material, such as burlap, linen, or manila paper, the latter being preferred. This packing is made by forming the paper into a tube by wrapping or spirally rolling the material around a mandrel, a thin pellicle of glue or cement having been previously applied to one surface of the strip, to make its folds adhere. The tube is then heated in an oven until the moisture is thoroughly evaporated, when it is immersed in a mixture which fills its pores thoroughly, and makes the packing impervious to water and air. After the treatment with this mixture the tubes are allowed to cool. They are applied to the head sheet in the usual way, that is to say, the tubes are placed in the annular recess in the head sheet, as shown in the engraving.

It is claimed that this packing will not rot, and that it will not be affected in any way by the steam or water of the condensers.

AN order has been given for 10,000 cars for the Pennsylvania west of Pittsburg. The Union Pacific has also ordered 5,000 cars; the Missouri Pacific, 3,000; the Baltimore and Ohio, 4,000; the Hocking Valley and the Ingalls Syndicate, 3,000 each; and the New York Central 3,000.



FORD'S TUBULAR PACKING FOR STEAM CONDENSER TUBES.

THE GIFFARD GUN.

There is much talk just now about a gun invented by Mr. Paul Giffard, in which liquefied gas is used, and which may possibly make a new revolution in munitions of war. We have consequently thought that it would prove interesting to our readers if we gave a description of this weapon, from the inventor's patents. The charge of liquefied gas, which replaces powder, is inclosed in a steel capsule, *f*, made fast to the barrel and screwed at *m* into the butt. This capsule terminates behind in a valve, *g*, pressed by a spring and the gas against a hard rubber seat, *h*, and provided with a rod, *j*, that traverses, at *j'*, a tight packing, *i*, of soft leather. A rubber packing, *l*, secures, on another hand, the tightness of the threading, *m*.

As soon as the trigger is pressed, the hammer strikes the extremity, *p*, of the rod, *j*, and, through its impact, thrusts the valve, *g*, to a distance regulated by the stop, *e*. There then escapes through *c* a certain quantity of liquefied gas, which expels the projectile that has previously been introduced into the barrel through a sort of cock, *d*. As for the valve, *g*, that is at once closed by the pressure of the liquid.

According to Mr. Giffard, the reservoir *f* might, with liquefied carbonic acid, serve for from 300 to 500 consecutive shots, "owing to the formidable power that it develops on passing from zero to 300°," and further on, in another passage of his patent, he adds that "the mild and gradual action of the liquefied gas upon the projectile, with a previous expansion of from 100° to 300°, brings about ballistic effects that are essentially new."

These considerations do not appear to us very clear. We do not see how, in this application of liquefied gases, temperatures of 100° to 300° that Mr. Giffard speaks of would be produced. In the capsule, *f*, we see merely carbonic acid at a temperature of 30° at the most, that is to say, under a pressure of about ten atmospheres. Now, although we do not know exactly the total work necessary to liquefy one gramme of carbonic acid, we can nevertheless assert that the total potential energy of one gramme of liquid carbonic acid ought not to exceed one-thirtieth of a kilogramme. That of one gramme of gunpowder is about 200 kilogrammes, of which we can scarcely utilize, at the most, more than $\frac{45}{100}$, or 90 kilogrammes. We do not see, then, *a priori*, how the liquid carbonic acid can exert a power greater than that of ordinary powder, as Mr. Giffard supposes, and it is permissible to have a little doubt upon this subject, while at the same time wishing the invention a most brilliant success.

Mr. Giffard proposes also, for blasting in mines, to replace the ordinary cartridges by capsules of liquid carbonic acid, that would be exploded by the detonation of an explosive cartridge in the interior of the capsule. It seems as if these capsules might, in mines subject to the presence of fire damp, offer guarantees of security that are worthy of attracting attention.—*Revue Industrielle.*

A FLOATING saw mill is in use in Florence, Wis. The boat is 40 × 80 feet in size, and draws 17 inches of water. The mill hands live aboard, and the boat is moved along the river to wherever there is a fine lot of timber near the banks.

Electrolysis of the Muscles.

In a recent number of the *Bulletin de la Societe Belge d'Electriciens*, Dr. G. Weiss contributes a brief account of some interesting electro-medical investigations undertaken by him. That electrolytic effects take place at the electrodes where an electric current enters and leaves the human body is, says Dr. Weiss, universally admitted; but is the electrolytic action confined to those points? Dr. Weiss then points out how, when intermittent currents of the same size are sent along the gastronemian muscles of a frog's leg, the contractions rapidly cease, and no amount of rest restores the muscles to their primitive condition. On the other hand, the duration of an alternating current does not perceptibly affect the contractions. This phenomenon points, therefore, to electrolysis of the muscle along the entire path of the current. Dr. Weiss then tested this theory as follows: He took two vessels containing a 1 per cent solution of chloride of sodium, connected them by a siphon filled with the same liquid, and passed a given current from vessel to vessel, using platinum electrodes. The experiment was then repeated with the two hind legs of a frog as connecting piece. The E. M. F. of polarization was considerably greater in the latter case than in the former. Dr. Weiss is of opinion that an electric current traversing a muscle gives rise along the whole length of its path to chemical decompositions, and that the products of these give rise in their turn to powerful secondary actions upon the substance of the muscles, which are rapidly attacked and destroyed. Microscopic examinations showed that the entire structure of a muscle was gradually altered by the passage of a current. Dr. Weiss then poured a strongly saline solution of gelatine, colored with well neutralized turnsol, into a U tube, and when the gelatine had solidified, he poured in water colored in a similar manner. The turnsol not only changed color at the platinum electrodes, but also at surface, separating the gelatine and the water. With albuminous water the albumen was coagulated at the positive, and completely dissolved at the negative, surface of separation.

Effects of Poisons.

One of the most mysterious of physiological phenomena is the influence of minute quantities of certain substances when introduced into the circulatory system. The wonderful effect of vaccination is familiar to all, and even more remarkable are the terrible results produced by a mere trace of saliva from a hydrophobic animal—a poison which, apparently, remains dormant in the body for days or weeks, and then suddenly springs into fatal activity. Similar effects follow from inoculation with the venom of serpents, but in such cases the poisonous effects occur almost immediately.

Even more powerful are the poisons used by the natives of Africa to render fatal the wounds made by their arrows, as described by Mr. Stanley in his recent work on Africa. These, when fresh, are of most extraordinary power. Faintness, palpitation of the heart, nausea, pallor, and beads of perspiration break out over the body with extraordinary promptness, and death ensues. One man died within one minute from a mere pinhole puncture in the right arm and right breast. A headman died within an hour and a quarter after being shot; a woman died during the time that she was carried a distance of a hundred paces; others, in varying spaces of time up to a hundred hours. The activity of the poison seemed to depend on its freshness. The treatment adopted was to administer an emetic, to suck the wound, syringe it, and inject a strong solution of carbonate of ammonia. This carbonate of ammonia injection seems to have proved a wonderful antidote if it could be administered promptly.

One of the poisons with which the weapons are smeared is a dark substance like pitch. According to the native women, it is prepared from a local species of arum. Its smell, when fresh, recalls the old blister plaster. It is strong enough to kill elephants. This poison is not permitted to be prepared in the village. It is manufactured and smeared on the arrows in the bush. All these phenomena are certainly wonderful and unexplainable; but, for that matter, there is hardly any action taking place in the living body of which we can form any satisfactory conception of the true nature.—*Popular Science News.*

Disinfecting Candles.

Of late, owing to its proved germicidic power, the vapor of bromine has come to the front as a disinfectant. According to *Industries*, the bromine is converted into the organic bromine compound dibromonaphthalene, an almost inodorous substance, and this is dissolved in any desired quantity in the fat or wax, before it is run into the moulds. The result is a candle or night light which in shape and appearance resembles an ordinary candle or night light, but differs from it in this respect, that when burnt it produces free bromine vapor, at the same time emitting the usual amount of light. The night lights are put up in various strengths, so as to give little or much bromine as required, and they are consequently suitable for disinfecting either a sick room, a closet, or any inclosed space where sulphureted hydrogen, mercaptan, or disease germs exist. The liberation of the bromine is easily explained, the halogen compound being first converted into hydrogen bromide, which at the temperature of the flame, and in presence of a large excess of atmospheric oxygen, is converted into free bromine and water. The use of the night lights and candles will undoubtedly prove an efficient means of preventing the spread of the malignant germs producing small-pox, scarlet fever, and other infectious diseases, and should, owing to the ease with which they may be utilized, come into general use in the wards of fever hospitals and in private houses as a substitute for those disinfectants which, on account of their being non-volatile, place very little or no obstacle in the way of the spread of disease germs.

Hygienic iodine night lights and candles which, on burning, liberate iodine vapor in any required quantity, in the same manner as the bromine night lights liberate bromine, and which are made in a similar way, promise to render considerable service in the treatment of throat and chest complaints. They are, in fact, the first means introduced of successfully dispersing a gentle and regular flow of the vapor of iodine through the air of a room.

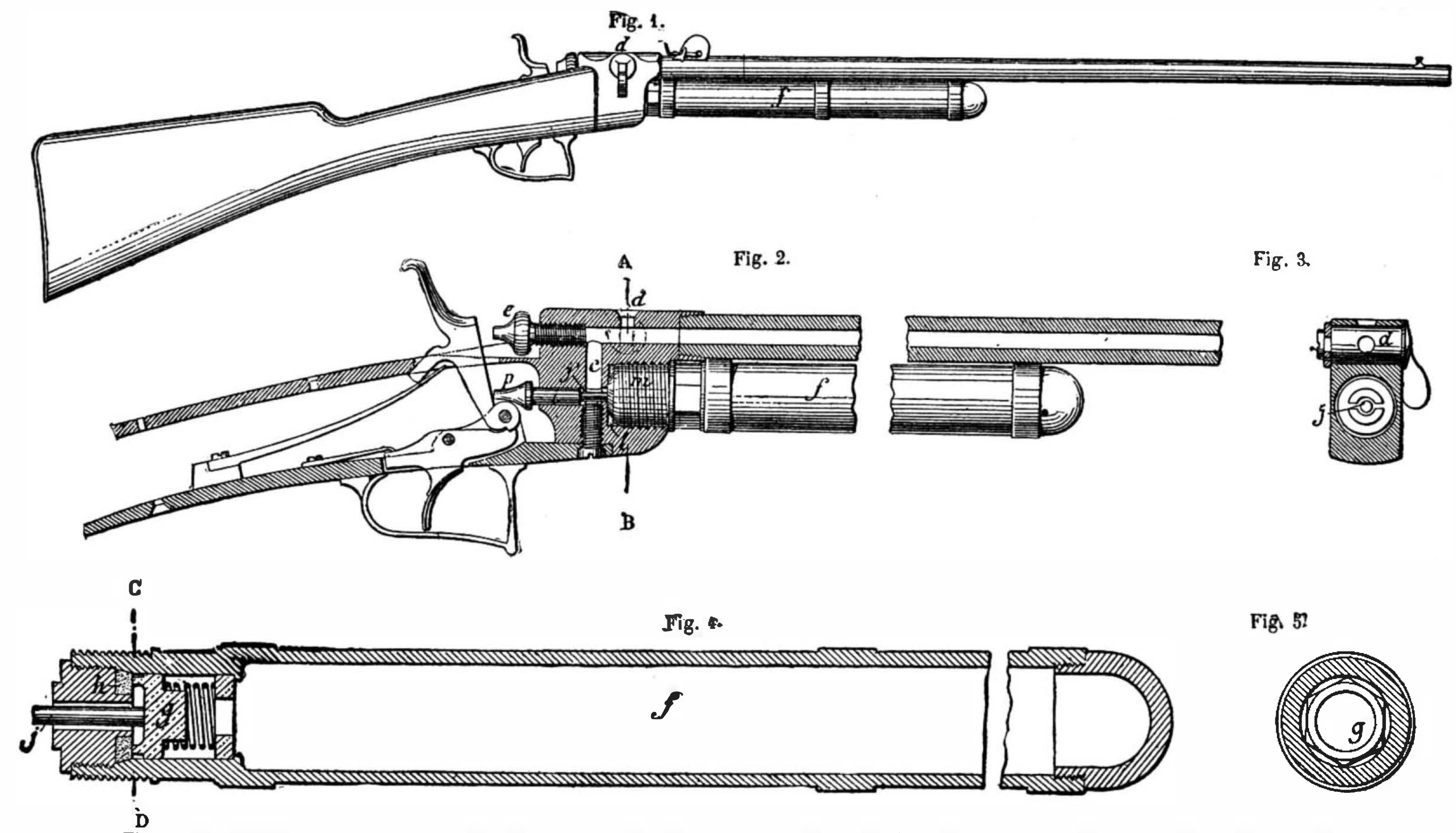


Fig. 1.—Side Elevation. Fig. 2.—Longitudinal Section. Fig. 3.—Cross Section at A B. Fig. 4.—Section of the Carbonic Acid Receiver. Fig. 5.—Section at C D.

THE NEW CARBONIC ACID GUN OF M. GIFFARD.

THE SCIENTIFIC USE OF THE PHONOGRAPH.

BY GEO. M. HOPKINS.

One of the uses to which the phonograph is peculiarly adapted is measuring the velocity of sound. From the nature of the instrument it is necessary that the sound be propagated in a confined space, and that this space begin and end at the mouth piece of the phonograph, to allow of making two distinct records on the wax cylinder, one of the sound as it is made directly in the mouth piece, the other of the same sound after it has traveled through the tube and returned to the mouth piece.

The accessories for this experiment are few and simple. The funnel, or auxiliary mouth piece, is in this case connected with the phonograph mouth piece by a flexible tube, and the funnel is suspended so as to cause it to maintain a fixed position, while the phonograph mouth piece and recording stylus traverse the record cylinder.

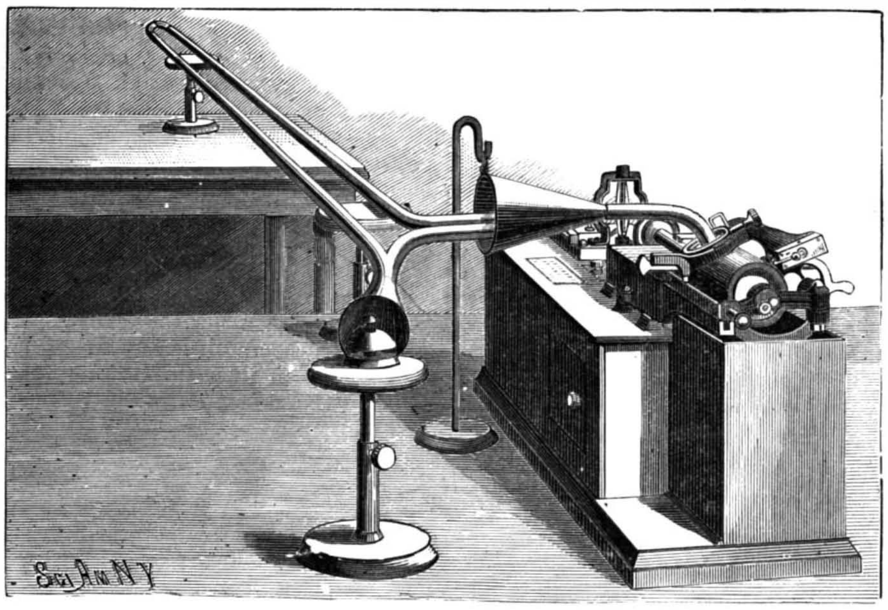


Fig. 1.—MEASURING THE VELOCITY OF SOUND BY THE PHONOGRAPH.

A forked tube, terminating in the flaring mouth piece, is connected by one of its branches with a long tube which extends away from the phonograph and, returning parallel with itself, enters the suspended funnel. The other branch of the forked tube opens directly into the funnel. The long tube is supported at suitable intervals, and in front of the flaring mouth piece is placed a bell, which is damped so as to produce only a momentary sound.

The phonograph is set in operation in the usual way, with the record cylinder revolving at a speed of say two revolutions per second. Now if a sound of sufficiently short duration is produced by the bell, the two records made, one by the sound entering directly into the phonograph mouth piece, the other by the sound traveling through the long pipe before reaching the mouth piece, will be distinct and separable on reproducing the record with the cylinder revolving at a slower speed, say sixty revolutions per minute. The interval between the records may be accurately measured in the manner described in a previous article.

In this way, knowing the length of the tube, the velocity of the sound in the tube is readily ascertained. A tube fifty feet long will show an interval between the records of one twenty-third of a second when the phonograph cylinder makes two revolutions per second. This is an appreciable interval, but when the speed of the cylinder is reduced one-half, the record shows double the interval. The interval may, of course, be increased by lengthening the tube, and it may be made more apparent by increasing the speed of the phonograph cylinder while recording, and greatly reducing the speed while reproducing the record.

The well known experiment in which the interference of sound waves produces silence may be readily adapted to the phonograph. The double tube is connected by one end with the phonograph mouth piece, and by the other with an ear piece. A record of a continuous musical note being in place on the phonograph, and adjusted so as to give a continued sound, the length of the adjustable tube is increased until the waves in that branch travel through half a wave length more than those in the other branch. Under these conditions the waves from the two branches, meeting in opposite phases in the ear tube, neutralize each other, and silence, or a close approximation to it, is the result.

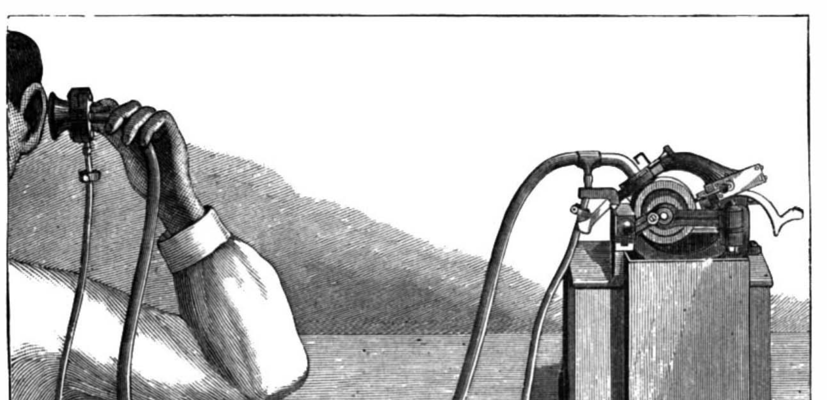


Fig. 2.—TESTING THE CONDUCTIVITY OF GASES.

In Fig. 2 is shown a simple device, by means of which the conductivity of gases for sound may be tested. A flexible gas-tight tube is connected by one end with the phonographic diaphragm cell, while the opposite end of the tube is attached to an ear piece consisting of a diaphragm cell provided with a very thin rubber diaphragm. In the side of the flexible tube, at opposite ends, are inserted smaller rubber tubes for changing the gas in the flexible tube. Each of the small tubes is provided with a pinch cock for shutting off the gas in the larger tube.

When the tube is filled with air the sound is conveyed with perceptible diminution. When hydrogen is substituted for the air, the sound is diminished so as to be scarcely audible. Other gases produce different results.

THE application of the Broadway Railway Company, New York, for leave to substitute cable propulsion for horses has been granted, and the cable machinery and appurtenances will soon be inaugurated. The works will be put in as fast as possible. The great thoroughfare is to be attacked in three sections at a time, the street to be closed while the slotted tube and rails are being laid.

Photographing Flowers.

There are certainly difficulties to be met with in photographing flowers which do not often assail those who are engaged in the more ordinary paths of work. One of the chief of these is the necessary nearness of the objects to the camera—a difficulty which will be at once appreciated by any one who endeavors to focus upon his ground glass screen the image of a flower-spangled hedgerow. It is at once seen that, owing to the various planes of the different petals, only a few can be brought to a sharp focus at one time. It is, of course, the same if we attempt to photograph a single flower or a mass of flowers in a greenhouse, but here we are relieved of one great difficulty in having a perfectly still atmosphere to work in. But whereas in the open air it is next to impossible to reduce the growth to one plane, unless, indeed, we clip away half its beauty with a pair of shears, in the greenhouse we are able to mitigate the evils to a very great extent by adopting certain precautions. The flowers, being in pots, can be moved about and grouped as we may think best, and any petal-bearing stems which are obtrusively prominent — and therefore out of focus—can be held back by the temporary expedient of attaching to them gray lines of the thinnest binding wire. We have tried this plan many times with great success, but care must be taken in adopting this method of pulling the stems out of their natural position that they are not so awkwardly placed that the dodge is likely to be detected. Care must also be taken that the wires used are properly concealed.

In photographing flowers in a greenhouse it will generally be necessary to provide some kind of background. The entire beauty of the picture will be sacrificed if the straight lines of the beading between the glass panes come into view, and more especially if the bright sky is seen through them. A square yard of some good tinted material—such as is used for ordinary studio backgrounds—will answer the purpose better than anything else, but it should, if possible, be stretched on a frame, so as to present one even, unwrinkled surface. In the absence of a greenhouse, and when we wish to photograph flowers in the form of a bouquet, we shall do well to conduct operations in the studio or in an ordinary room. In the first case no difficulty should present itself with regard to lighting, for curtains, screens, and blinds are under ready control, but in an ordinary room, as in the case of portraiture, special arrangements have to be made.

The flowers must first of all be grouped as artistically as possible, and may by preference be held in some kind of ornamental vase. This should be of glass or of some light colored material—such as alabaster—in order that there may be contrast between it and the flowers which it holds. This vase should be placed near a window where there is a good diffused light—not actual sunlight—with a looking glass or white screen at the other side, so as to reflect light on its shady parts. The background should not be too dark, nor should it be of a pronounced pattern of any kind. All must be as light and airy in design as possible. The flowers themselves must not be matted together, and it will be found that a few—say some choice roses or lilies relieved by springs of maidenhair or feathery grasses — will be far more effective than a great number. We have occasionally seen flower photographs—generally roughly colored—exposed for sale in some of the shops, and they are useful as a guide to show what to avoid. These flowers appear to have been grouped and supported on a sheet of white cardboard, with the result that a heavy black shadow—a kind of mourning band—borders them on all sides, for the light in which they have been photographed appears to have come from the front, that is, behind the camera. Strong contrasts are most easy to obtain in photographing flowers, and they should be carefully avoided, first by suitably lighting the object and providing a proper background, and secondly by giving a prolonged exposure with a small stop, so that development may proceed without the least forcing and blocking up of the high lights.

The lens which is kept to use for flower work is one of the rectilinear type. Almost any lens except a portrait lens will do for photographing flowers, provided it can be well stopped down. To get the best results, it is as well to use isochromatic plates, and many published pictures have shown us all what good service such color sensitive plates will do in this particular field of work. But ordinary plates, if used with a yellow screen behind the lens, and with the protracted exposure which that course entails, will give results which are difficult, if not impossible, to distinguish from those obtained by the use of isochromatic plates. —*Photo. News.*

Rolling Cold Steel.

The particles of any metal in cooling are supposed to make a definite crystallized arrangement. Heat, in a certain sense at least, is as to the atoms a disintegrating or repellent power, and, under great force or pressure, crystallizations may be compelled to rearrange themselves on new lines or submit to a change in form. In drawing wire, for example, the force applied is in the direction assumed by the fiber, as softened by heat, and its strength is supposed to depend upon this arrangement of particles, compacted more or less by the die through which it was drawn. Now rolled wire is a reversed process, as the compression of molecules both changes their form of arrangement and form of crystallization. Up to a recent period heat was always supposed to be a prime factor in the process, and that without it no alteration in what may be styled granulation was possible. Now a Chicago paper announces a change in manipulation that completely explodes the old theory. Bars of cold steel are as easily rolled into wire as if the metal were hot, and not only that, but the process nearly doubles the tensile strength. That of hot-drawn steel wire is 56,460 pounds to the square inch, while cold-rolled is 105,800 pounds.

What is the nature of the changed arrangement of particles that produces such results? It must be compression that forces the atoms into new forms, or compacts them more closely together, and yet one effect of compression is to evolve heat. The fact of added strength is abundantly vouched for, but the reason of it remains to be explained. Manifestly if wire can be rolled from cold bars with such results, why may not steel plates for ships or other purposes; yea, why not even railroad bars? If these things are possible, with strength doubled and cost diminished, this manufacturing industry is certainly on the eve of a total revolution. Science, too, has added to its domain the wealth of a new discovery whose value is beyond estimate. Gains on any line of advancement, as all experience proves, are but a prelude to greater gains on other or similar lines. The ending of a beginning in what is new now is beyond the ken of the wisest.—*Iron Trade Review.*

A PATENTEE is protected from the use of all plans or devices which, however seemingly different from the patented invention, are the same in principle and operation.

Correspondence.

Ingrowing Toe Nails.

To the Editor of the Scientific American:

In a recent number of your valuable paper I noticed that an inquirer was advised for the cure of an ingrowing toe nail to slit the center of the nail.

I think a much better way is to thin the surface of the whole "top" of the nail with glass paper (sand paper), say No. 2, or finer, as best suits the case; keeping the nail short in the center, allow the corners to grow till they are a little beyond the flesh; place a little double of cotton cloth between the sore place and the edge of the nail. All this being done, the relief is immediate and the cure certain. C. R. W.

Philadelphia, Pa.

Cutting off a Bottle.

To the Editor of the Scientific American:

I noticed in SCIENTIFIC AMERICAN, No. 4, July 26, that W. J. M. asks how to cut the neck off a large bottle without breaking it. If he will fasten the bottom of the bottle to a chuck on a wood lathe with melted resin, and then revolve the lathe at a high rate of speed, he can cut it as true as a straight edge by holding a piece of thin, soft iron wire on the spot where it is desired to cut it off, keeping it there till the wire gets red hot, then project a little water on the hottest part of the wire, when the neck will fly off. This is the best way it can be done, and is the way French ware is cut off in glass factories, only the chuck is hollow.

If the bottle to be cut is thicker in one place than another, the cut may not be quite as true.

R. WAGNER.

Beaver Falls, Pa.

Cutting Glass Bottles.

To the Editor of the Scientific American:

I have had good success in cutting off glass bottles, both round and square, up to half gallon in size, by cutting carefully clear around with an ordinary glass cutter, then placing the bottle in a lathe, or on a microscope turntable, or on any apparatus that would allow it to turn steadily and smoothly (suspending by a cord from ceiling might do), then revolving it at a speed of 50 to 75 revolutions per minute, and directing the flame of a blowpipe on the mark made by the glass cutter; in a half to two minutes, the bottle will crack the greater part of the way around, when the blowpipe can be removed, and by gentle traction upon the two parts, they will separate very readily; if not, a few drops of water on the unbroken part, or better, a wet string laid on the mark, will usually complete the operation. I never had any success with any other plan, and always spoiled the bottle until I hit upon this, and would advise W. J. M., question 2348, in your issue of July 26, to try it, practicing upon a few smaller bottles first.

The main thing is to heat the glass evenly clean round. D. H. CAPWELL, M.D.

Van Horne, Ia.

Submarine Vision.

Mr. Hermann Fol, in a lecture upon "The Impressions of a Diver," delivered before the Nautical Club, of Nice, and published in full in the *Revue Scientifique*, gives, among other things, some interesting observations made by him upon submarine vision by means of the diving suit with which the laboratory installed by him at Nice is provided. According to Mr. Fol, the illumination of the bottom of the sea resembles that of a room without windows, which receives its light from a glazed aperture in the center of the ceiling. If the diver, after reaching the bottom, looks upward, he will see a large, circular, luminous space, that may be considered as the base of an inverted cone, of which his eye occupies the apex. The periphery of this circle is more or less ragged, since the surface is never absolutely calm. The rays of the sun are pale, and penetrate in moving waves that resemble what we see in a room near the seaside when the Venetian blinds are down and the rays of the sun, reflected from the movable surface, illuminate the ceiling.

The diminution in the intensity of the solar rays is very rapid, and at about 95 feet they are almost completely diffused. At the moment that the sun is descending toward the horizon such a darkness suddenly supervenes that one would be led to think that night had arrived. There is an angle at which the proportion of the rays reflected to those refracted becomes so unfavorable to the latter that the illumination of the bottom abruptly diminishes.

The transparency of the water varies greatly along the coast from one day to another. When the water is relatively clear it absorbs so much light that, at a depth of 95 feet, when the sky is overcast, it is impossible to see plainly enough to capture very small animals. It is impossible under such circumstances to distinguish a rock at a distance of more that 25 or 26 feet in a horizontal direction. If the sun is shining and the water is limpid, it is possible to see a brilliant object at a distance of 65 feet, perhaps even at 75 feet. But, under ordinary circumstances, it is necessary to be content with half of these figures.

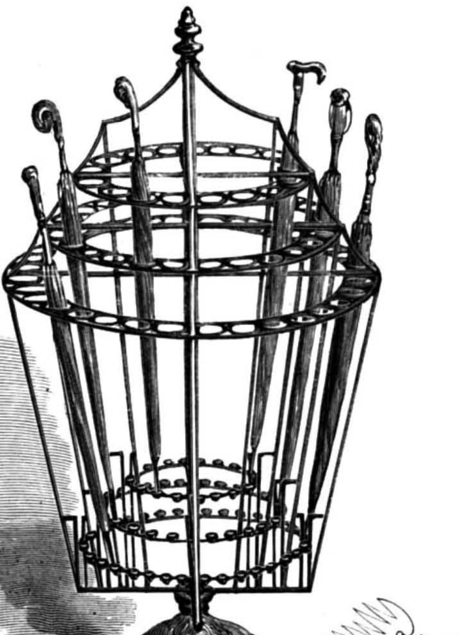
Mr. Fol concludes from these facts that marine animals move about as if in a fog, and cannot avoid surprises. Our fishing apparatus would prove unavailable for capturing animals that were capable of seeing to some distance. There is another point that Mr. Fol insists upon, and that is that a submarine boat cannot see its way under such circumstances. Provided it be swift, it will not have time to back astern when it sees some large obstacle loom up before it, since, at the moment of distinguishing the object, the boat would not be more than 30 feet distant therefrom. It will always be obliged to get its direction before plunging, and to navigate over a known ground, whose bearing has been carefully taken. Submarine navigation is thus confined within limits that man cannot widen, since it is impossible for him to modify the transparency of the water.

The color of the water varies from blue to greenish, according to its degree of clearness. Even at a depth of 30 feet objects take on a bluish tint, and at 75 or 95 feet the light is already so blue that animals of a dark red color, such as the *Murex plalomus*, appear to be black, while the green and bluish algæ seem very light in comparison. Upon rapidly ascending to the surface, the aerial landscape appears red to the eye that has got accustomed to this blue light.

The red rays are the first ones extinguished. It is the blue rays that, being the least absorbed, penetrate to the greatest depth, and it is precisely these rays that act with the most energy upon the photographic plate. Thus fall the objections that certain scientists, with a persistency that does no credit to their notions of physics, have urged against the use of the photographic plate for finding to what depth daylight penetrates water.

NEW UMBRELLA OR PARASOL EXHIBITOR.

The engraving shows an umbrella or parasol exhibitor recently patented by Messrs. Abraham Y. and



KNISELY'S UMBRELLA OR PARASOL EXHIBITOR.

John P. Knisely, of Steelton, Pa. This exhibitor consists of a series of light annular frames of different diameter, arranged at different heights and supported by light rods. The lower annular frames contain cups for receiving the tips of the umbrellas, while the upper annular frames contain series of rings of sufficient size to receive the body of the umbrella or parasol. The support thus formed is arranged to turn on the upright rod, so as to render the entire contents of the exhibitor readily accessible.

The device, although light and compact, will hold a large number of umbrellas.

Natural Gas Notes.

An Oakland, Cal., note, under the date of July 15, says that the wildest kind of excitement was created north of Oakland by discovery of natural gas in abundance on one of the ranches north of Lake Merritt. The gas vein was discovered while a farmer was boring an artesian well on his property, and when ignited the flame is over 80 ft. high and burns with a roar that can be heard for miles. The well has been plugged, and a number of others are being bored by way of experiment.

At Pomeroy, O., three miles back of town, gas was recently struck at a depth of 400 ft. The pressure was so strong that the tools were blown out of the well; oil, rock and dirt being blown high in the air.

The excitement by reason of the discovery of natural gas west of Meadville seems to increase rather than diminish. The drill is going down in the well near the Cussewago Mills, and has reached the depth of about 800 ft.

A gas well has just been drilled in Coshocton County, O., that yields 300,000 ft. of gas daily. It is 600 ft. deep. Its horizon is in the shale below Berea grit.

Report from Calf Creek, W. Va., says a big gas well was struck on the Sheets place. The actual measurement gives the flow of gas as 3,000,000 ft. every 24 hours.

A description of the newly discovered well at Chittenango, N. Y., which is creating such an excitement in its vicinity, states that the first vein of gas was struck at a depth of 950 ft. It was a weak vein and was soon exhausted. A stronger vein was reached at a depth of 2,651 ft., another at 2,690 ft., a third at 2,875 ft. None of these veins lasted for any length of time. At a depth of 2,884 ft. a vigorous vein was uncovered, but this soon ceased to be interesting, for on July 9, at a depth of 2,904 ft., the drill opened a vein that made the subscribers to the enterprise smile. The escaping gas was confined to an inch pipe, which ran out into the street. The gas was then fired and the blaze was 5 ft. in diameter and rose to a height of 15 ft. It was allowed to burn for 26 hours, and a large number of persons visited the well during this time. When a reporter visited the well recently, the drill had penetrated the earth to a distance of 3,013 ft. The contracts call for a well 3,023 ft. deep, and drilling will be stopped when that limit is reached. Since the last vein was reached, the gas has been used as fuel for the engine, and no trouble has been found in keeping the steam up to 150 pounds. The gas is conveyed to the fire box through a pipe which fits loosely into the mouth of the well. Consequently, but a small part of the gas is carried to the engine. The remainder escapes into the air.

The prolongation southward of what is known as the Cincinnati axis should give in some parts of Kentucky and Tennessee one or more gas fields. Then the Indiana gas field is a prolongation of the Ohio oil field, but on another axis. It might be inferred that there should be another gas field in North Illinois, but that is not the case. Throughout Northern Illinois there are a few isolated areas which furnish gas in small quantities from the Trenton, but nothing in commercial quantities. This is due to the fact that the great axial elevation of the Trenton brings it too near the surface for the gas to be retained. In Western Indiana on a prolongation of the great Illinois axis is an area of territory which will produce gas from the Trenton limestone in liberal commercial quantities. That is a distinct field from the Indiana gas field at present operated. Then in Southern Illinois there are two axial lines which will no doubt produce gas in large commercial quantities.

New wells are being struck, with good results, at Muncie, Ind., at a depth of 900 ft.—*Light, Heat and Power.*

James W. Queen.

James W. Queen, founder of the house of James W. Queen & Co., Philadelphia, died on July 12, at Cresson, Pa. Mr. Queen was about seventy-eight years old. When a boy Mr. Queen entered the employment of John McAllister, then a well known optician on Chestnut Street. When McAllister retired, Mr. Queen, together with W. Y. McAllister and Walter B. Dick, succeeded to the business under the firm name of McAllister & Co. In 1853 this firm was dissolved and J. W. Queen started at 924 Chestnut Street. In 1855 Samuel L. Fox was taken into partnership. The firm is now controlled by Samuel L. and Edward B. Fox. In 1868 Mr. Queen retired from business and traveled extensively, visiting nearly all civilized countries. Until last year he enjoyed excellent health. He leaves a widow, but no children.

James W. Queen's reputation was of the highest, and he was noted for his integrity. Mr. Queen was very skillful as a manufacturer of delicate instruments for scientists, surveyors, and chemists, and his reputation in that direction was worldwide. He had for a long time past represented in this country the leading European makes of electrical apparatus for measurements, etc., and had lately gone into the manufacture of such apparatus himself.

Money Order Postal Card.

Germany and Austria intend to increase the facilities of the postal traffic. Amounts of one gulden (Austrian money) or two marks (German money), or less, may be transmitted in future by buying postage stamps for the amount required, which are pasted on the back of a card, where they are canceled at the post office, like the postage stamp on the front of a card which pays for the postage. The addressee of such a card takes it to his post office, and receives the amount indicated by the postage stamp on the back of his card.

EIGHTEEN words have come into the language—probably temporarily, most of them—to denote the act or state of electric killing. They are as follows:

Electromort, thanelectrize, thanatelectrize, thanatelectrisis, electrophon, electricise, electrotony, electrophony, electroctony, electroctasy, electricide, electropœnize, electrothenese, electroed, electrocution, fulmen, voltacuss, and electrostrike.—*Garratt.*

TORPEDO TARGET PRACTICE AT KIEL.

Among the weapons which are called upon to play an important part in modern warfare, the torpedo stands in the foremost rank of interest, and yet very little is known of its peculiarities, especially of those of the German torpedo. Its greatest danger does not lie in the fact that it is an engine of destruction, but in the power to direct it with fatal certainty. This is accomplished by treating the torpedo, to a certain extent, as if it were a living creature, its character and peculiarities being observed, and the results of these observations being recorded in a list of particulars, to which those in command refer when firing. Especial attention is paid to target shooting, and keeping a careful record of the results thus obtained; and besides this, the torpedoes just from the works are tested as to their mechanical correctness, with a view to regulating them.

In our article of to-day we treat of a very important factor in the life of the torpedo—the practice ground, with all its interesting details. The celebrated firm of "Schwarzkopf," which, as is well known, supplies half the world with torpedoes, has two practice grounds of this kind, one in the harbor of Kiel and the other near Venice. A third one, which was built on the same model at Yokohama, now belongs to the Japanese government.

A practice ground of this class consists of two parts connected by a railroad track, viz., the machine house, which contains all the machinery necessary for the regulation of the torpedoes, and the shooting place proper. To this leads a bridge which extends sufficiently far over the water to give the torpedo and the pinnace employed in the operation the required depth. At the head of the bridge is the trestle, the under part of which is arranged for the reception of the torpedo tube, while above, on the platform, is a little house for the engineers. (See Fig. 1.)

We will now follow the very interesting details of firing, which is by no means as simple as the firing of guns. Let us begin by placing the target, which consists of a float about 25 meters long and 1½ meters wide, carrying a breastwork on the side toward the practice waters. (See Fig. 2.) The supports of the breastwork are 1 meter apart, and thus serve to measure the course of the torpedo in relation to the center of the target, which is marked by a stake carrying one of the usual round disks. On the float there is also a kind of sentry box for the protection of the target man or guard.

The preparation for firing consists, first, as we have said, in placing the target. The pinnace tows it about 400 meters into the bay, the correct position being obtained from the bridge by means of sextants, and then it is secured in place by four anchors carried out from the four corners by a boat. When the float is firm, the torpedo is brought out of the shop, along the bridge, on a truck, to the crane, Fig. 3, by which it is swung out on to the loading frame. Here it is filled with compressed air. This operation, which can be detected at a distance by a peculiar singing sound, consists of forcing compressed air—by means of a pump located in the shed—into the torpedo through a small copper tube, which can be seen in our illustration, Fig. 3. The supply of air is regulated by a man at the manometer, while it is cut off by another man who stands by the torpedo. Then it is launched, pushed in front of the firing tube, and is finally raised and pushed into the tube, which is closed and lowered to a depth of 2 meters. (See Fig. 4.) The torpedo is now ready for firing. The torpedo is propelled in part by the impulse given to it when fired from its gun and in part by the compressed air with which it is charged, which acts on the propeller at the rear of the torpedo.

The red flag, which means "clear the way," is now raised above the commander's shed on the bridge, and the man on the target and those on the pinnace, which is lying to the starboard of the target, answer with their flags. As soon as the signal has been returned, the commands "ready," and then "go" follow, and the torpedo is fired. With a roar which reminds us of the shrill, hoarse cry of a beast of prey, the monster shoots out of the tube (see Fig. 5), and its course is marked by a strange wake of foaming, seething water, between the cross waves of which great bubbles of air come to the surface. The man on the target has calculated the probable course of the projectile from the wake, and he keeps his eyes fixed in the depths, until suddenly he sees it rush by; then he pulls down the flag, and a hundred meters beyond the target the torpedo springs out of the water like a sea monster. The moment it passed the target the pinnace started in after it under full head of steam, so as to catch it when it came to the surface. For this the greatest foresight is necessary, as the torpedo has to be handled carefully. The pinnace approaches it slowly, fastens a line to its head, and then starts off to the target. (See Fig. 6.) Here the net is taken on board, which has been used in a manner presently to be described. The target man determines the horizontal distance of the course of the projectile from the center of the target by means of the supports referred to above; but to find its depth, several nets are secured below the target, the meshes of which are so arranged that the torpedo cannot pass through without breaking one of them. After the projectile has passed the target, the man stationed there raises the net (see Fig. 7) which has been struck and hands it over to the pinnace, which now returns with the net and the torpedo to the starting point, which must also be approached with great care, so that by skillful management the torpedo may receive the proper impulse to deliver it to the hands of the man waiting to receive it. After being brought back in this way from its sea voyage the torpedo is raised and prepared for another trial, while the net is given to the engineers, who spread it out and measure the broken meshes. Then the record is made and the operation is completed.

It will be seen that this is a much more complicated operation than the firing of guns, and consequently only about five shots can be fired in an hour. Of course, a trained body of men is required for manipu-

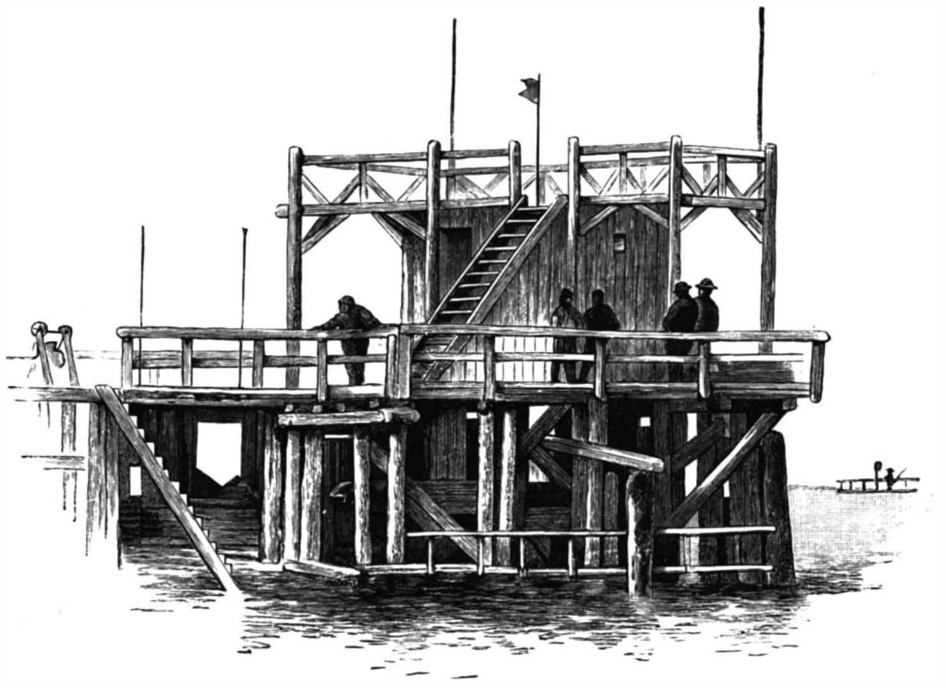


Fig. 1.—THE COMMANDER'S SHED.

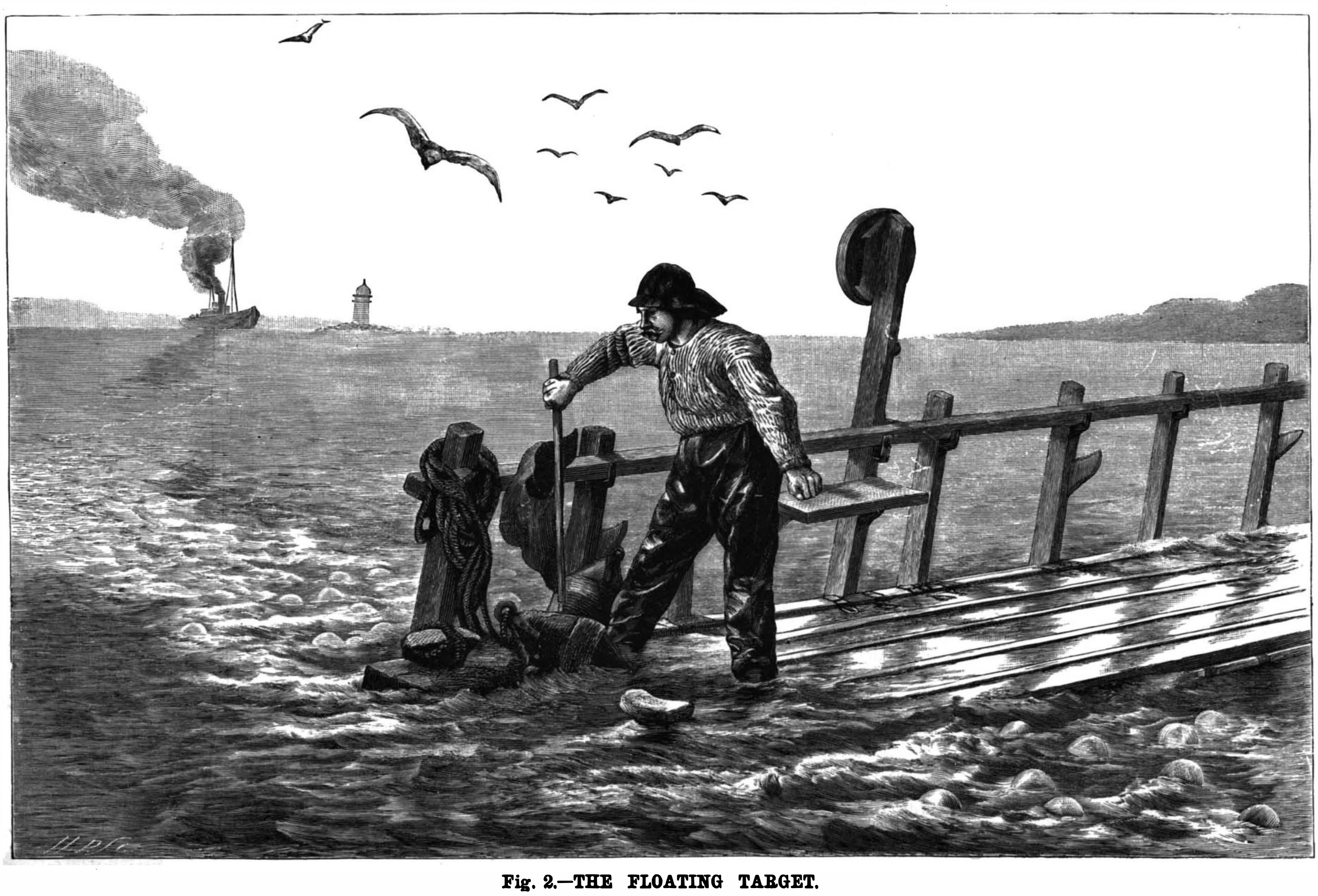


Fig. 2.—THE FLOATING TARGET.

lating the different apparatus. The target man, in particular, must have a great deal of practice in observing the course of the torpedo. Before he has become accustomed to his work he cannot see the projectile as it moves rapidly through the water. This post is, besides, a dangerous one, for it has repeatedly happened that the torpedo has made an unexpected jump over the float and wounded the guard, but fortunately none of these accidents has proved fatal. Sometimes the torpedo does not come up in the prescribed spot, but runs on until its air is exhausted, in which case it is likely to be lost. Of course great pains are taken to recover it, for no small amount of capital is at stake. A torpedo costs from $2,400 to $2,800.

Torpedoes are not now fired exclusively under water, as heretofore, but also above water, from a deck, by means of compressed air or powder. —*Ueber Land und Meer.*

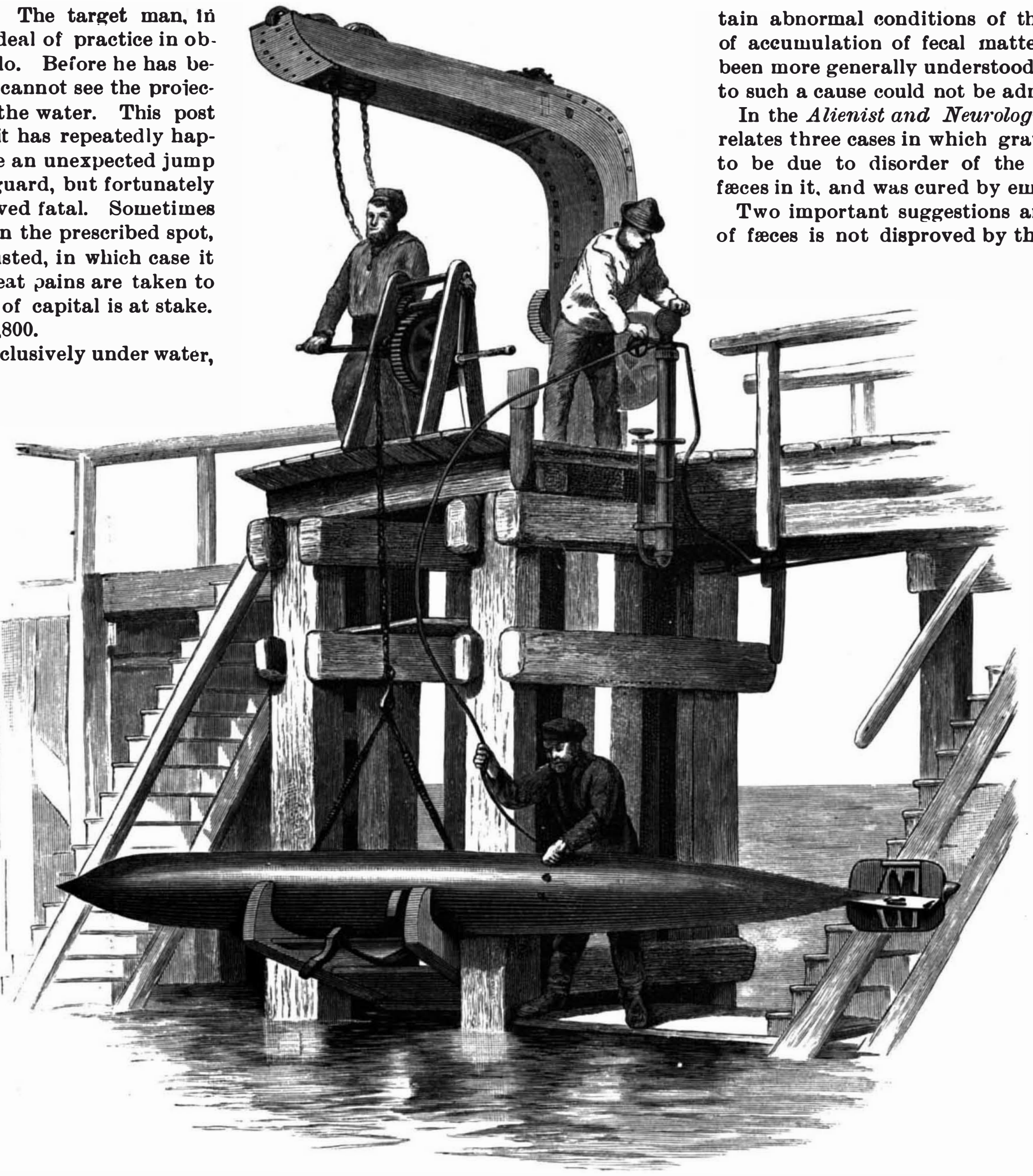


Fig. 3.—FILLING THE TORPEDO.

Insanity Proceeding from the Colon.

Few general practitioners will agree with the eye specialist who stated that he had rejected as mere superstition the prevalent views concerning the importance of securing thorough action of the bowels in sickness. While it is true that some persons are much more affected by the occurrence of constipation than others, it is also true that the health of a large part of the human race is greatly influenced by the state of the intestinal functions. As some one has expressed it, one of the best preparations for active life is a good set of bowels. Probably the worst indictment that can be brought against our modern system of education is that it cultivates in the boys and girls a habit of intestinal sluggishness, by compelling them to hurry off in the morning to school, and to repress the desire for stool; by producing feebleness of muscle and passive congestion of pelvic organs as the result of long sitting and want of physical exercise. This habit is, in men, sometimes corrected by the out-door labors of after life; but in women, especially those of the wealthier classes, it is confirmed by confinement indoors and want of muscular exercise. The important part which intestinal inactivity (glandular as well as muscular) bears in the causation of sickness is witnessed by the fact that purgatives are among the remedies most frequently taken. Probably no other class of drugs is so often called for.

It will be readily admitted that many of the milder affections of the nervous system may be caused by excessive and long-continued accumulation of fæces in the large intestine, or rather by the abnormal state of the system which permits or arises from such an accumulation. Since the discovery of the nature and poisonous influences of ptomaines, and kindred bodies, and of their formation in certain abnormal conditions of the digestive tract, the dangers of accumulation of fecal matters in the large intestine have been more generally understood. That insanity could be due to such a cause could not be admitted without direct proof.

In the *Alienist and Neurologist*, January, 1890, Dr. Moyer relates three cases in which grave mental disturbance seemed to be due to disorder of the colon, with accumulation of fæces in it, and was cured by emptying of this organ.

Two important suggestions are made. That accumulation of fæces is not disproved by the occurrence of free passages, and that treatment should be by large, repeated, high injections, purgatives doing only harm.—*Medical Record.*

[We are cognizant of a case of paresis, the early indications of which could be traced back for more than twenty-five years prior to the death of the sufferer. During the whole of this period he was a victim to constipation, which became more and more obdurate, and the paresis correspondently progressed. — ED. S. A.]

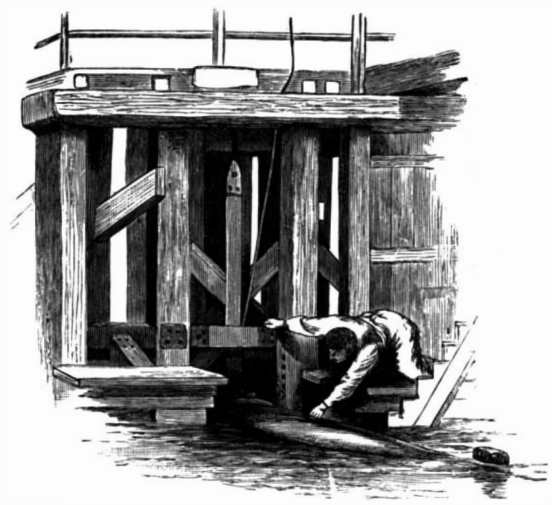


Fig. 4.—PLACING THE TORPEDO.

Fig. 6.—TAKING THE TORPEDO IN TOW.

Fig. 7.—RAISING THE NET.

How to Reach and Enjoy Old Age.

It is no simple matter to state in terms at all precise what forces are directly connected with the production of hale and happy old age. More certainly is involved in the process than mere strength of constitution. Healthy surroundings, contentment, and active, temperate, and regular habits are most valuable aids. Hard work, so long at least as it is not carried beyond the limit necessary to permit of the timely repair of worn tissues, is not only a harmless, but a conducive circumstance. It is, in fact, by living as far as possible a life in accordance with natural law that we may expect to reap the appropriate result in its prolongation. Civilization is at once helpful and injurious. Under its protecting influence normal development at all ages is allowed and fostered, while the facilities it affords for self-indulgence are constantly acting in an opposite direction. The case of Hugh Macleod, aged almost 107, which has lately been published, illustrates in a remarkable manner the truth of these observations. This man, a Ross-shire Highlander, in what must be the somber twilight of a blameless and fairly active life spent in his native county, still shows, it is said, a notable degree of vigor. He takes a lively interest in the affairs of life, has good appetite, is generally healthy, cuts and carries his peat for household use, and goes about among his neighbors as of old. His food is of the plainest, though nutritious—porridge, fish, a little meat; and his habit in this and other matters is not unworthy the attention of many who are daily hastening by opposite courses the end of a merrier, shorter, but perhaps not happier life.—*The Lancet.*

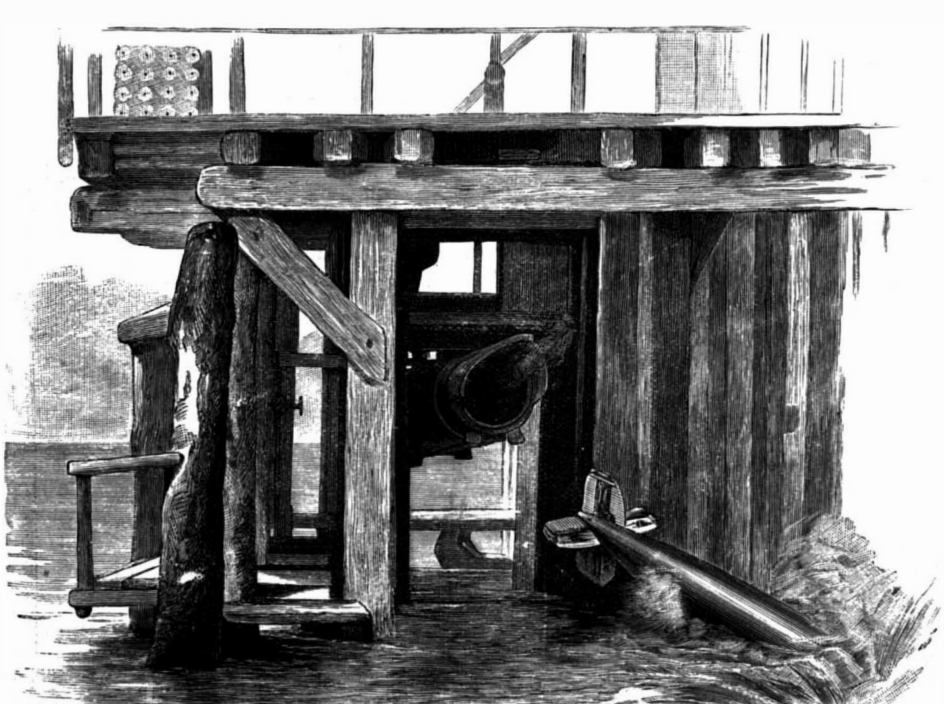


Fig. 5.—FIRING THE TORPEDO.

Sir Edwin Chadwick.

Full of years and honors, Sir Edwin Chadwick, K. C.B., the father of modern sanitary science, died on July 5 at his residence, Park Cottage, East Sheen, in his 91st year. Educated as a barrister, Edwin Chadwick early devoted himself to the study of the causes of zymotic diseases, and the means by which the losses of health and life resulting therefrom could be diminished. Chadwick then preached to a generation with ears that were deaf and eyes that were blind to the startling facts he brought before them ; but though his views on cleanliness were rudely ridiculed, Jeremy Bentham left him a small legacy and part of his library. Earl Grey nominated Chadwick in 1833 as assistant commissioner to inquire into the operation of the Poor Laws of England and Wales, and the outcome of his searching investigations and elaborate report was the passing of the Poor Law Act. Mr. Chadwick was appointed secretary to the Poor Law Board, and during more than twenty years his labors in connection with it and the general board of health were untiring. Factory labor, half time, and instruction occupied some of his attention. In 1838 he obtained a special commission of inquiry into the prevention of disease and the improvement of dwellings in England and Wales, and in 1843 one on interments in towns, which laid the foundation for subsequent legislation. In 1848, Mr. Chadwick was appointed a commissioner of the general board of health, from which he retired nearly six years later on a well deserved pension of £1,000. His services to the country were only tardily and grudgingly acknowledged. Created a C.B. in 1848, he was only a twelvemonth since advanced to the rank of knight in the same order. His labors have been indefatigable in all matters relating to the health and welfare of the people, and were continued to the last. His volume on "The Health of Nations," of which an abridged edition, revised by Dr. W. B. Richardson, has just been published, is a standard work on the subject of the benefits conferred on the people by attention to hygienic rules. Chadwick was an earnest worker in the Sanitary Institute from its formation, and was half a dozen years president of the newly organized Association of Public Sanitary Inspectors, and his address to that body, read in his absence through enfeebled health, at the Annual Congress, at Leamington in October last, was as fresh and vigorous in style as any of his earlier writings.—*Building News.*

Life on Lake Titicaca.

SOLON I. BAILEY.

Lake Titicaca rests in the elevated plateau between the eastern and western ranges of the Andes.

The mean elevation of its surface is 12,505 feet above the level of the sea, or about twice that of the summit of Mt. Washington, White Mountains.

It lies northwest and southeast. Its greatest length and width are about 120 and 50 miles respectively. It holds the well-known distinction of being the loftiest lake in the world upon which any considerable navigation is carried on. At present two small steamboats make regular trips on the lake between Puno, in Peru, and Chililaya, in Bolivia.

This steamboat service supplements the railway system from Mollendo to Puno, and together with a well equipped stage line from Chililaya, completes the connection between the Pacific and La Paz. The present terminus of the railway is Puno. Neither this nor any other line of railway reaches La Paz, as has been incorrectly affirmed by some American publications. The distance from Mollendo to Arequipa is 107 miles, and from the latter city to Puno 218 miles, in all 325 miles from the ocean to the lake. Between Arequipa and Puno the road crosses the crest of the Cordillera, or Western Andes, reaching, at Crucero Alto, the elevation of 14,666 feet, making it without doubt the loftiest railway in actual operation in South America.

From Puno across the lake to Chililaya is 104 miles, and 36 miles thence by stage to La Paz.

From Juliaca, on the Puno division of the above railways, is a branch road extending northwest. This is known as the Cuzco division, but at present it only reaches Santa Rosa, a distance of 82 miles from Juliaca and less than one-third the distance to Cuzco.

The ancient capital of the Incas has not yet been disturbed by the whistle of the locomotive, but it is proposed to extend the main line around the southern shore of the lake to La Paz, and the branch to Cuzco.

The two small steamboats, of some 60 tons burden, now running on the lake, were built in England as gunboats for the Peruvian government. Before the construction of the railway, they were brought in sections on the backs of men and animals from Arica, and set up on the shores of the lake. Not proving necessary as a protection against Bolivia, they were remodeled for merchant service and have made regular trips for some years. They are not fast boats, but speed is not necessary where the only competition is with Indian "balsas." The lake is very deep in many parts, but unfortunately near Puno and Chililaya it is quite shallow, especially in Puno Bay, requiring considerable dredging. The fuel used on these boats is unique in steamboat navigation. Coal is very expensive. To run each boat one hour requires 400 pounds of coal, costing four dollars. Llama dung is, however, collected in great quantities by the Indians and sold in sacks containing four bushels at 10 cents per sack. Eight sacks of dung run the boat one hour and cost but 80 cents, only one-fifth the expense of coal. The fire thus furnished is sufficiently hot, but is quite unsteady, and with much waste, causing the engineer and firemen some annoyance.

This same fuel is used in all this region for cooking. In this connection it may be of interest to state that on the locomotives that run between Mollendo and Puno is used a fuel called "yareta," a moss-like form of vegetation which grows in dense conical masses from one to two feet in diameter. It contains considerable resinous matter, and makes a hot fire. It grows on the lofty plateaus and mountains, is cheaper than coal, and is used in considerable quantities.

When the depth of the water will allow, two small steamers also ply on the river Desaguadero, as far as Nasacara. The river Desaguadero forms the only outlet for Lake Titicaca, and though it is a stream of considerable size, it is evident that more water flows into the lake than finds its way out by this channel. Owing to its great area and its position, no doubt a vast amount is lost by evaporation. In fact the water, though apparently fresh in the deeper parts, has, near the shore, an alkaline taste.

The small steamboats mentioned do not comprise all the navigation that takes place on Lake Titicaca. Formerly they made trips around the lake to various small ports, picking up cargoes. Now the trade between Puno and Chililaya and the Desaguadero River takes all their time, and their place in other localities is in part taken by the Indian and his balsa. The balsa of Lake Titicaca is an interesting craft. It is constructed of the reeds that grow abundantly in the shallow places. These are bound together into huge bundles of the desired length. Two of these bundles fastened together and turned up at the ends, in canoe fashion, form the raft or balsa proper. Two smaller bundles form rude gunwales. A sail is made of the same materials, and by this and a long pole the Indian makes his way for considerable distances. Speed is not necessary, for he is in no hurry. These balsas have been used for many generations. A commentary on the Indian character is furnished by the following incident: When unable to use his sail, he must paddle his craft slowly and laboriously by means of his pole. A gentleman, desiring to improve their condition, procured some oars with broad blades for their use, but these they refused, remarking that poles had served their fathers well and hence were good enough for them also. From the northern parts of the lake the Indians bring fruit and vegetables to Puno for sale.

From the islands of Taqueli and Soto are brought pebbles—from the former black or drab, and from the latter white. These are used for the variegated pavements in the courts of the better houses. The Indians avoid, however, the more exposed portions of the lake, as violent storms occasionally sweep over it. At such times even the steamboats find it necessary to change their course, and passengers are especially liable to seasickness.

A Peruvian gentleman, for fourteen years a purser on Pacific steamships without a touch of seasickness, experienced a severe attack of this unpleasant malady during a storm on the lake. Not far from Puno is a little fishing town, the huts being built on the steep, rocky hillside and the balsas drawn up on the shore. The lake furnishes abundance of good fish, and the surface near shore swarms with a variety of water fowl. Several islands are inhabited. The largest is Titicaca, sacred in Peruvian annals, for on its bleak northern end is the spot where Manco Capac, divine messenger from his father, the sun, first stepped. He certainly chose a bleak and unpromising spot from whence to start on his beneficent mission.

On Titicaca and Coati, near by, are the ruins of various so-called palaces of the later Incas and temples for the priests and virgins of the sun. These islands now belong to Bolivia, and for political reasons no one is allowed to land on them without special permission from the government. Among these monuments of the past live to-day a few Indians, really but serfs in a land once ruled by their ancestors. On the southern end of Titicaca is a large sheltered bay, with pleasant hills sloping up from the shore, with cultivated fields and the huts of the natives. Both here, however, and on the plateaus surrounding the lake, the climate is severe and the conditions of life hard, and furnish a good commentary on the genius of the Inca race. Corn will not ripen, or with the most extreme difficulty. The only cereals capable of cultivation are barley, quinoa, and cañagua. The summer and rainy season is from November to March. During this time whatever agricultural labor is to be done must be accomplished. Even during this season sleet is not uncommon, and snow lies low on the surrounding mountains. By birth and experience inured to the rigors of such a climate, with bare legs and feet, the natives seem not much affected by the cold. Lake Titicaca never freezes over, yet ice forms near shore. In winter the temperature is often far below the freezing point. Yet the lake must tend to equalize the temperature. On the Bolivian side, at 5 P. M. of November 26, I found the temperature of the air 52° F., and that of the water 58°. At 7 A. M. the following morning, in the Gulf of Puno, the temperature of the air was 42° and of the water 57°. In the middle of the day no doubt the air is warmer than the lake. To the north of Titicaca, toward Cuzco, there are some populous towns, and the people are largely engaged in caring for the enormous herds of cattle of the great land owners.

For this labor each receives about $25 per year, besides which they are allowed some of the sterile land for cultivation. Their poverty can be judged by the fact, vouched for by a Peruvian gentleman of wealth and position, that although a whole sheep can be had for 40 cents, these Indians are too poor to eat meat.

Strong drinks have to a large extent taken the place of the comparatively harmless "chicha," adding to their misery. They live in little adobe houses, with earth floor and usually grass-thatched roof. To keep warm they have a small door, and for a window one little opening from four to six inches square. On the Bolivian plateau the condition of the Indian seems more favorable. Yet everywhere they appear fairly contented. They have no Yankee love of change; no dreams of political advancement haunt them. Seeing them, one can understand how they were content under the paternal despotism of the Incas. They are quiet, stupid, and superstitious. Yet they have not forgotten their origin. The very air in Peru is full of the past. Stories of the glories of the Incas, and of treasures buried and not yet found, are everywhere current and everywhere believed.

In a great cathedral I saw an Indian with rapt face worshiping before an image of the Christ. But the image was decked out in the full garb of an Inca. Even in his religion—and he is very religious—the Indian seems to be thinking of the past, when, instead of belonging to a servile race, people of his blood held sway over a country embracing the present limits of Ecuador, Peru, Bolivia, and Chili. Apparently he has lost much by the Spanish conquest. In contact with a higher civilization he has not held his own. A so-called Christian conquest accomplished the material, moral, and religious degeneration of the Indian of the Andes.

Natural Gas in Utica, N. Y.

On July 10, a vein of natural gas was struck in a well being drilled for the National Brewing Company, on their grounds on South Street, the site of the old Eaton Match Company. The well is six inches in diameter and is being drilled by the veteran well driller P. H. Foley, of this city. From almost the very first the drill penetrated black slate rock, in which it remained for 555 ft. No water was found, and throughout the entire drilling it has been necessary to pour water into the hole in order to operate the sand pump. At 555 feet the Trenton rock was struck, and alternate layers of the hard sand rock and water lime streaks were found from that time until the gas was reached, at 570 ft. As soon as it was discovered that the well was furnishing some gas, a cap was put on the top of the one length of casing, and a small pipe about fifteen feet long was attached, so as to convey the fluid about the drilling apparatus. The gas was then lighted, and it gave out a strong, steady flame two or three feet in height throughout the night. The flow continues today without any apparent decrease in volume, and bears every evidence of keeping up as it has started. The gas burns with the peculiar solid rose-colored flame always found in the gas from the Pennsylvania wells, and betrays none of the blue streaks and sputtering of swamp or pocket gas. Mr. Foley, who has drilled wells all over this country, and many in the city, is confident that the drill has penetrated the first seams of a strong and paying gas vein. For a number of years he has been strong in the belief that Utica was situated upon a paying gas belt. Two years ago, while drilling a well for the Globe Woolen Mills, Mr. Foley found a strong vein of gas at 800 ft. The flow at that time was so strong that the gas took fire and was put out with difficulty. The well was intended for water, and so the gas was cased out and the drill sent down until the water was found. Much difficulty was experienced in casing out the gas, the pressure being so strong that the casing was bent and split when the first attempt was made to place it. Several other wells have been drilled by Mr. Foley in which gas has been found, and he has attempted to get some of Utica's capitalists interested in the matter, but they have always thought the speculation a hazardous one. The present find, however, is so pronounced in its nature that there is now a strong probability that the territory will be tested. The National Brewery Company is after water, but if they have touched a gas vein instead, as now seems most probable, it will prove of more value than would water, which can be procured from other wells. The fact that gas is found at such a depth, and is covered with such an impenetrable covering of slate, would indicate that it is pretty sure to be "a stayer."—*Utica Observer.*

THE GARTER SNAKE.

The ribbon snakes, or "garters," as they are generally called, are the most common serpents of our country. Notwithstanding their frequency, their life history is but little known. The larger and most numerous species is the *Eutænia sirtalis,* first described by Linne. It varies greatly in color and markings, not only in different sections, but even in the same localities. Naturalists from time to time have made about 26 distinct species out of this one *sirtalis*, and it is extremely perplexing, and enough to make the young scientist weary, to study these many long, dry and useless descriptions, only to find in the end that they describe one common species of snake known to science since 1758. Out of these 26 so-called new species, we can find about seven varieties only of the well known *E. sirtalis* of Linne. The common garter snake can be identified by the following description, which I make as plain and with as few technical terms as possible: Form rather robust when full grown. Ground color above olive brown or gray to greenish or brownish black. One vertebral and two lateral yellowish white or pale greenish yellow lines. These three lines are often very indistinct, and sometimes entirely wanting. The vertebral strip generally remains visible anteriorly. Between the dorsal and lateral stripe on each side are two rows of alternating black or dark brown spots, quadrate, and sometimes conspicuous on a light ground, at other times lost in the ground color. Beneath generally pale bluish olive, chin and throat white, sometimes yellow or green tinged. A black spot margined with white (sometimes double or two) on each side of and at the base of each abdominal plate, the skin between the dorsal scales often appearing as small white lines or dashes. Head distinct from the body, flat on the crown, and of a uniform olive brown color. Often a pair of small linear whitish spots on the center of the head. Anteorbitals one (rarely two). Upper lip plates 7 or 8. The scales of the back are all ridged in the center, (carinated), in 18 to 21 rows, narrow above, broad below. Abdominal plates 145 to 155 (to over 180 in some varieties). Plates on the under side of tail 50 to 90, all divided. Length when full grown, from two to nearly three feet.

In the Middle States the garter snake awakens from its winter sleep and comes forth in the early spring. I have met with it as early as March 24, while the snow was yet upon the ground in many places. The males and females immediately seek each other, and may often be found in warm sunny spots, joined in copulation. At this season especially they emit a rank and disagreeable odor, particularly noticeable when captured, and I feel convinced that the sexes follow and find each other entirely by scent. The garter is ovoviviparous, that is, the thin transparent egg case is broken at the moment of oviposition, and the young come into the world formed and colored like the adult, while the hog-nosed snake (*Heterodon*), checkered snake and king snake (*Ophibolus*), and the black snake (*Bascanium*), lay eggs covered with a tough, whitish, somewhat flexible shell, which takes many days to hatch under warm sand or decaying vegetation. The young are generally born in the month of August. The earliest date I have recorded is July 23, and the latest August 25. The number produced at a birth varies from 13 to 80, and their length is about 7½ inches, not one or two inches, as some have supposed. The rattlesnake and copperhead produce only from 5 to 12 at a birth.

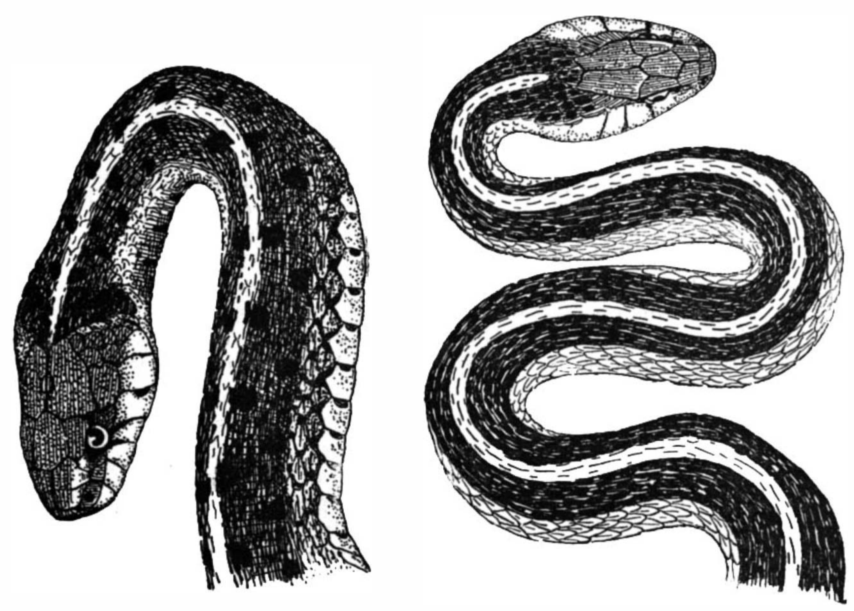
A few summers ago I had a large female *sirtalis*, which had been caught the previous spring, in a vivarium, by herself. I was greatly astonished one morning to find that the vivarium contained 28 snakes instead of one, the happy mother having during the night given birth to 27 baby snakes. They were quite a lively little party, crawling about and over their mother with unmistakable infantile glee. Notwithstanding their playful activity, they were continually yawning during the morning, perhaps not fully recovered from their prenatal sleep. The first thing thought of was how and what to feed this interesting family. I knew that a toad or frog, once or twice a week, was food sufficient for the mother, but the snakelets did not appear able to master a large grasshopper, much less a toad. Having been informed that young snakes fed upon insects, I at once went on a collecting trip and secured a number of crickets, grasshoppers, beetles, flies, moths, and caterpillars for them, but not one even attempted to catch or swallow one of the insects. At last I concluded to try earthworms (*Lumbricus*). The first worm I brought to them was recognized by several of the snakes when yet about three feet away from the glass front of their cage, and the worm had scarcely dropped from the forceps in my hand, before five of the baby snakes seized upon it, and such fighting, twisting, rolling, and pulling I never before witnessed! The worm was torn apart, and four snakes began greedily to swallow the two pieces. One of the snakes not only swallowed his end of the worm, but also the head of his brother who was at work at the opposite end, and when the snake discovered that while eating he was being eaten, the writhing and squirming was indescribable, until the unfortunate snake disengaged his head and neck from the teeth of his brother.

After this I had no trouble in feeding, having discovered what may be called the milk for baby garter snakes. I am of the opinion that many species of our land snakes, when immature, feed upon earthworms. Dr. Holbrook, in his work, "North American Herpetology," says that the little brown snake, *Storeria De Kayi*, feeds upon insects, but I could never get them to eat insects of any kind. Earthworms were their only food. The mature garter snakes feed mainly upon toads and frogs. I have never known them to be insectivorous. In captivity I have seen them swallow salamanders and small fishes, but I doubt very much if they ever pursue and capture the latter in the water.

I once found a *sirtalis* that had captured a frog too large for his mouth. He had swallowed one hind leg of the frog, but could proceed no further. The frog had evidently been dead for several hours, still the snake held on, and expressed anger when I feigned to take the frog away.

The garter snake is perfectly harmless, and of a timid disposition, yet it will sometimes bite when caught in the hand. The bite, however, amounts to nothing more than a few slight scratches. Out of the many living individuals of this species I have had only one of them, a male, possessing an ugly disposition. When teased he would flatten himself like a black *Heterodon*, showing white between the scales, and strike and bite viciously at an offending object again and again, until he would fall over in a paroxysm of rage. At last he died after one of these fits.

C. FEW SEISS.



THE GARTER SNAKE.

Protection for the Originators of New Plants.

Different plans for patenting plants have been often advocated, but the essential objection to them all was well stated by Professor Bailey, as follows: "It is exceedingly doubtful if a patent could be secured for varieties which spring up from a chance seedling, and most of our varieties come in this way. But if the patent were granted, there are innumerable cases in which no jury of experts could agree concerning the distinctness of varieties." Few cautious persons would be willing to swear to the identity of a given strawberry or rose, and it would be difficult to prove in any given instance that the flower or fruit in question was not a new one closely resembling an older variety.

Mr. A. L. Bancroft, of California, suggested a horticultural register wherein separate plants, like roses, chrysanthemums, ferns, apples, grapes, could be kept and numbered, on a system similar to that adopted in the various herd books where choice live stock is registered, but we then pointed out that a herd book was devised for a purpose quite distinct from those which it is proposed to secure by a system of plant registration. Individual animals are registered so that they may be identified, that their pedigree may be established, and that purity of blood may be maintained in a given breed or strain of live stock. In the case of plants, where the registration of one individual must stand for an entire class and where the parentage is often unknown and always of secondary importance, it is difficult to see how such a list would prevent a duplication of names for the same plant or the selling of different plants under the same name. Mr. Bancroft's scheme has been carefully elaborated since then, and a plan of registration has been adopted by the California State Horticultural Society. We have no space here to go into the details of the plan, which have been very carefully elaborated, but as it was discussed it seemed to the nurserymen in their convention that it was quite too cumbersome to be practical and effective.

There is, however, considerable protection already given to the originator of a new fruit in the copyright law. Mr. Hoyt, of New Canaan, Connecticut, stated that he had taken out such a right on his label of the Green Mountain grape, and had been instructed by eminent legal authority that no man could use this title on a label to a grapevine and sell it without his consent. It is true that if any one should buy a plant of Mr. Hoyt he could propagate it as largely as he chose for his own use, or could sell the vines under another name, but there would be little temptation to a grower to sell a really valuable variety under a name which would conceal its identity. The name is the very thing the plant pirate most wants, and he very often sells nothing else but the name of a good variety, attaching it to an entirely different plant from the one it really belongs to. This registered trade mark has proved of value too in preventing the sale of spurious plants under the label so registered, so that copyrighting assists in preventing the sale by unauthorized persons both of genuine plants and their counterfeits.

It is hard to see how much greater protection than this can be secured by a horticultural register. The plan of registering new plants has, however, many merits in other directions. It would be of interest to have an accurate description of any new plant filed in some public office, with its portrait and parentage so far as known. We should like to compare a plant and berry of Hovey's seedling strawberry as grown to-day with a preserved specimen of the original plant and its berry, or accurate portraits and descriptions of them, to see if any variation from the type had taken place. In questions of identity the register might give some assistance, but the inherent difficulties of accurate varietal description would remain. An organized effort to secure registration would be of value, too, in enlisting the co-operation of all horticulturists to secure to originators their rights, for, although no system yet devised can add much to the protection now given by the trade mark laws, this protection would be much more effective if it had an active and united public sentiment behind it.

Of course this protection to the introducers of new plants would make such plants more expensive for a time, just as patented machinery and copyrighted literature is more expensive. But although this increased price might be considered a burden upon horticulture, the advantages gained would be positive and important. Chief among these would be the encouragement offered to careful experiments in hybridizing. When growers can feel sure that they will reap some reward from discoveries in this field, we may entertain a reasonable hope that the breeding of plants may be reduced to something like a system or a science.—*Garden and Forest.*

Indianapolis Meeting of the American Association for the Advancement of Science.

By the invitation of the Governor of Indiana, and other State officers, the mayor and common council and aldermen, and the board of trade of Indianapolis, together with the Indiana Academy of Science, and several educational institutions, the American Association for the Advancement of Science will hold its thirty-ninth annual meeting in the State House of Indiana, from August 19 to 28, together with several allied societies for the promotion of agriculture, botany, entomology and geology. Originally the society was known as the Association of American Geologists and Naturalists, which held its first meeting fifty years ago in Philadelphia. Its scope was enlarged and name changed in 1848, and a constitution adopted admitting other departments of science. In that year the membership was 461. In 1871, when the twentieth meeting was held in Indianapolis, there were 668, and now more than 2,000 are enrolled, of whom fully a thousand are expected to attend this year's meeting. The A.A.A.S. is divided into eight sections, each of which will meet by itself to discuss matters pertaining to its own department of science. General sessions of the entire association are also held at times set by the council. It is expected that nine general addresses, and about 200 special papers will be read. President Mendenhall will give his annual address on Tuesday, August 19, and resign the chair to his successor, Professor Goodale, of Harvard University. Arrangements have been made for excursions on Saturday, August 23, and also at the close of the meeting. For information as to special railroad rates and entertainment, etc., application should be made to Alfred F. Potts, Esq., Indianapolis, Ind. Every effort will be made by the local committee to secure the comfort of visitors, and to promote the success of this great assembly of distinguished men of science.

The Annealing of Copper.

BY G. WYCKOFF CUMMINS, NEW YORK.

Copper is at present almost universally annealed in muffles, in which it is raised to the desired temperature and subsequently allowed to cool either in the air or in water. It may be stated for the benefit of those not versed in the practical work of annealing that a muffle is nothing more or less than a reverberatory furnace. It is necessary to watch the copper carefully, so that when it has reached the right temperature it may be drawn from the muffle and allowed to cool. This is extremely important, for it is found that if the copper is heated to too high a temperature, or is left in the muffle at the ordinary temperature of annealing for too long a time, it is "burnt" as the workmen say. Copper that has been "burnt" is yellow, coarsely granular, and exceedingly brittle—so much so that in some samples in my possession it cannot be bent once at a right angle without breaking. It is even more brittle at a red heat than when cold.

In the case of coarse wire it is found that only the surface is "burnt," while the interior is damaged to a far less extent. This causes the exterior to split loose from the interior when bent or when rolled, thus giving the appearance of a brittle copper tube with a copper wire snugly fitted into it. Cracks a half inch in depth have been observed on the surface of an ingot on its first pass through the rolls, all due to this exterior "burning." It is quite apparent that copper that has been thus overheated in the muffle is entirely unfit for rolling, either for rods or sheet copper or for wire drawing. It is found that the purer forms of copper are far less liable to be harmed by overheating than samples containing even a small amount of impurities. Even the ordinary heating in a muffle will often suffice to "burn" in this manner the surface of some specimens of copper, and thus render them entirely unfit for further working. The explanation of this will be made later. Copper that has been thus ruined is of use only to be refined again.

As may be inferred from the above, only the highest grades of refined copper are at present used for drawing or for rolling. This is not because the lower grades, when refined, cannot stand sufficiently high tests, but because the present methods of working are not adequate to prevent these grades of copper from experiencing the deterioration due to overheating. This is unfortunate for the manufacturer since, I understand, he has to pay cash in advance for the highest grades of refined copper.

In order better to appreciate the explanation of the various phenomena of copper annealing, let us see what refined copper is. The process of refining copper consists in an oxidizing action followed by a reducing action which, since it is performed by the aid of gases generated by stirring the melted copper with a pole, is called poling. The object of the oxidation is to oxidize and either volatilize or turn to slag all the impurities contained in the copper. This procedure is materially aided by the fact that the suboxide of copper is freely soluble in metallic copper and thus penetrates to all parts of the copper, and, parting with its oxygen, oxidizes the impurities. The object of the reducing part of the refining process is to change the excess of the suboxide of copper to metallic copper. Copper containing even less than one per cent of the suboxide of copper shows decreased malleability and ductility and is both cold short and red short. If the copper to be refined contains any impurities, such as arsenic or antimony, it is well not to remove too much of the oxygen in the refining process. If this is done, "overpoled" copper is produced. In this condition it is brittle, granular, of a shiny yellow color, and more red short than cold short. When the refining has been properly done and neither too much nor too little oxygen is present, the copper is in the condition of "tough pitch" and is in a fit state to be worked.

"Copper is said to be tough pitch when it requires frequent bendings to break it, and when, after it is broken, the color is pale red, the fracture has a silky luster, and is fibrous like a tuft of silk." On hammering a piece to a thin plate it should show no cracks at the edge. At tough pitch, copper offers the highest degree of malleability and ductility of which a given specimen is capable. This is the condition in which refined copper occurs in the market, and if it could be worked without changing this tough pitch, any specimen of copper that could be brought to this condition would be suitable for rolling or drawing. We have seen that tough pitch is changed if we either add oxygen to or take oxygen from refined copper.

By far the more important of these is the removal of oxygen, especially from those specimens that contain more than a mere trace of impurities. This is shown by the absolutely worthless condition of overpoled copper. The addition of carbon also plays a very important part in the production of overpoled copper.

That the addition of oxygen to refined copper is not so damaging is shown by the fact that at present nearly all the copper that is worked is considerably oxidized at some stage of the process, and not especially to its detriment.

Let us see how the above facts are related to the process of annealing copper. I have already referred to what is known as "burnt copper." This you may already have recognized as nothing more nor less than copper in the overpoled condition. This is brought about by the action of reducing gases in the muffle. By this means the small amount of oxygen necessary to give the copper its tough pitch is removed. You must remember that this oxygen is combined with impurities in the copper, and thus renders them inert. For example, as explained by Dr. Peters, the oxide of arsenic or antimony is incapable of combining more than mechanically with the copper, but when its oxygen is removed, the arsenic or antimony is left free to combine with the copper. This forms a very brittle alloy, and one that corresponds almost exactly in its properties to overpoled copper. To be sure, overpoled copper is supposed to contain carbon, but that this is not the essential ruining principle in case of annealing is shown by the fact that pure copper does not undergo this change under conditions that ruin impure copper, and also by the fact that the same state may be produced by annealing in pure hydrogen and thus removing the oxygen that renders the arsenic or antimony inert. No attempt is made to deny the well known fact that carbon does combine with copper to the extent of 0·2 per cent and cause it to become exceedingly brittle. It is simply claimed that this is probably not what occurs in the production of so-called burnt copper during annealing. The amount of impurities capable of rendering copper easily "burnt" is exceedingly small. This may be better appreciated when it is considered that from 0·01 to 0·2 per cent expresses the amount of oxygen necessary to render the impurities inert. The removal of this very small amount of oxygen, which is often so small as to be almost within the limits of the errors of analysis, will suffice to render copper overpoled and ruin it for any use.

Perhaps the most interesting part of this article, to practical men at least, will be the description of a method of avoiding the numerous accidents that may occur in the annealing of copper, due to a change of pitch. As already pointed out, the quality of refined copper is lowered if oxygen be either added to or taken from it. It is quite apparent, therefore, that a really good method of annealing copper will prevent any change in the state of oxidation. To accomplish this it is necessary to prevent access to the heated copper both of atmospheric air, which would oxidize it, and of the reducing gases used in heating the muffle, which would take oxygen away from it. Obviously the only way of accomplishing this is to inclose the copper when heated and till cool in an atmosphere that can neither oxidize nor deoxidize copper. I find that by so doing copper may be heated to the melting point and allowed to cool again without suffering at all as regards its pitch. There are comparatively few gases that can be used for this purpose, but, fortunately, one which is exceedingly cheap and universally prevalent fulfills all requirements, viz., steam. In order to apply then in practice the principles already enunciated, it is necessary only to anneal copper in the ordinary annealing pots such as are used for iron; care being taken to inclose the copper while heating and while cooling in an atmosphere of steam. This will effectually exclude air and prevent the ingress of gases used in heating the annealer. Twenty-four hours may be used in the process, as in the annealing of iron wire, with no detriment to the wire. This may seem incredible to those manufacturers who have tried to anneal copper wire after the manner of annealing iron wire. By this method perfectly bright annealed wire may be produced. Such a process of annealing copper offers many advantages. It allows one to use a grade of copper that has hitherto been worked only at a great disadvantage, owing to the ease with which it gets out of pitch. It allows one to use annealers such as are ordinarily used for annealing iron, and thus cheapens the annealing considerably as compared with the present universal use of muffles. There is no chance of producing the overpoled condition from the action of reducing gases used in heating the muffles. There is no chance of producing the underpoled condition due to the absorption of suboxide of copper. None of the metal is lost as scale, and the saving that is thus effected amounts to a considerable percentage of the total value of the copper. The expense and time of cleaning are wholly saved. Incidentally bright annealed copper is produced by a process which is applicable to copper of any shape, size, or condition, a product that has hitherto been obtained only by processes (mostly secret) which are too cumbersome and too expensive for extensive use and, as is the case with at least one process with which the author is acquainted, with the danger of producing the overpoled condition, often in only a small section of the wire, but thus ruining the whole piece.

If it is desired, the copper may be annealed in an apparatus so arranged that the copper when heated may be dropped into a body of water without access of air, and thus make a far smaller annealing plant suffice. It may be mentioned that copper seems to be made neither softer nor harder by being cooled suddenly in this manner than if cooled slowly, though some of the alloys of copper are rendered somewhat softer by a sudden cooling; in fact, there is not the slightest evidence anywhere to justify the quite prevalent belief that an art of hardening copper was known to the ancients. The hardest tools of the ancients were made of bronze, not copper.

By application of the same principles it is possible to prevent both deoxidation and oxidation in the heating of copper ingots for the rolls, and thus, by keeping copper at tough pitch all along, any copper that can be given tough pitch can be used for rolling as sheet copper or for wire.

I think it also practicable to produce bright copper rods direct from the rolls.

Compound Interest Table.

CONSTRUCTED BY FREDERIC R. HONEY, PH.B., YALE UNIVERSITY.

	Double.	Triple.	Quintuple.	Septuple.
Rate per cent.	69·3197	109·8692	160·9554	194·6051
From 1 to 10	·3431	·5438	·7967	·9632
" 11 " 20	·3382	·5360	·7853	·9494
" 21 " 30	·3336	·5286	·7745	·9364
" 31 " 40	·3292	·5217	·7643	·9241
" 41 " 50	·3251	·5153	·7548	·9126
" 51 " 60	·3213	·5092	·7460	·9020
" 61 " 70	·3177	·5036	·7377	·8920
" 71 " 80	·3144	·4983	·7300	·8826
" 81 " 90	·3112	·4933	·7227	·8737
" 91 " 100	·3083	·4886	·7158	·8654

By means of the accompanying table, it is easy to ascertain the number of years in which *any* sum of money put out at compound interest may be doubled, tripled, quintupled, or septupled. The method of using the table is illustrated by the following examples.

Ex. I.—*To find the number of years in which any sum of money put out at* 15 *per cent will be tripled.* Look down the vertical column under *rate per cent* for 15; it lies between 11 and 20; carry the eye along this horizontal column until it reaches the vertical one under the word *triple*, and the figure ·5360 is found; multiply ·5360 by 15 (the rate per cent). The product is 8·04; add this figure to that at the head of the column, viz.: 109·8692; divide the sum, viz., 117·9092, by 15; the quotient 7·86 is the number of years required.

Ex. II.—*To find the number of years in which any sum of money put out at* 25 *per cent will be quintupled.* Look down the vertical column under *rate per cent* for 25; it lies between 21 and 30; carry the eye along this horizontal column until it reaches the vertical one under the word *quintuple*, and the figure ·7745 is found; multiply ·7745 by 25 (the rate per cent); the product is 19·3625; add this figure to that at the head of the column, viz., 160·9554; divide the sum, viz., 180·3179, by 25; the quotient 7·213 is the number of years required.

By the same table it is easy to determine the number of years in which a sum of money may be quadrupled, by doubling the number of years in which it will be doubled; sextupled, by adding the number of years in which it will be tripled to the number in which it will be doubled; octupled, by tripling the number of years in which it will be doubled, etc.

The above statements suppose interest to be payable *annually*. If payments be made *half yearly*, the calculation must be made for half the rate per cent, and the answer will come out in the number of half years, *i. e.*, the answer must be divided by 2 in order to ascertain the number of years. Also if payments be made *quarterly*, the calculation must be made for one-quarter the rate per cent, and the answer divided by 4 in order to obtain the correct result.

The Manufacture of Celluloid.

The manner in which celluloid is made in France is as follows: A huge roll of paper is unwound slowly, and while unwinding is saturated with a mixture of five parts of sulphuric and two parts of nitric acid, which is carefully sprayed upon the paper. The effect of this bath is to change the cellulose in the paper into pyroxyline. The next process is the expelling of the excess of acid in the paper by pressure and its washing with plenty of water. It is then reduced to a pulp and bleached, after which it is strained, and then mixed with from 20 to 40 per cent of its weight in water. Then follows another mixing and grinding, after which the pulp is spread in thin sheets, which are put under enormous hydraulic pressure and squeezed until it is as dry as tinder. These sheets are then put between heated rollers and come out in quite elastic strips, which are worked up into the various forms in which celluloid is made.

The Iridium Light.

Upon a suitable plate or support, such as wax, the form of the desired filament is penciled with plumbago; this is placed in an electrical iridium bath. When a film of sufficient thickness is deposited upon the stenciled design, the filament is peeled off from the beeswax and the plumbago brushed off the back. Iron wires are used as conductors. The filament is incandesced in the atmosphere, as it is practically non-combustible, or, for security against breakage, it may be incandesced in any suitable gas or in a vacuum.

RECENTLY PATENTED INVENTIONS.

Engineering.

Mr. David J. Lupton, of Jerusalem, O., has patented an improved car platform, which is pivoted to the top of the car coupler, so that the ends of the platform may move backward and forward in recesses in the ends of the car, and adapted to have its outer edge coupled to the platform of the adjoining car.

The same inventor has patented a combined car and air brake coupling that couples upon contact and that can be uncoupled from the platform of a passenger car or from the top of a freight car, so that the operator will not need to stand between the cars. This inventor combines with the car coupler an automatic coupler for the steam or air brake connections, so that the air pipe will be coupled and uncoupled by the same operation that couples and uncouples the car couplers, thus enabling air brakes to be used upon freight cars with as great facility as they are now used upon passenger cars.

Mechanical.

Mr. Marcus W. Chamberlain, of Hackettstown, N. J., has patented a machine for expanding can covers and other similar articles. Upon this machine the flanges of can covers crimped or battered by constant use to such an extent that they are rendered unfit for service may be expeditiously and conveniently expanded to their original shape.

Improved mechanism for the excavation of gravel or soil, and for its disintegration by movable jets of water controlled from the surface and operating upon the bottom beneath a body of water, has been patented by Mr. Adoniram Fairchild, New York City. A revoluble spheroidal shell having a number of overhanging inclined faces on its lower wall, with jet nozzles fitted in the faces, is mounted on a support whereon the shell may revolve by the force of the water.

Mr. Austin J. Hanks, of Wilmington, O., has patented a machine for forming steel fellies for vehicle wheels. The inventor employs preferably ten shafts, journaled transversely in a frame and arranged in two horizontal lines of five each, the upper shaft being located in vertical alignment with the lower shaft. The shafts are made in two lengths, five being about twenty inches in length, and the remainder twenty-two inches in length, and in the arrangement of the several shafts they are made to alternate with the shorter ones in each row. Each set of rolls is made of two disk sections and are adjustable to any sized blank that the operator may desire to pass between them, by introducing between the members one or more spacing disks of proper thickness. The blank enters the machine at one end and is delivered as a felly at the other end.

The same inventor has patented a vehicle wheel of the class of wheels known as "suspension wheel." The invention consists in a peculiar construction which cannot be adequately described without illustrations.

Mr. Thomas C. Conrad, of Philadelphia, Pa., has patented a toy engine, which is provided with parts resembling those of a reciprocating engine. It is attached to a stick in such a manner as to permit of rolling the fly wheel along the floor. By the motion thus imparted the engine is made to illustrate the principle of the steam engine.

An improvement in breech-loading fire arms, which relates especially to that class of arms known as "hammerless," has been patented by Mr. James T. Walsh, of Red Fork, Ark. The object of the invention is to provide a simple, positive, and durable mechanism for operating the breech block or extractor, and also to employ in connection with the breech block a safety lock capable of automatic action, and which may be applied at will to prevent the trigger from being drawn.

An improvement in machines for shelling peas has been patented by Mr. Giuseppe Paci, of New York City. In this machine green peas in the pod may be introduced in quantities and the peas cleaned and expeditiously separated from the pods irrespective of size. The machine is provided with a means for discharging the pods and the shelled peas separately into convenient receptacles.

An improved nutmeg grater designed to operate upon a number of nutmegs at the same time has been patented by Mr. Joseph E. Giroux, of Alpena, Mich. It consists in a revolving grating cylinder provided with a crank handle, a spring-seated follower for holding the nutmeg to grating contact, and a case of peculiar construction inclosing the parts.

An improved game counter adapted for keeping the tally of points and games in the playing of billiards and like games has been patented by Mr. William B. Atkinson, of Franklin, Ky. The apparatus is provided with a dial, concentric independently operating hands movable in opposite directions around the dial, pulleys and ratchet wheels connected with the shafts, and operating hand cords secured to and depending from the opposite sides of the pulleys.

Electrical.

Mr. Willis Eugene Robinson, of Faribault, Minn., has patented an improved telephone call register, which consists in the combination with a train of spring-actuated gearing provided with a stop-motion of an electro-magnetic releaser for starting the train, a dial for recording the number of separate movements of the train, and mechanism for permitting of the winding of the driving spring without disarranging the other parts of the apparatus, and devices which permit of setting the index.

An automatic regulator for dynamo-electric machines, in which the current delivered by the machine is made to shift the commutator cylinder on the armature shaft, and thus vary the output of the machine, has been patented by Mr. Perley P. Belt, of Fredonia, Kan. This invention consists in the combination with a dynamo-electric machine of a commutator cylinder mounted upon a sleeve placed on the armature shaft and adapted to move through a quarter of a revolution, a pulley mounted upon the sleeve and connected by a belt with an electric motor in the main circuit of the dynamo, a spring connected with the armature shaft and commutator-supporting sleeve, and arranged to hold the commutator cylinder forward to the point of maximum output, a pair of brushes making contact with the commutator cylinder, a rotary dash pot carried by the armature shaft and having a piston connected with the commutator cylinder, and the electric connections between the commutator bars and sections of the armature.

Agricultural.

Mr. George W. Haupt, of Germantown, O., has patented an improvement in hand planters especially adapted for setting out tobacco, cabbage, and similar plants. It is a light, durable, and simple device whereby, without stooping, the farmer may expeditiously set the plants in the ground and press the surrounding earth in close contact with their roots.

An improved baling press has been patented by Mr. George Ertel, of Quincy, Ill. This is an improvement on the press for which letters patent No. 336,305 were granted to the same inventor February 16, 1886, and in such manner as to obviate all jamming of the power mechanism by the chain or link connections between the sweep head and the plunger pitman.

Miscellaneous.

Mr. James J. Ryan, of Brooklyn, N. Y., has patented a salve, which is intended as a remedy for piles. The composition consists of bloodroot, Armenian bole, resin, lard, and Stockholm tar, in certain definite proportions.

An improvement in mattresses patented by Harriette J. Webb, of Lockport, N. Y., has for its object to so construct a mattress that a section thereof may be entirely removed and an opening thereby created for the reception of a bed pan or similar article, also to provide a hinged section adjoining the detachable section, whereby the pan may be removed without inconveniencing the patient.

Mr. Has Brouck Alliger, of Rondout, N. Y., has patented an improved can opener, which is so constructed that when the cutting blade is passed through a portion of the can to be opened, it may be made to assume an inclined position, whereby as the knife is drawn through the metal of the can a clean shearing cut is produced with a minimum of exertion.

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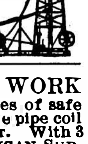

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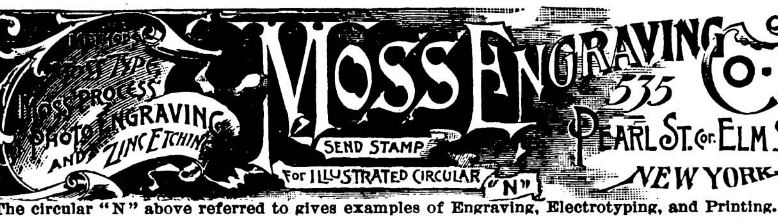

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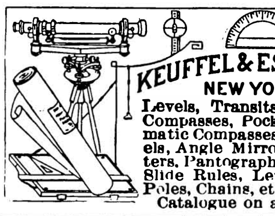

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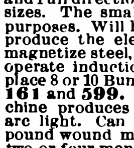

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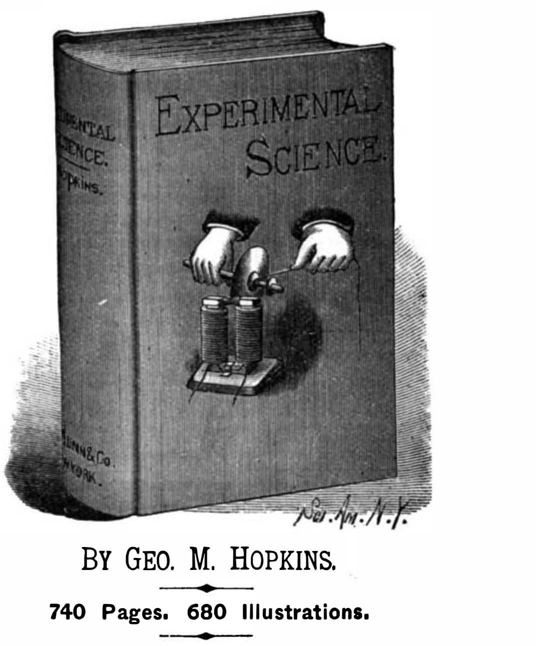

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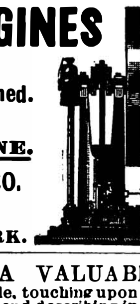

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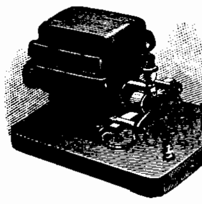

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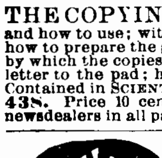

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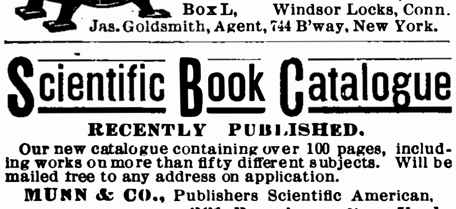

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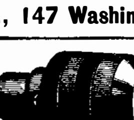

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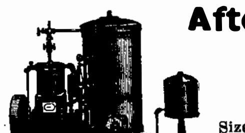

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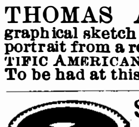

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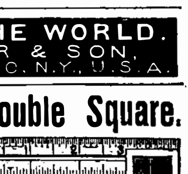

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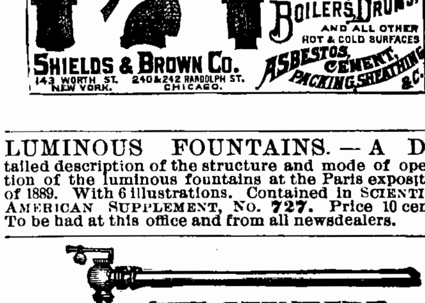

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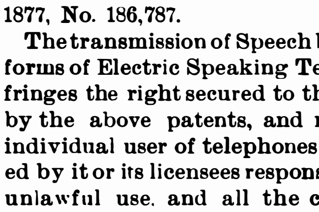

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