SCIENTIFIC AMERICAN

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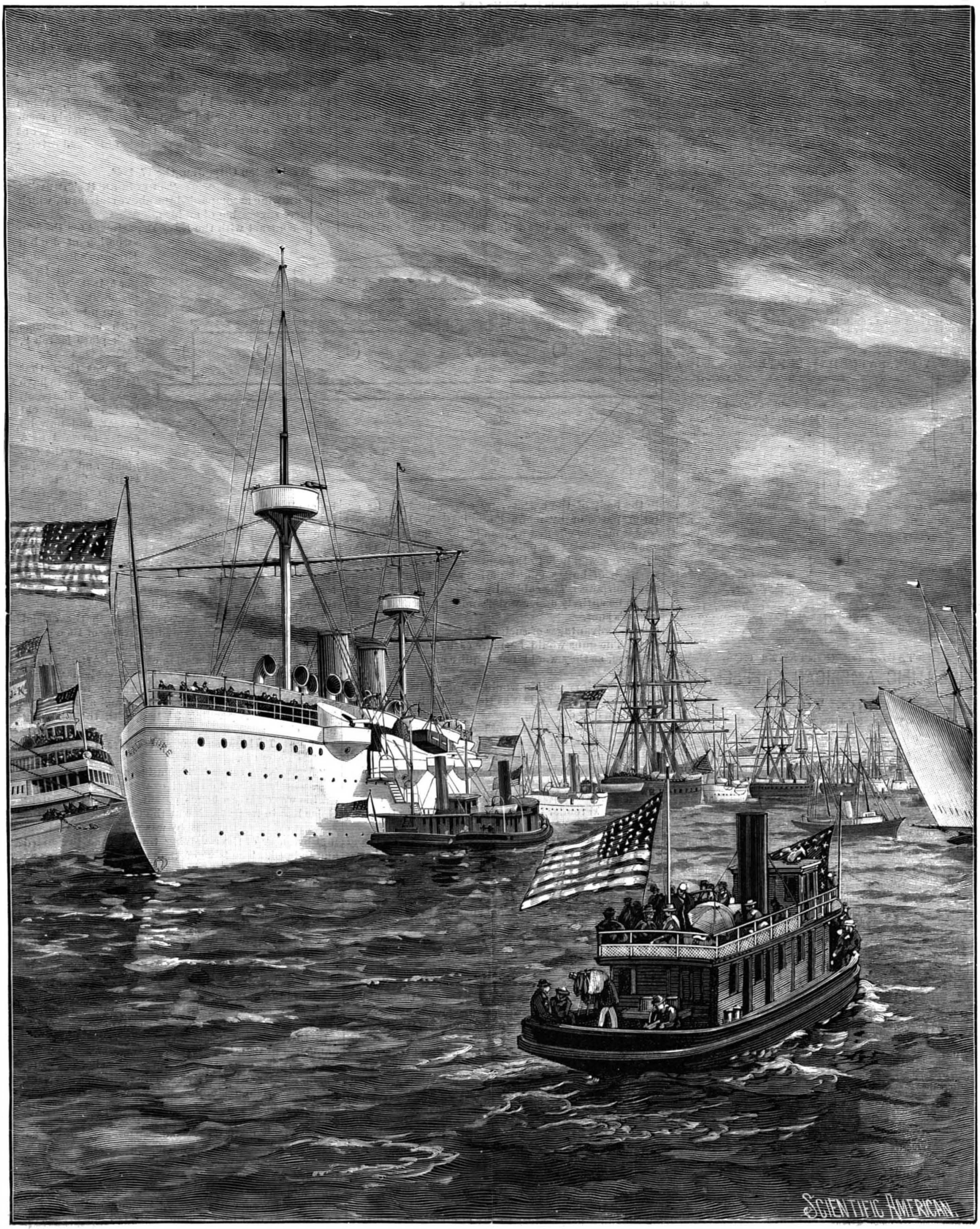

THE U. S. WAR SHIP BALTIMORE RECEIVING THE REMAINS OF ERICSSON.—[See page 148.]

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NEW YORK, SATURDAY, SEPTEMBER 6, 1890.

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 766.

For the Week Ending September 6, 1890.

Price 10 cents. For sale by all newsdealers.

ERICSSON'S REVOLVING TURRETED WAR SHIP.

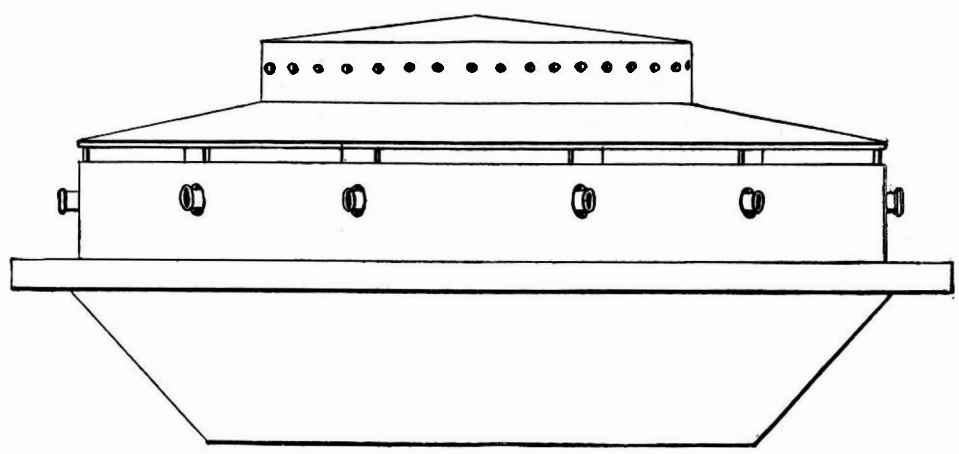
Nearly fifty years ago a young man named Theodore R. Timby, hailing from the village of Cato, Cayuga County, N. Y., filed in the Patent Office a caveat for what he termed a revolving metallic fort. Doubtless he thought the device was new, but it was in fact a very old idea, substantially the same thing having been described in 1805 in the *Nautical Chronicle*. A similar invention was also made about that time, or perhaps sooner, by Abraham Bloodgood of New York. Indeed, it seems probable that the ideas given in the *Nautical Chronicle* were derived from Bloodgood.

In the Transactions of the Society for the Promotion of Useful Arts in New York State, published in 1807, vol. 2, pages 230, 231, will be found a description and an engraving of Bloodgood's invention. This work may be found in the Patent Office library at Washington. We give from it the following description of Bloodgood's invention:

"A FLOATING BATTERY ON A NEW CONSTRUCTION.

"By the late Abraham Bloodgood.

"The model of this battery was exhibited to the society; with a verbal description only. The annexed plate shows an exact profile view of its body, the shape of which, as seen from above, is circular. It is to be connected at the center of its bottom with a strong keel, in such a manner that while the keel is held by cables and anchors in one position, the battery is made to turn round on its center. This motion may be given to it either by the tide acting on float boards, attached



to the body of the battery, by sails raised on its exterior parts, or by manual application. In this last way it may be effected by men in the hold, drawing on a lever fastened to a post fixed to the keel, and rising through a well-hole in the center of the battery. The strength of horses might perhaps be applied to the same purpose. The cables by which the keel is held are to be entirely under water and thus secure from an enemy's shot.

"The advantages of such a battery would be—

"1. The guns would be more easily worked than is common, as they would not require any lateral movement.

"2. Its rotary motion would bring all its cannon to bear successively, as fast as they could be loaded, on objects in any direction.

"3. Its circular form would cause every shot that might strike it, not near the center, to glance.

"4. Its motion, as well as its want of parts on which grapplings might be fastened, would render boarding almost impossible.

"5. The steadiness with which it would lay on the water would render its fire more certain than that of a ship.

"6. The men would be completely sheltered from the fire of the elevated parts of an enemy's ship.

"7. The battery might be made so strong as to be impenetrable to cannon shot."

In 1812 Colonel John Stevens, of New Jersey, proposed to construct an ironclad floating battery, which was identical in all its leading features with the circular battery. This odd craft was intended for harbor defense. It was to be a saucer-shaped vessel with a bomb-proof deck, and armed with a number of the heaviest guns. It was anchored by a swivel at its center, about which it was to be rapidly turned by a set of submerged screws driven by a steam engine. As each gun during its revolution came into the line of fire, it was discharged, and was reloaded before the completion of another revolution brought it into line again. The plan evidently resembled somewhat the Monitor in principle. This was probably the first ironclad of which plans were ever prepared.

January 18, 1843, Timby filed his caveat, which reads as follows, as certified by the Patent Office:

"*To the Commissioner of Patents:*

"The petition of Theodore R. Timby, of Cato, County of Cayuga and State of New York, respectfully represents:

"That I have made an improvement which I call a metallick revolving fort and am now engaged in maturing the same preparatory to my applying for Letters Patent, therefor I do therefore pray that the subjoined description of my invention may be filed as a caveat in the confidential archives of the Patent Office agreeably to the provisions of the act of Congress in that case made and provided, I having paid twenty dollars into the Treasury of the United States and otherwise complied with the requirements of the said act."

A description of the above improvement is as follows:

"My fort, when completed, will form a circle leving about two-third of its diametor from near the bottom of the fort is open space, the first deck being near the bottom upon this deck, and at the extremity of the open space alluded to are placed two propelling figures, one opisit to the other. When used on the land thes engines act upon a shaft, each which are connected or made fast to the deck mentioned; upon these shafts each is a flanged wheel resting upon a circler railway track underneath and otherwise independent of the fort. Above the deck mentioned are several others, each a proper distance above the other and each forming a circle within the bulwarks of the fort, and upon the decks are placed the cannon when used. When used on the watter I place the fort, as allredy mentioned, on a circler hull with the anchor to be cast at center and watter wheels in the place of flanged driving wheels.

"Washington City, Jan. the 17, 1843.

(Signed) "THEODORE R. TIMBY."

No drawing accompanied the above statement, which is a mere suggestion of an idea.

The contract with the Navy Department for the construction of John Ericsson's first monitor was dated October 5, 1861. Her first memorable battle in Hampton Roads with the Merrimac took place March 9, 1862.

It was then that Timby seems to have woke up to the recollection of his old caveat, and now he comes forward as a claimant as the original and first inventor. The official records show that he applied for a patent May 27, 1862, and that it was rejected June 13, 1862, on the ground that the application presented no novelty, the references cited being English patent No. 715, granted in 1858 to Minton and Thomas, also Coles English patent No. 778, granted in 1859. Both of these patents show revolving metallic fortresses, and with all the appurtenances for construction and operation drawn in full detail.

Furthermore, Timby was, according to the official records, referred to the revolving battery of Bloodgood above mentioned, as described in the Transactions of the Society for the Promotion of Useful Arts. Timby then asked to have the rejection set aside in view of his caveat of 1843, and strange to say his request was complied with by the Patent Office, and a patent was issued to him September 30, 1862, with the following broad claim:

"What I claim as new and desire to secure by Letters Patent is,

"A revolving tower for defensive and offensive warfare, whether placed on land or water."

This was clearly a bogus patent, because the Patent Office had in its possession at the time of the issue the clearest evidence that Timby was not the original and first inventor of the revolving tower, as he pretended and claimed. The issue of the patent was an error on the part of the Patent Office, and there are reasons for the presumption that it was brought about by a combination of official and non-official trickery, and that, by means of the fraudulent document thus obtained, the Treasury of the United States and probably the pockets of certain private individuals were depleted of considerable money.

Be that as it may, from the date of the fraudulent patent to the present time, Timby has posed as the original inventor of the Monitor, and has endeavored, with some success it must be admitted, to make the public believe that he was in truth the original Jacobs.

In the ninth volume of the *American Cyclopædia*, published in 1874, is an article by General James Harrison Wilson, upon the subject of ironclad ships, in which, among other vessels, a description is given of Ericsson's original Monitor, being the first vessel ever constructed carrying an iron revolving tower upon its decks. We quote from the article:

"The plan upon which she was built is known as the turreted or monitor system, and was invented by Theodore R. Timby, of Dutchess Co., New York. On January 18, 1843, he filed his first caveat for the invention in the United States Patent Office. His specifications were for a revolving metallic tower and for a revolving tower for a floating battery to be propelled by steam. . . . . His patents covered the broad claim for a revolving tower for offensive and defensive warfare, whether used on land or water. When therefore the monitors were to be built, the constructors at once recognized the validity of his claim, and paid him a liberal sum for the right to use his invention."

Perhaps in the next edition of the Cyclopædia the editor will take occasion to correct the foregoing and give the true history of the invention.

The long and short of the whole matter appears to be this: Captain Ericsson was the first to design and construct a war vessel carrying an armored revolving tower or turret; and he was unquestionably entitled to all the honors and emoluments that pertained to that great production of his genius.

TYROTOXICON.

A number of cases of poisoning from eating ice cream have recently occurred. On June 30 some forty people in the neighborhood of Third Avenue and Seventy-fifth Street, New York, were poisoned in this way, the cream having been purchased of a confectioner in the neighborhood. A few weeks previous to this, a man was poisoned by cream partaken of at a saloon in New York. He was confined in St. Vincent's Hospital for several weeks, and has since instituted a suit against the proprietor of the establishment where the cream was purchased. On August 18, some twenty-five guests at Hotel Berwick, Narragansett Pier, were poisoned from eating ice cream, and a number of them were reported to have been very seriously ill. Cases of poisoning from eating cheese and drinking milk have also been of sufficiently frequent occurrence to stimulate inquiry and experiment regarding their true cause. Among the most successful of these investigators have been Doctor Victor C. Voughan and Doctor Frederick G. Novy, of the University of Michigan, who have made an exhaustive study of the nature of poisons which are introduced into the human body from without, and those which are generated within the body. They have recorded the results of their investigations and experiments in a volume entitled "Ptomaines and Leucomaines," in which is also given the results of the labors of other eminent chemists in the same field. Voughan and Novy succeeded after a series of most interesting experiments in isolating tyrotoxicon, and have cited a number of cases where it has been found in poisonous cheese, ice cream, and milk. Tyrotoxicon, however, is but one of a number of basic poisons which these scientists have designated as ptomaines, and in order to convey a comprehensive idea of the place assigned to tyrotoxicon, as well as ptomaines in general, in the chemistry of putrefaction, the following definition by Voughan and Novy is given:

"A ptomaine is a chemical compound which is basic in character, and which is formed during the putrefaction of organic matter. On account of their basic properties, in which they resemble the vegetable alkaloids, ptomaines may be called putrefactive alkaloids. All putrefaction is due to the action of bacteria, and ptomaines result from the growth of these micro-organisms, the kind of ptomaine formed depending upon the individual bacterium engaged in its production, the nature of the material being acted upon by the bacterium, and the conditions under which the putrefaction goes on, such as the temperature, amount of oxygen present, the electrical conditions existing, and the duration of the process. Different ptomaines will be formed in decomposing matter freely exposed to the air and in that which is buried beneath the soil or from which the air is largely excluded. Even when the same ferment is present, the product of the putrefaction will vary, within certain limits, according to the extent to which the putrefying material is supplied with air.

"The kind of ptomaine found in a given substance will depend also upon the stage of putrefaction. Ptomaines are transition products in the process of putrefaction. They are temporary forms through which matter passes while it is being transformed by the activity of bacterial life from the organic to the inorganic state. Complex organic substances, as muscle and brain, are broken up into less complex molecules, and so the process of chemical division goes on until the simple and well known final products, carbonic acid gas, ammonia, and water, result; but the variety of combination into which an individual atom of carbon may enter during this long series of changes is almost unlimited, and with each change in combination there is more or less change in nature. In one combination the atom of carbon may exist as a constituent of a highly poisonous substance, while the next combination into which it enters may be wholly inert."

The case of ice cream poisoning which is cited above as occurring in New York on June 30 was thoroughly examined by the New York Board of Health, and Dr. Martin, the chemist of the board, made an analysis of a sample of the cream; but while the symptoms of those who suffered ill effects from eating the cream all pointed to poisoning by tyrotoxicon, it was not found in the sample submitted for test. The failure to find tyrotoxicon in this case may be due to the fact that this poison is present under certain conditions and not present under others.

Doctors Voughan and Novy found tyrotoxicon in ice cream which made many persons sick at Lawton, Michigan. Vanilla had been used in flavoring, and it was at first thought that this was the cause of the sickness, and a similar error has been made in other cases of ice cream poisoning. Each of the gentlemen took twenty drops of the vanilla extract, and one of them took two teaspoonfuls more without results, which clearly proves the non-poisonous nature of the vanilla. It was found that the portion of the custard which had proved to be poisonous was allowed to stand for some hours in an old building which was surrounded by shade, had no underpinning, and the sills of which had settled into the ground. There were no eaves troughs, and all the water falling from the roof ran under the building, the streets on two sides having been raised since the building was erected. The building had been unoccupied for a number of months, without ventilation, and the back end, where the cream had been frozen, was previously used as a meat market. The symptoms of the persons poisoned were severe vomiting and purging, griping of the stomach and abdomen, with headache and backache. The tyrotoxicon obtained from this cream was administered to a kitten about two months old, and in ten minutes it began to retch and soon vomited, and was unable to retain food upon its stomach.

It seems clear from the statement just made that the cream absorbed the putrefactive elements from the old and unsanitary building in which it was made, and other cases of ice cream poisoning can be traced to similar causes. The cream which poisoned forty people in New York on June 30 stood in a cellar two days without freezing, which was ample time for putrefactive germs to enter into its composition. The copper found in the sample of cream by the New York Board of Health was not sufficient to cause the poisoning, neither was there any other poisonous element discovered. The further tests regarding poisoning by tyrotoxicon made by Voughan and Novy are most interesting, and the facts they elicited and recorded should be better understood than they are. Not only are laymen generally in ignorance of these important discoveries, but many physicians are yet unfamiliar with them.

Natural Gas Phenomenon in Indiana.

On August 11, at 9 o'clock A. M., the farmers near Waldron, which is eight miles southeast of Shelbyville, Ind., were startled by a terrific explosion. When they reached the Ogden graveyard, which is on a bluff near the Flat Rock stream, they discovered that fully ten acres of the earth was in commotion. Geysers were shooting up to the height of six and eight feet, and gas was blazing from ten to fifteen feet above the water of the geysers. The river bed was torn up and the water had stopped running below the graveyard. Flames are still shooting from fifty different fissures in the earth.

The county had not been considered in the gasbelt, although local companies have sunk many wells. At Waldron a sufficient flow of gas was found to supply the citizens with fuel. Nobody thought that a gusher was slumbering near the town, and few have entertained the idea of permanent flow of gas in this locality. A little stream known as Flat Rock runs southwesterly through the county, and about three miles south of Waldron, on the banks of Flat Rock, is a sort of butte upon which a country graveyard has been in use for many years. The river at this point runs west, and Conn's Creek empties into it from the north, forming a kind of horseshoe-shaped strip of land opposite the graveyard. Edmund Cooper owns the land on the north side of the river, and it was in this strip that the explosion occurred.

J. H. Lowe, who lives on the Cooper farm, heard a terrific report, and felt the earth quivering beneath his feet. He went toward the graveyard, and was soon confronted by a sheet of flame 200 feet high.

Then fifty or more fountains of fire burst from the earth. These were interspersed with six or eight active geysers. At the east side of the eruption a large stack of straw was in flames, and a field of green corn was drooping before the excessive heat from the ten acres of flame. The river bed was torn to pieces, and huge fissures were receiving the river's water. Sheets of flame swept over the water, and an area of about one acre was quickly converted into a huge hole, from which a continuous roaring and rumbling noise proceeds.

Within the bend of the river and for one-eighth of a mile along the stream great rents were seen in the earth and river bed. At the bend of the river, which is of limestone, is a fracture a quarter of a mile in length and stones the size of a house have been hurled from their places. The graveyard was shaken up, the skeletons of the dead being distinctly seen in the fractures of the earth. Gas flows freely from the entire surface of the ten acres.

It is said when the explosion occurred, rocks and trees were thrown 200 feet high.

A correspondent of the New York *Sun* who visited the locality the next day says: Birds, snakes, rabbits, and fish in profusion are dead, and the fish, thoroughly cooked, are thickly scattered through the waters.

A log fire was blazing on the ten acre tract when, without warning, the earth belched forth flame. Great rocks and trees were hurled skyward, a part of the adjoining graveyard was torn off and reduced to dust, and the waters of Flat Rock were converted into foam and steam. A vast pocket of natural gas under or near the log fire had exploded. The gas had accumulated apparently under the creek bed, held in by a thick stratum of bluish clay, and fed from the great depths below, whence the somewhat meager natural gas supply of Shelby county is obtained.

The explosion threw great volumes of the blue clay into the air, and left yawning caverns, some of them big enough to hold a house. Through the caverns and holes the gas continued to pour after the explosion. It blazed fiercely up above the trees. The gas escaped under such pressure that the flame was forced as high as the tree tops. The flames at times would rise 100 yards. This continued all of one afternoon and the same night.

On August 12, the fire had been extinguished, but the gas, under reduced pressure, still escaped. The gas is odorless, like the Pennsylvania natural gas.

The general conviction is that no other agency than gas could have produced the effect. Neighbors who saw the flying debris and heard the roaring noise say they thought for a moment that a tornado was doing the mischief, and many hurried with their children to places of shelter.

One of the marvelous results is the effect upon the water. Not a drop of Flat Rock's water has gone below the cavern since the upheaval. The great caverns have taken in the current, and a wild foaming Niagara is created on the edges of the abysses as the volume of gas comes in contact with the falling water.

At noon to-day the holes are about full of water and the creek begins to deepen with the back water. The water is even flowing up stream, but presently will doubtless cut a new channel and flow on its downward course.

Across the river from the Haban farm are fissures, and the explosion in its scope took in many more acres besides the ten where its damage was greatest. In these, every living thing apparently was killed, and the fish, if not killed outright, were cooked by the gas blazing on the river's surface. The water still boils to-day, but the fires are out.

The excitement over the natural gas explosion still prevailed on the third day, August 14, throughout the country, and thousands of people were flocking to the scene. It is now discovered that the soil for many miles around is impregnated with the combustible, and by piercing the soil with a stick or crowbar the gas may be ignited and a blaze produced large enough to cause considerable illumination. In Van Buren township, twenty-four miles north, the gas has broken into the water wells, and the use of water from them has been abandoned. Some of the farmers cased the wells, and are using the gas from them for fuel.

The whole neighborhood in the vicinity of the young volcano is saturated with natural gas and the soil is full of it.

This would indicate that the gas from the wells has found its way below the limestone, and in many places fractures in the stone permit it to escape into the sand and gravel immediately below the surface soil, which partially prevents its escape into the air. This bears out the theory that gas has for some time been escaping from the sides of the gas wells and diffusing itself in the sand and gravel below the limestone.

The whole township seems to be filled with the combustible and the inhabitants are threatened with disaster. No telling but the lighting of a match may blow two or three townships into smithereens. It is altogether probable that the diffusion of gas into the soil more or less affects the growing crops. The great question may yet be as to the advisability of sinking gas wells, or if sunk at all whether other methods should not be used to case and confine the explosive. Pockets of gas are no doubt forming beneath the limestone all over the region of the gas belt, and it is only a question of time when it will break forth in terrific force. It is yet a question as to which is the most hazardous, the accumulation of gas in pockets, followed by eruptions similar to the Waldron blowout, or permitting it to permeate the soil as it is now doing in Van Buren and Noble townships, poisoning the water and air. On August 14, boys were roasting corn by gas jets produced by sticking canes down in the soil a few feet near the volcano.

THE shipbuilding industry on the American lakes is active, and Cleveland claims to lead the way. Since January 1 the vessels built number 78 steamers, the gross tonnage being 63,922, and 18 barges and sailing ships of 15,315 tons. Last year the vessels built on the great lakes measured 107,080 tons.

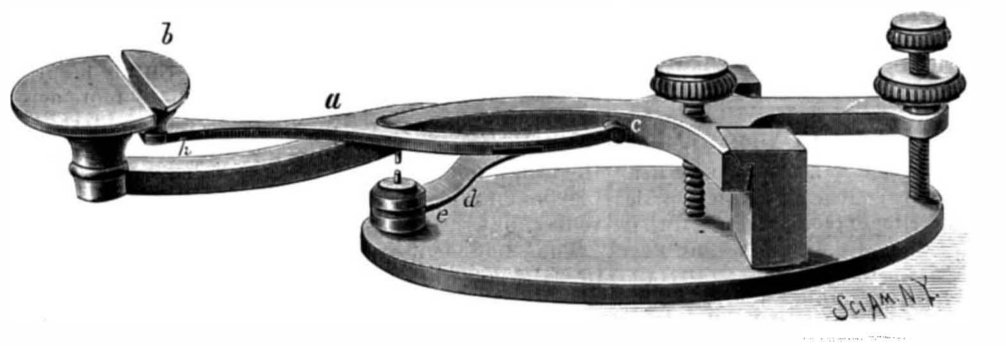
Relief of the Idiot.

Dr. Lannelongue, an eminent specialist in the Children's Hospital, Paris, has just succeeded in the effort to give intelligence to a poor little idiot. The child, a little girl four years old, had a deformed head, only about one-third the size of an ordinary little one of her age. She never smiled, never took notice of anything, and she could neither walk nor stand. The doctor became convinced that the condition of the little creature was due to the abnormal narrowness of the head, which hindered the natural growth of the brain. About the middle of May last he made a long and narrow incision in the center of the skull and cut a portion out of the left side of it, without injuring the "dura mater." The result of this operation was something astounding. In less than a month the child began to walk. Now she smiles, interests herself in everything around her, and plays with a doll. A tolerably bright little child has taken the place of the idiot.

AN IMPROVED TELEGRAPH KEY.

The accompanying illustration represents, in perspective view, a telegraph key provided with means for automatically closing the circuit as the operator releases the key, and for opening the circuit when the key is grasped by the thumb and finger. The cut shows the attachment as applied to a "Victor" key. It is a patented invention of Mr. John B. Van Deusen, of Saratoga Springs, N. Y. The key is of the ordinary construction, with base plate and standards in which the key lever is pivoted, while a leg, *e*, passing through the base plate and insulated therefrom, is provided with an anvil contact for opposing the contact of the key lever.

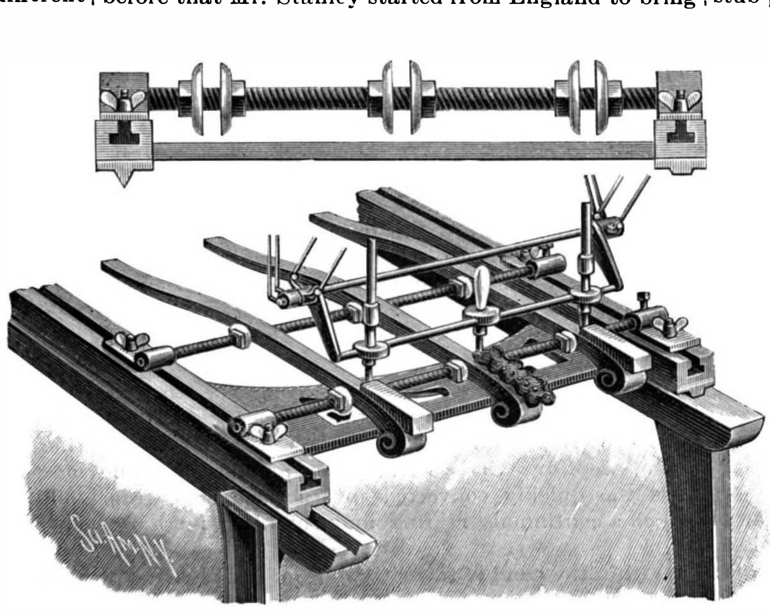
Under the head of the leg is a flat spring, *d*, curved rearwardly and upwardly, and slit at the ends to form arms at opposite sides of the key lever, a central arm contacting with the under surface of the key lever. A short distance in front of the trunnions of the key lever at *c* is pivoted a forwardly extending forked lever, *a*. The key knob is divided, its forward portion being attached directly to the end of the key lever in the usual way, and the rear portion, *b*, attached to the forward end of the forked lever, each arm of which has a strip of insulating material resting on the side arms of the springs on each side of the key lever. The key is operated in the same way as an ordinary key, the circuit being opened and closed at the anvil contact points, but when the operator releases the key the forked lever is automatically lifted by the spring, as shown in the illustration, and the circuit is closed, a matter which the operator, through neglect or otherwise, often fails to attend to.



VAN DEUSEN'S TELEGRAPH KEY.

A WORK-HOLDING TABLE FOR CARVING MACHINES.

The table shown herewith, patented by Mr. Frank. R. Potter, is designed to support work of different lengths and widths, or work curved upward or downward, or to either side, without the use of "blocking up" blocks or plates, thereby saving time and facilitating the doing of the work in a more satisfactory manner. The illustration represents in perspective a wood-carving machine to which this work-holding table is applied, the upper figure being an end view of the table. The table is adapted for reciprocation on the bed of the machine, and is made with a support to which two screw shafts are held in boxes or bearings adjustable along the support, the shafts having adjustable work-clamping collars. The table is made with a supporting frame open at the center to give room for bent or curved work. In the application of the improvement, as represented, the carving bits or cutters are rotated by flexible shafts driven by an overhead shaft, pulley and gearing (not shown), the cutter head supporting the stylus and cutters being sustained from the machine frame by universally jointed links. This work holding table may, however, be used with any other style of carving or cutting machine, almost any shaped pieces of work of ordinary length being securely and quickly clamped by the screw shaft collars. For further information relative to this invention, address Mr. Allen E. Maynard, No. 540 East Twentieth Street, New York City.


POTTER'S WORK-HOLDING TABLE FOR CARVING MACHINES.

AN IMPROVED CULINARY VESSEL.

The illustration represents a form of ear and bail for a tea kettle or other vessel, by means of which the bail may be retained in an upright position or folded down on the top of the vessel. This improvement has


HICKS' EAR AND BAIL.

been patented by Mr. Franklin Z. Hicks, of Rapid City, South Dakota. One of the ears, as shown, is of the ordinary form, to receive the eye on one end of the bail in the usual way, but the other ear is elongated, and the aperture therein for the other end of the bail is made in the form of a vertical slot, while extending in from the top of the ear is also a similar vertical slot, as shown more plainly in the small view. With this construction, the bail swings freely in either direction when it is lifted, but when the eye at one end of the bail is allowed to come to rest in the vertical slots of the ear, the bail is thus held in upright position.

Surgeon Parke.

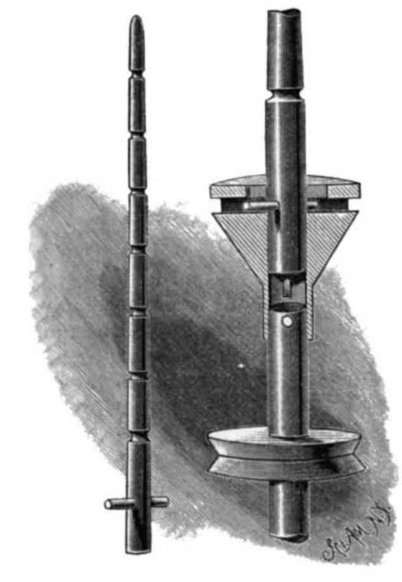
Dr. Parke, whose brilliant services with the Emin Pasha relief expedition have excited the admiration of the civilized world, was on the 6th of June last presented by the editors of the *Lancet* with a massive silver salver, and on the evening of the same day, says the New York *Medical Journal*, was the guest of a brilliant representative gathering of the members of the medical profession, who had assembled to do him honor at a dinner at the Criterion restaurant. Sir Andrew Clark presided. Mr. Jonathan Hutchison, Sir James Paget, Sir Prescott Hewitt, Sir Joseph Fayrer, Sir Spencer Wells, and many other distinguished members of the profession were present.

After several speeches suitable to such an occasion had been made, Surgeon Parke, amid great applause, rose to respond and made a very modest speech, in the course of which he said that he would remind the company, if they were not already tired of hearing about Africa, that it was just three years and three months before that Mr. Stanley started from England to bring relief to Emin Pasha—not to bring him away from Africa, but to bring him relief. With a force of about eight hundred strong, they started from the mouth of the Congo on March 18, 1887. The shortest time any of them spent in the forest was one hundred and sixty-two days. The pygmies or dwarfs they met stood about three or four feet high, had tiny hands and feet, with fairly good features, and were bright and intelligent. They were covered all over with down, such as is seen on the cheeks of a boy of eighteen or nineteen in this country. The European provisions that the party took with them were finished within a month. The two bottles of brandy which each had were also soon exhausted. They had exactly the same food as the natives—bananas, with occasionally a goat a week divided among six or eight.

The Europeans survived much better than the natives did. Of the two Europeans who died, one died from climatic causes and the other was murdered. Emin Pasha was qualified in medicine by a German degree, of which he was very proud. He spoke twenty-two languages, of which he could write and read thirteen. When they started he (Surgeon Parke) took the precaution of vaccinating the majority of the men, and when the epidemic of small pox broke out, only four were attacked by the disease, and none of them died. On the other hand, the camp followers, who had not been vaccinated, took the disease in a bad form and died in great numbers. After a three years' march across Africa they reached Zanzibar with Emin Pasha. He wished to place on record the great admiration he and his brother officers felt for their illustrious leader, Mr. Stanley.

A SEPARABLE SPINDLE FOR SPINNING WOOL.

The spindle shown in the engraving is designed to obviate the necessity for using cop bobbins or quills in spinning wool, and secure better results in the quantity and quality of work performed. It has been patented by Mr. George Bailey, of Middleborough, Mass. The lower portion of this separable compound spindle has a cylindrical stub piece on which is a whirl to receive a driving band, and on the upper end of the stub piece is mounted a coupling head, secured in position by a cross key, or the stub piece may be screwed into the coupling head. The detachable part of the spindle, shown at the left in the illustration, is slightly tapering, and annularly grooved at intervals in its length, to prevent yarn from slipping off until its removal is desired. Near the top surface of the coupling head is a transverse rectangular slot, and in alignment with this slot is vertically formed another slot of less width and length. The latter slot extends an equal distance on each side of the center hole in the coupling head, and is adapted to permit diametrically opposite locking pins to enter into the wider slot below it, when, by a partial revolution, the detachable part of the spindle is locked fast to the coupling head. Just above the top end of the stub piece a transverse slot extends through the coupling head to permit the removal of dirt that might enter the socket hole in which the detachable part of the spindle is seated. Cops or quills may be used with this spindle if desired, in the same manner as with other forms of spindles. When a spindle is filled it can be removed bodily from the stub piece and coupling head by grasping the spun yarn and lifting the spindle, a slight revoluble movement releasing the interlocking connection of parts.


BAILEY'S SEPARABLE SPINDLE.

A Broken Neck Mended.

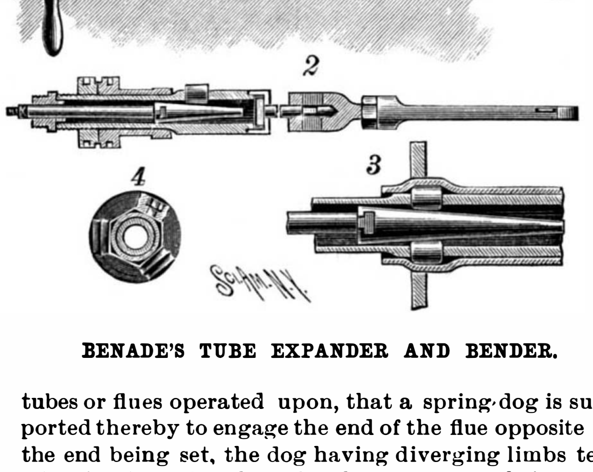
Physicians connected with the Presbyterian Hospital are highly elated over the fact of their having successfully mended a broken neck. The patient, Harry Reigel, aged fourteen years, fell from an elevator, landing on his head and dislocating his neck, on May 8. When brought to the hospital the case was considered hopeless, but by experiments with extending weights attached to the patient's head and feet the neck was eventually set and kept in place by means of a plaster of Paris jacket The displaced bones are now properly set and the patient has full power of the neck.

AN alloy that expands in cooling and is suitable for repairing cracks in cast iron is made with nine parts of lead, two of antimony, and one of bismuth.

A TUBE EXPANDER AND BENDER.

The implement shown in the accompanying illustration is designed to lock fast to one end of a tube or boiler flue, and retain the parts in position to expand the tube inside of the boiler against the flue sheet when the device is rotated, afterward flanging the end of the flue to return its projecting end against the outer surface of the flue sheet. This device has been patented by Mr. P. H. Benade, of Punxsutawney, Pa. Fig. 1 is a side view of the tool and Fig. 2 a longitudinal section of its front portion, Fig. 3 being a detached view of parts showing its operation in expanding a tube in contact with a flue sheet. The body or shell of the tool receives a conically tapered pin, and it has three spaced apertures for the reception of cylindrical rollers adapted to expand the flue when they are forced outward by the tapering pin and the shell is rotated. On the inner end of a sleeve sliding on the front end of the shell is a hub with three integral studs, for the reception and revoluble support of grooved flanging rollers, shown in Figs. 1 and 4, these rollers impinging on the front end of a flue to flange it when the device has been moved longitudinally to position in the flue. Through a threaded plug in the front end of the shell extends a bar with threaded outer end forming a detachable shank for the conical pin, there being a hand wheel on the outer end of the bar. Integral with the front end of the shell is a collar with radial perforations for rotating the shell with a lever, a loose collar with radial perforations serving as a nut to bear against the fixed collar, forcing the sleeve further on the shell, the other end of which has a cap nut to receive a connecting rod.

This rod is of such length, proportioned to that of the

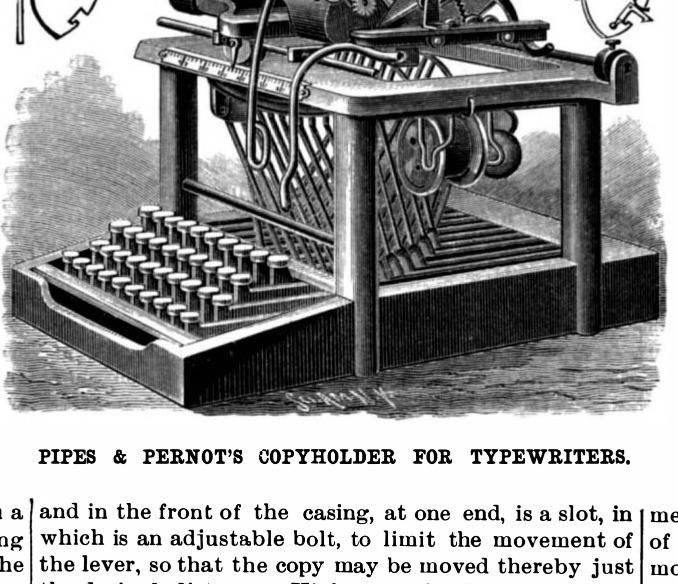


BENADE'S TUBE EXPANDER AND BENDER.

tubes or flues operated upon, that a spring dog is supported thereby to engage the end of the flue opposite to the end being set, the dog having diverging limbs terminating in wedge-shaped enlargements at their outer ends, and being connected with the rod by an interlocking coupling box, which is prolonged as a threaded bolt. In use the dog is passed into the flue from the end which is to be expanded and flanged, an accurate adjustment for length being effected by revolving the dog on the bolt end, the dog automatically maintaining the connecting rod, coupling box, and its bolt end extension axially coincident within the tube. The adjustment is such that the rollers in the three spaced apertures of the shell will lie opposite the portion of the flue engaged by the sheet, so that a rotation of the shell by the handle bar will expand the flue and force it against the edge of the sheet as the conical pin is forced against the rollers by the hand wheel at the end. After such expansion has been effected, the device is adjusted to bring the flanging rollers against the outer end of the flue, and the operation is completed by the joint action of these rollers and the feeding collar or nut. After the flanging or beading of the flue end, the rollers are withdrawn by reverse movement of the collar, allowing the sleeve to be slid forward, when the tool is pushed through the flue rearwardly.

A COPYHOLDER FOR TYPEWRITING MACHINES.

The illustration represents a device easily applied to typewriters to facilitate reading the lines of the copy, which can be readily inserted and moved as desired. It has been patented by Messrs. Martin L. Pipes and Emile F. Pernot, of Corvallis, Oregon. The casing, of which an end view is shown in Fig. 1, is adapted to be fastened to the front rail of the carriage, which is held in a suitable recess by a spring-pressed hook lever. Within the casing, as shown in the transverse section, Fig. 2, are two longitudinally extending rollers, the trunnions of the upper one of which extend through an inclined slot in the ends of the casing, and are spring-pressed, to hold this roller on the copy placed between the two rollers. The trunnions of the lower roller are in fixed bearings, and on the outer end of one of them is a ratchet wheel, adapted to be engaged by a double pawl on the end of the casing, the pawl being fulcrumed on an arm in which is a transversely extending slot, into which extends one arm of a bell crank lever, whose other arm extends downward on the front of the machine to within a short distance of the keys. A spring holds this lever in normal position,

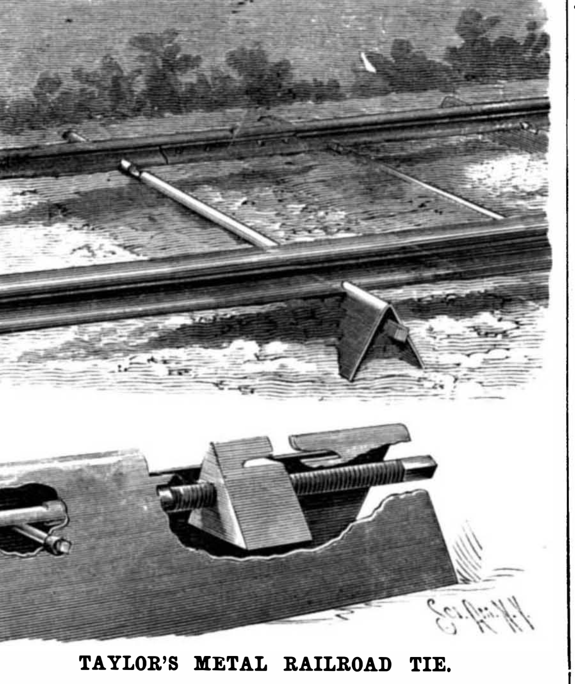


PIPES & PERNOT'S COPYHOLDER FOR TYPEWRITERS.

and in the front of the casing, at one end, is a slot, in which is an adjustable bolt, to limit the movement of the lever, so that the copy may be moved thereby just the desired distance. Higher up in the front of the casing is a longitudinal slot through which the lines of the copy appear, the width of this slot being increased or diminished, according to the height of the reading lines of the copy, by moving a plate with arms fulcrumed on the ends of the casing. A spring pawl holds the lower roller in place after it has been moved, and plates are arranged to guide the copy between the rollers, upward past the slot, and to the rearward, as shown by the arrows in Fig. 2. When the operator desires to turn the copy backward, it is only necessary to change the double pawl on the end of the casing, so that its other arm engages the ratchet wheel. The entire copyholder is held on the carriage, moving with and being swung upward with it when the operator desires to examine the typewritten copy.

AN IMPROVED METAL RAILROAD TIE.

A metal railroad tie designed to be light, strong, and durable, while having a degree of elasticity adapted to prevent injurious shocks to the rolling stock, is shown in the accompanying illustration, and has been patented by Mr. James P. Taylor, of Fort Worth, Texas. The tie is intended, when in position, to be

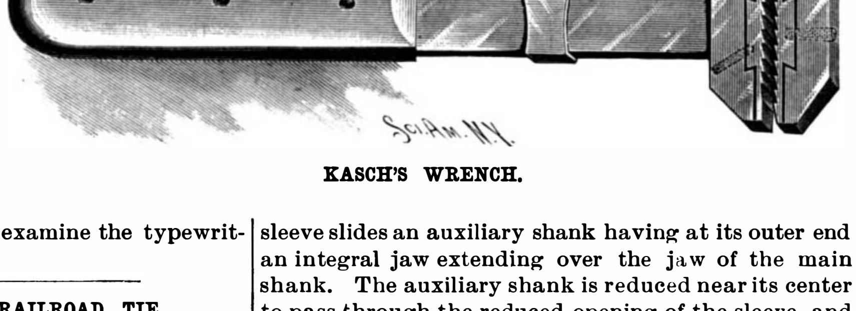


TAYLOR'S METAL RAILROAD TIE.

embedded in the ballast of the roadbed, and its shape is such as to facilitate the keeping of the roadbed dry and more stable than is the case with ties of the ordinary construction, as water will readily flow from its inclined sides. The body of the tie is preferably of wrought iron plate bent to nearly triangular shape in cross section, with longitudinal slots at the apex of the triangle for the rail seats, integral lips or flanges of the tie being adapted to hook over the outer edge of the base flange of the rail. To facilitate the ready and firm fastening of the rail in position, there is located in the body of the tie a rod, oppositely threaded at each end, where blocks or nuts are mounted, as shown in the small figure, each block having a lug adapted to fit upon the inner base flange of the rail. The blocks are brought into engagement with the rail flange by the application of a wrench to the outer squared end of the rod, a middle portion of the rod being also squared, and resting upon a transverse bolt, to retain the rod from rotation when in place, sufficiently to prevent it from relaxing the lugs, although the rod will yield when turned by a wrench to adjust the parts.

AN IMPROVED WRENCH.

A wrench which is more especially adapted for use as a pipe wrench, but which may also be employed as a monkey wrench, and has practically two handles, one of which may be used as a lever to disengage the jaws from the pipe, and adjust the outer jaw to and from the inner jaw, is shown in the accompanying illustration, and has been patented by Mr. Frederick W. Kasch, of No. 504 East Avenue, Austin, Texas. The main shank of the device is rectangular in cross section, and has integral with its outer end a jaw, immediately beneath the heel of which is hinged one end of a sleeve, in such manner that the sleeve will have more or less swinging movement on the main shank. To one side of the sleeve, and limiting its outward movement, is attached a yoke which encompasses the main shank, the sleeve being normally held quite a distance from the shank, and parallel therewith, by a spring. The sleeve is rectangular in cross section, and has a reduced opening at one end, and within the



KASCH'S WRENCH.

sleeve slides an auxiliary shank having at its outer end an integral jaw extending over the jaw of the main shank. The auxiliary shank is reduced near its center to pass through the reduced opening of the sleeve, and the further portion of such shank is threaded and covered by a tubular handle. This handle has fitting in and projecting beyond its outer end a nut capable of receiving and turning upon the threaded section of the auxiliary shank, the nut having near its outer end a circumferential groove in which is inserted a tongue upon a clamping plate attached to the sleeve. By the manipulation of the tubular handle, through the medium of the nut acting upon the threaded portion of the auxiliary shank, the jaw of the latter is moved to increase or decrease the distance between the two jaws, the tubular handle forming a very convenient grasp for the hand in detaching the wrench from a pipe. This wrench is designed to be of a superior character in exactness of working, durability, and convenience.

Growth of Manufactures.

The trade statistics for 1889 of the eleven leading manufacturing industries—cottons, woolens, chemical, paper, agricultural implements, flour, lumber, glass, iron and steel, and ship building—are so complete and accurate that they anticipate the census reports, and furnish an instructive indication of the progress our entire industrial system has made in the last decade. These eleven industries in 1879 had $1,165,000,000 capital invested in them, and 844,776 hands employed, they paid out in wages $256,795,000, consumed $1,197,000,000 worth of raw materials, and showed a gross product of manufactures of the value of $1,774,000,000. In 1889 they had $1,784,840,000 capital invested, and 1,274,000 hands employed, they laid out in wages $320,689,000, consumed $1,586,000,000 worth of materials, and gave a product of manufactures of the value of $2,293,779,000. The increase has been in capital invested $619,740,000, in the number of hands employed 429,224, in the amount of wages paid out $93,894,000, in the materials consumed $397,000,000, and in the value of the product turned out of $519,779,000. There is over 50 per cent more capital invested in the specified manufactures than there was ten years ago, 50 per cent more hands employed, over 36 per cent more wages paid out, over 30 per cent more material consumed, and nearly 30 per cent greater product.—*Trade and Traffic.*

DEPARTURE OF THE BALTIMORE FOR SWEDEN.

The imposing ceremonials which took place in this city August 23 last, in homage to the memory of the late Captain John Ericsson, were brought to a close by the final act of transferring the casket containing the precious remains to the decks of the war ship Baltimore. The scene is depicted in the illustration upon our first page. A procession of citizens, some six thousand in number, followed the hearse from the cemetery down Broadway to the Battery. It was a solemn and impressive spectacle. Among those in the line were the members of the American Society of Swedish Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Marine Society of New York, the workmen of the Delamater Iron Works, the Farragut Naval Veterans Association, lodges of Odd Fellows, marines, and officers, naval and military, of the United States.

The scene from the Battery, when the procession reached that point, was striking and animating. A fleet of national war vessels lay extended over the bay in a long line, the Baltimore at the head, while the adjacent waters were covered with steamers and vessels of every description, all crowded with spectators.

From the landing at the Battery the casket was conveyed on a small government steamer to the side of the Baltimore, and then reverently raised by tackle from the yard arm to the deck of the ship, the booming of minute guns on board the Ericsson monitor Nantucket being maintained throughout this solemn proceeding. The flag signals for sailing were soon after this displayed, the anchors were raised, and the stately Baltimore began her ocean voyage to Sweden. As she steamed slowly past the line of war vessels each one delivered its salute of twenty-one guns, and the same tokens of honor came from the embrasures of the various fortifications as the ship proceeded down the bay and went out to sea. John Ericsson was born in Sweden, July 31, 1803, and died in New York, March, 1889, at the age of nearly 86 years, of which about half a century was spent in this his adopted country. He was a man of wonderful intellect and remarkable achievements. His name is indissolubly connected with the early history of the locomotive and with the practical application of the propeller to ocean steamers. His great services to the people of this country in designing and realizing at a critical moment the turreted war vessel can never be forgotten.

THE NEW STATE HOUSE AT INDIANAPOLIS, IND.

INDIANAPOLIS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY H. C. HOVEY.

Nineteen years ago the A. A. A. S. met in the city of Indianapolis. Since then its meetings have been scattered annually from Montreal to Minneapolis, and as far south as Nashville. Meanwhile great changes have taken place in all parts of the country, and nowhere have these been more marked than in the Hoosier State. One of the most agreeable and noticeable improvements is the State House itself, where the daily meetings of the Association have been held, from Aug. 19 to Sept. 1. Any one who ever saw the dingy old capitol, in whose halls we convened two decades ago, would appreciate the transformation that has been effected by a happy combination of money, brains, and integrity in using the finest building materials obtainable in constructing the capitol, magnificent in its dimensions and unsurpassed in the thoroughness and perfection of its construction. As this edifice is a model in its way, it may be well here to give some of the principal facts as they were stated to me by Prof. John Collett, to whom, together with Gen. T. A. Morris, Gen. John Love, Messrs. Nelson, Seward, and others associated with them as State House commissioners, are chiefly due the admirable results embodied in this form.

In the center of a park of nine acres, bounded by four broad avenues and located in the heart of a city of 125,000 inhabitants, rises a lofty and stately structure whose crowning glory it is that from its massive foundation to its gilded dome every foot of it is honest work, all paid for within the original appropriation made by a vote of the legislature. The length of the building is 500 ft., its width 283 ft., its height 235 ft., and the portico 100 ft. high. The style is Neo-Grac, with interludes of Victorian plainness. The foundation and solid walls laid in hydraulic cement are claimed to have strength enough to resist cyclonic or seismic action, and the building in every part is so absolutely fire proof as to dispense with the need of insurance.

The main material used is Indiana oolitic limestone, which contains 98 per cent carbonate of lime, and resists heat or cold from plus 100° to minus 30° F. Glacial tracks down to the finest hair lines remain upon its exposed surfaces unchanged during the centuries untold that have passed since they were made. It was all selected from the quarries of Monroe and Lawrence counties, Ind. The workable beds are from 10 to 100 feet thick and are easily cut by steam channeling machines. The stone is homogeneous, grayish white, with a density of 150 pounds per cu. ft. and a crushing weight from 10,000 to 26,000 pounds to the inch. Since its introduction into the State House the demand for it has increased a thousand fold, and the railroad facilities are insufficient to carry the burden. Specimens of this stone may be seen in some of the finest buildings on Wall Street, New York, in the Vanderbilt palace on Fifth Avenue, in some of the best buildings on Chestnut Street, Philadelphia, in the new State House at Atlanta, Ga., and the Cotton Exchange at New Orleans, whose outside statuary groups remain perfect where neither marble nor granite would endure. It is estimated that during the four years since the State House was completed it has paid for itself ten times over as an advertisement of the resources of the State, especially in the items of stone, lime, cement, and hard woods. The rooms are finished with white oak, quartered, no other kind being used in the building. The stone work throughout is dressed to faced edges, from ¼ to ⅛ inch joints, so there is no possibility of cracking, as occurred in the dome of the Connecticut capitol, which had to be filled with type metal to keep it from falling. Here the dome is as solid as the natural rock, and the commissioners defy any visitor to find the slightest crack or sign of settling in any portion of the immense structure. The granite foundation stones and numerous polished granite shafts were brought from Maine, the white marble for tablets and statuary from Vermont; the clouded and variegated marble for the columns for the magnificent colonnade, visible at one glance through three stories, are from Tennessee. Every block of stone in the building passed under the inspection of Prof. John Collett, who inexorably rejected whatever was suspicious or in any way objectionable. There is not a block of stone in the whole building taken from a quarry where either powder or dynamite had been used.

Begun in October, 1878, it was finished October, 1888, and has now been in constant use for four years, during which time not one dollar has been spent for alteration or repairs. The original appropriation was two million dollars. Costly substitutions were made as the work progressed, granite for brick, marble for limestone, solid oak for cheaper woods, and yet the total cost was but $1,980,969, thus coming considerably within the limit set. This unusual and honorable result is due to the integrity, skill, and fidelity of the commissioners.

Among the merits especially appreciated by the scientific visitors to the capitol may be mentioned its perfect water supply, perfect ventilation—enabling members to keep awake during the dullest discussions. The royal commissioner of Austria, in visiting this State House, remarked that in all his travels he had never seen a large public building, temple, or cathedral, that did not have many dark, dirty recesses; but he found here that the corridors were so lighted from immense skylights that every nook and corner was flooded with light: while every business room was, at some hour of the day, visited by sunshine. If undue space seems to have been given to the description of this spacious and commodious building, my excuse is that the Association was so delighted with it as to spend all their spare time either in admiration or praise; and much of the success of this meeting has been due to the fact that it was held in an edifice where there was room for all the sections within easy reach of each other and with every facility for carrying on their special sessions to advantage. The citizens of Indianapolis, moreover, were justly proud of their guests, and did everything in their power to make the meeting the most brilliant and enjoyable the body has ever held. When Lieut.-Governor Chase, in his hearty address of welcome, declared that for the occasion he put the 36,000 square miles of the commonwealth of Indiana at the disposal of the A. A. A. S., every citizen who heard him said amen. The meeting for organization and welcome was held in the Hall of Representatives, with several hundred members of the A. A. A. S. present, besides a sufficient number of citizens to occupy every seat and overflow into the lobby. The opening prayer was offered by Dr. Van Anda, after which the retiring president, Prof. T. C. Mendenhall, resigned the chair to Prof. G. L. Goodale of Harvard. Dr. G. W. Sloan, in behalf of the local reception committee, made brief remarks, and introduced Lieut.-Gov. Chase and Mayor Sullivan, who welcomed the Association in behalf of the State and city.

After the general session, addresses were made by the vice-presidents before their several sections. In section "A" Prof. S. S. Chandler made an address in regard to the community of nature between the variable stars and the other stars of our sidereal system; their number, size, color, and fluctuations of brightness. In section "B" Prof. Abbe urged a broader study of terrestrial physics, as distinguished from the line of molecular physics, to develop which many laboratories and professorships have been established. Under the general head of geo-physics he would include vulcanology (the study of interior depths), geogomy (the study of the earth's crust), magnetism, the aurora borealis, gravitation, attraction, oceanic waves, currents and tides, seismology, and meteorology. In section "C" Prof. R. B. Warder spoke on recent theories of "Geometrical Isomerism," illustrating his paper by models and diagrams to explain the campaign that is being carried on against the stronghold of atomic mysteries. In section "D" Prof. J. C. Denton, of Hoboken, N. J., gave a very interesting history of "Attempts to Determine the Relative Value of Lubricants by Mechanical Tests." He illustrated, in a unique manner, by means of the stereopticon, experiments with crude and refined oils in their effect upon the rubbing of wearing surfaces; and in explanation of the paradox that overheated journals may be relieved by applying sand or emery to the bearings. In section "E" Prof. J. C. Branner spoke at great length on the "Relations of State and National Geological Surveys;" which as he claimed should stimulate each other and encourage private enterprise and investigation. With a splendid equipment of men and means, the respective work of the various surveys ought to be more sharply defined to prevent a waste of effort. As it now is, much geological literature is practically worthless, being an incumbrance rather than a help. Many errors and annoyances might be prevented by skillful and cordial co-operation. He made a special plea for utilizing local talent, even of a non-professional sort, under the direction of competent conductors. In section "F" Prof. Minot treated a subject of special interest to biologists, "The Phenomena of Old Age." He entered on a large field of statistical inquiry, with hints as to how it might be worked, and its materials made to yield valuable results. He made the singular statement that there is, scientifically speaking, no period of vital development, but only a steady decline from birth onward. There is much to be done in the domain of biology to solve the problems of reproduction, heredity, sex, growth, variation, death, and the general economy of nature, in order to explain the phenomena under consideration.

In the section of economic science and statistics, Hon. J. R. Dodge delivered a very careful and original address on the American standard of living and the advantages enjoyed by the producing classes of the

United States. He spoke of the wasteful use of food in this country as compared to other countries of the world, the profuse supply of clothing, the constantly increasing demand for the adornment of the home, the alleged depression of the agricultural class, which he considered to be greatly exaggerated, as he did also the unfortunate statements made in regard to farm mortgages and their relation to independence and prosperity. He treated also on the growing demand for a higher education, which, he said, was too often linked with a distaste for useful industry. In view of all these things comes the question, "Shall the present manner of living be maintained, and with it the constant increase in wages demanded by the American people?'

In the anthropological section Dr. Frank Baker, of Washington, D. C., gave his views "In Regard to the Ascent of Man." By this he meant the effort of the human being to assume an erect position from one that had previously been semi-erect. He regarded the struggle as still going on, and as serving to explain the liability of man to certain deformities and diseases from which quadrupeds are exempt.

The races of men and the anthropoids sprang from a common stock, as he thinks, far back in prehistoric night; though each being, in its own way, has fought the struggle for existence. The results of the erect position are so great as to affect the whole life of man, controlling his habits, directing his actions in war, the chase, and society, and, finally, moulding peoples, nations and races.

Correspondence.

Cutting Glass Bottles.

To the Editor of the Scientific American:

I have seen three different modes of cutting glass bottles described in your valuable paper, and do not doubt they are practicable. Yet I should like to mention a very simple and easy way, which I have tried several times without failing. Saturate a piece of cotton string in kerosene (alcohol, benzine, etc., will, I suppose, answer just the same), tie it around the bottle as close as possible and apply a match. By holding the bottle in a horizontal position with both hands, it can be turned slowly, allowing the fire to burn round. If the glass does not crack immediately after the flame is extinguished, let the water from the hydrant drip on it, and the cut is clear and even. Smooth the sharp edges with a file.

Chicago, Ill. CHRISTIAN KOCH.

Work of Amateur Electricians.

To the Editor of the Scientific American:

I have made simple electric motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, with a few changes. Made the commutator and brush holders same as they are made by electric companies. The bearings of brass, and bolted them to the sides of field magnet, which is of solid iron. Use the Thomson-Houston incandescent current. Use the motor to run novel window displays during the holidays. Have made a working telephone, also described in one of your SUPPLEMENTS, and am now making a phonograph. H. C. ALBRECHT.

Terre Haute, August 19, 1890.

To the Editor of the Scientific American:

Seeing in your issue of SCIENTIFIC AMERICAN, July 19, a request that the amateur electrical workers report, I will state that I have read SUPPLEMENT Nos. 161, 599, and 600, and have made a dynamo of the same size as the one described in SUPPLEMENT, No. 161, but I improved it according to the two other articles. I had the field magnets cast in the same shape as those of the eight-light dynamo. It has a Siemens armature, made with washers of wrought iron as a core, and having twelve coils of No. 20 wire, each coil having about 20½ feet of wire in it. The commutator is made of large copper wire, flattened into bars, mounted on a hardwood cylinder, and held in place by two brass bands, one at each end. The bands are separated from the bars by pieces of tape, and each bar is separated from the others by pieces of shellacked walnut wood. The fields are wound with four parallel No. 18 wires, which can also be connected in series similar to the eight-light dynamo. It works better as a shunt machine running the field coils in series.

With the dynamo I can run two six-candle Edison lamps, in parallel or series; but it takes a very high speed to run them in series, from which I conclude that the voltage must be from 16 to 22, according to the speed. The lamps require 10½ volts. I can produce strong shocks, run small motors, charge accumulators, produce a small arc light, and heat an inch or more of No. 30 iron wire white hot. I have added to the field coils four layers of No. 20 wire, which I run in parallel with the No. 18, and find that I can produce the same results with a much lower speed. I have learned a great deal about electricity since I subscribed for the SCIENTIFIC AMERICAN, about eight months ago. I shall probably make a larger dynamo next winter. C. F. KELLOGG.

Prairie Center, Ill., August 21, 1890.

To the Editor of the Scientific American:

I noticed your request to electrical workers in the July 19 issue, and will tell of my experience in making an induction coil according to the instructions in SUPPLEMENT, No. 160.

My first attempt was with bare wire in the secondary coil, and as I had no engine lathe to secure uniform spacing of the wire, I tried to space by the aid of a comb with the teeth cut very short. The result was anything but satisfactory, and led to the construction of a new secondary coil, using silk-covered wire. Winding each layer the full length of the coil, and then giving it two coats of shellac varnish, then over each layer of wire was wrapped two layers of common manila wrapping paper and another coat of shellac applied.

The coil was finally completed and mounted on its base with commutator and everything complete, a battery was attached and the current breaker buzzed like a bumble bee, but no spark could be obtained, though an accidental contact with the poles with bare hands showed that the induced current was there, and much too strong to pass through any one's system with safety.

Here was a dilemma, something was wrong, and letters to various authors of text books on electricity gave no way out of the difficulty.

In the course of a week or more a spark, perhaps the thirty-second of an inch in length, could be obtained between the poles, and in the course of a week more increased in length to perhaps one-eighth inch.

This was encouraging, but not satisfactory, and a new coil was determined on. This time I used silk-covered wire, but wound the coil in two sections, as described in the SUPPLEMENT, using no shellac. The space between the sections was filled with a piece of walnut made into a ring. This was split and boiled in paraffine wax to insure its insulating qualities. The two halves were then fastened together by means of screws. I used only one pound of wire in the secondary coil.

This coil when completed was a success, giving with a battery of four cells a spark from three-quarters to an inch in length.

This coil was constructed some eight years ago, and afterward sold to the high school at Tecumseh in this State, where it is still in use.

The failure of the shellacked coil was a source of much perplexity to me then, and I am not positive that I can explain it yet, but I have been informed that shellac varnish, while apparently dry in a few hours, is not sufficiently dry to serve as a complete insulator, and requires weeks to become so, and had I placed the coil in a dry room for three months, it would then have acted satisfactorily. I believe there is some truth in this, and it may aid some other amateur perplexed as I was. E. A. CONDIT.

Morenci, Mich., August 23, 1890.

The English Hop Industry.

A report has been issued by the Select Committee of Parliament appointed to "inquire into the causes which have produced the steady decrease in the acreage of land under hop cultivation, and the serious displacement of labor occasioned thereby, and to report as to the best means, if any, of providing a remedy." We abstract the following:

In the wealds of Kent and Sussex and in Mid-Kent the decrease of hop cultivation has been very serious, namely, from 43,400 acres to 31,900 acres, or 26 per cent, and there can be no doubt that, having regard to the great amount of capital outlay necessary for bringing hop land into cultivation, and for providing the necessary buildings, and to the yearly expenditure on labor for cultivating and picking the hops, this great reduction in the area under cultivation has told with exceptional severity on all classes in these districts.

From the evidence received it appears that the best qualities of hops are grown in East Kent and in parts of Mid-Kent, then come the Farnham, the Herefordshire, and Worcestershire hops, the last two of which have grown greatly in favor the last few years, and lastly come those of the wealds of Sussex and Kent, where hops abundant in quantity but of less value in quality are grown. The decrease of cultivation, therefore, has occurred mainly in those districts where hops of inferior quality are produced, and it is from these districts mainly that complaints have been made to the committee.

The immediate cause of the decrease is owing to the very low prices which have ruled for hops during the last few years.

The great majority of witnesses engaged in the cultivation of hops attribute this fall of price mainly, if not wholly, to foreign imports. They allege that the price of foreign hops rules the market for English hops, and that foreign hops have largely supplanted English hops in the home consumption. The greater number of these witnesses favor the imposition of a duty on foreign hops to the amount of 30s. or more per cwt. By some it is suggested that this duty should be accompanied by a tax of £1 per acre under cultivation of hops in England. This, however, was objected to by the great majority of witnesses. The proposal, therefore, is practically one for a protective duty on hops. But the committee cannot recommend the imposition of a duty upon foreign hops.

All the evidence shows that cultivation of hops was carried on with profit previous to 1879, the import of foreign hops during this period was large, but in spite of this the area of cultivation rose from 56,000 acres in 1866 to 71,700 acres in 1878. It is evident, therefore, that the recent depression is due to other causes besides foreign competition.

From the evidence and statistics laid before your committee, there is reason to conclude that those causes have been—(1) the reduced consumption of malt and sugar for brewing purposes, and consequently of hops since 1879, owing to the depression of trade and other causes; (2) the economy effected in the use of hops in proportion to malt since the year 1882, owing to the more scientific manufacture of beer and to the altered taste of the public, which has required a beer of lighter and brighter character; (3) the use to a certain degree of hop substitutes.

The evidence further shows that there has been a considerable economy in the use of hops since the year 1882. The very high price of hops in that year induced brewers to turn their attention more closely to the subject, and science was brought in aid of the manufacture of beer. It was found possible by the use of ice to brew continuously throughout the year, the consumption of beer became more rapid, it was no longer necessary to keep large stocks of beer for many months, the taste of the public altered, a brighter quality of beer, less heavily hopped, is now preferred. As a result of these changes, the proportion of hops used to a quarter of malt has been reduced to an amount estimated generally at 1½ pound per quarter of malt, or 15 per cent. When there is added to this the reduction due to a reduced consumption of malt, estimated at 12 per cent, the two together account for a largely reduced demand, and consequently for a fall of prices. It was to be expected, therefore, that there would be a reduced cultivation of hops corresponding to the increased cultivation in the decade prior to 1879.

The change which has taken place in the quality of beer, and the increased demand for a lighter and brighter beer, has also told mainly on the inferior qualities of hops, for the better qualities alone can be used for beer of this kind, and it has consequently followed that the reduced demand has mainly affected those districts where the inferior qualities of hops have been grown. The evidence shows that the same causes have led, in many parts of the Continent, to a reduced cultivation during the last few years of much land where inferior hops were grown.

It is confidently stated that none of the so-called substitutes can be relied upon to perform the work of hops in the manufacture, flavor, and keeping of beer. The use of hops is represented to be fourfold—first, to precipitate or render insoluble certain nitrogeneous ingredients of the wort; secondly, to preserve the beer by preventing a renewal of fermentation during the time before it is fit for consumption; thirdly, to give it the bitter taste to which the public have become accustomed; fourthly, to give it a delicate aroma.

None of the various drugs which are advertised as substitutes for hops performs any of these functions except the third, that of giving a bitter taste to the beer. It is admitted generally that it is impossible to make beer such as the public requires without hops, and that at most the drugs referred to can only be used as substitutes for a small proportion of the hops which would otherwise be used. It is alleged that none of the larger and better class of brewers makes use of any of these substitutes.

Electric Light in the Suez Canal.

The number of vessels passing through the Suez Canal at night by means of electric light is increasing with extraordinary rapidity. The regulations for the use of the electric light came into operation in March, 1887, and during the remainder of that year (according to statistics given in the recent British consular report from Port Said) the number using it was 394. In 1888 the number rose to 1,611, and last year reached 2,445. Prior to March, 1887, the privilege of traveling by night with electric light had been restricted to vessels carrying the mails. Since then all ships which conform to the regulations are allowed to proceed by night. The average time of transit has also been considerably shortened. In 1886 it was 36 hours; in 1887, 33 hours and 58 minutes; in 1888, 31 hours and 15 minutes; and in 1889 it had been reduced to 25 hours 50 minutes. The average time for vessels using the electric light in 1889 was 22½ hours. The shortest time taken by a steamer in the transit of the canal in 1889 was 14¾ hours, which is ten minutes less than the fastest passage on record previously.

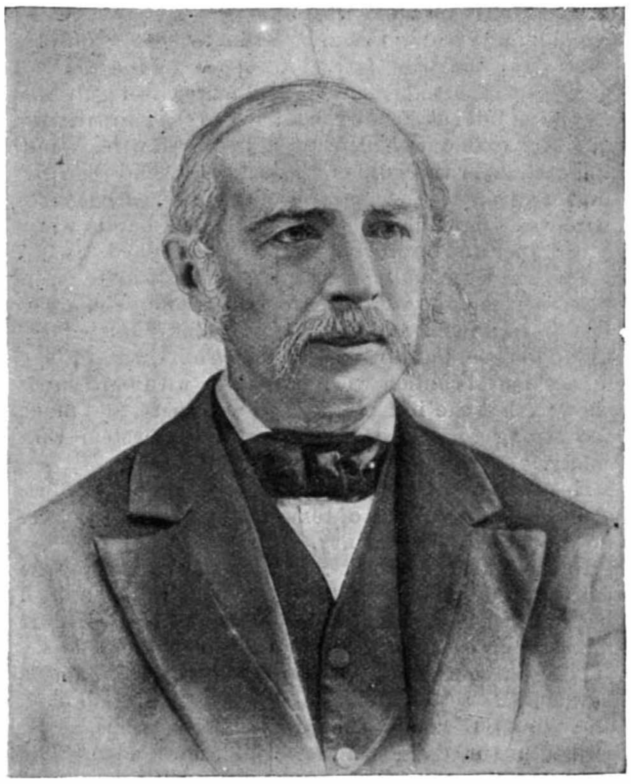
CHRISTIAN HENRY FREDERICK PETERS.

Professor Peters was born in Coldenbuttel, in the Duchy of Schleswig (then a dependency of Denmark), on September 19, 1813. He was educated at the University of Berlin, where, in 1836, he received the degree of doctor of philosophy, and then spent some time in study at Copenhagen. In 1838 he accompanied Baron Sartorius von Walthershausen to Sicily, where, until 1843, he was engaged in making a survey of Mount Etna. Owing to the death of Walthershausen, the survey was never finished, but the published results of the work are said to afford the most exhaustive description that has ever been given of any mountain. At the close of this work he was engaged at Naples on the topographical survey of the Sicilies, but soon retired to join the revolutionary forces. He served under Garibaldi, and was made major in the artillery for bravery on the field of battle. Twice he was severely wounded, and when the movement collapsed, a price was set upon his head by the government. He was obliged to live in the woods for weeks, with hardly any food and no shelter, to escape capture and execution. Eventually he escaped on a small brig to Turkey, and there devoted himself to the pursuit of his chosen science. A few years later he made the acquaintance of George P. Marsh, the United States minister in Constantinople, by whom he was persuaded to come to this country. His letters of indorsement from scientists abroad, including one from Von Humboldt, secured for him an appointment in 1853 in the United States Coast Survey, and at first he was stationed at the observatory in Cambridge, Mass., but later was assigned to work at the Dudley Observatory, in Albany, N. Y.

In 1858 he was called to Hamilton College as the first director of the Litchfield Observatory in Clinton, N. Y., and thereafter remained connected with that institution until his death. In 1867 Edwin C. Litchfield, of Brooklyn, N. Y., presented the college with the sum of $30,000 to endow a chair of astronomy, and Dr. Peters was at once chosen to that place.

Soon after his settling in Clinton he began that work with which his fame is so justly connected—the observation of the zone stars and placing them on charts. In this direction it is said that he accomplished more than any other astronomer. At the time of Herschel not over 20,000 stars were registered, and this number was increased to 50,000 by Lalande, while Dr. Peters proved and registered more than 112,000, including stars as minute as the thirteenth magnitude in his scheme. It was in prosecuting this work, which is his distinguishing contribution to astronomical science, that he also became famous as a discoverer of planetoids. While examining stars to determine their place, a strange star would be observed in the field, and which, if after-calculation confirmed the record that no star existed in that particular spot, would be reported as a newly discovered asteroid. Forty-eight of these discoveries are credited to Dr. Peters, which is a larger number than any other astronomer can claim. On the night of July 31, 1872, and again on the night of June 3, 1872, he discovered two of these planetoids. His last discovery was on the night of August 25, 1889, when he found asteroid No. 287. From his first computation it appeared that a portion of the new asteroid's orbit was within a portion of the orbit of Mars, and while subsequent calculations made this theory doubtful, still it is probably the nearest asteroid to the sun yet discovered. The largest number of these found by him in a single year (1879) was eight, and a computation of the aggregate surface of forty of them indicates an area of 266,978 square miles, or about that of the State of Texas. Dr. Peters fixed the locality of the zodiacal stars upon charts which give an accurate picture of the parts of the sky that they depict, and which will serve hereafter as a sure basis for studying changes in the heavens. Twenty of these, under the title of "Celestial Charts," were published by him, at his own expense, in 1884, and a second series was completed and ready for the press in 1888, but have not been published.

For ten years Dr. Peters made a daily observation of solar spots, making a record of nearly 14,000 spots, but he never published his results, which still remain in the safe of the Litchfield Observatory. Every observation has a drawing showing the position of the spot as proved by calculations at the time when seen. This work is believed by astronomers to have been the most valuable of his researches, especially since stellar photography makes easily possible the star charts upon which he spent so many years.



CHRISTIAN HENRY FREDERICK PETERS.

Under the auspices of the regents of the University of the State of New York he determined the longitude of several places in this State, including the western boundary. Dr. Peters had charge of a party that observed the solar eclipse of August 7, 1869, at Des Moines, Iowa, and in 1874 was chief of the expedition sent to New Zealand by the United States government to observe the transit of Venus on December 9 of that year. By means of double image micrometers he measured the apparent diameter of Venus, thus determining the real size of the planet with an error of probably not more than 1-300th part of its value, and also secured 237 photographs of that shy planet. Of his work at that time it was said: "There is no need of other observations. Dr. Peters has accomplished all that was to be done." He was less fortunate in the second transit of Venus, on December 5, 1882, for clouds hid the planet during the time when the observation had to be made; and likewise in 1883, during the occultation of Jupiter, a phenomenon of centuries, a similar fate befell him. But he accomplished much, and of him it has recently been said: "The reputation of this learned man fills the world, and not only that, but it is written upon the stars themselves."

An unfortunate controversy marred the last two years of his career. He sought the aid of Chas. A. Borst, in the preparation of a "Star Catalogue," and the latter, with his sisters, spent several years in computing the results, also aiding in the researches necessary to its completion. Ultimately Mr. Borst claimed that the work was his own, and in that opinion he was sustained by several distinguished authorities, including Simon Newcomb and Asaph Hall, of the U S. Naval Observatory in Washington, D. C. The case went before the courts, and a decision was rendered awarding the "Star Catalogue" to Dr. Peters as being his property, with interest on its value, and six cents damages to carry costs. It is understood that an appeal will be taken against this decision by Mr. Borst.

Dr. Peters was a member of both foreign and American scientific societies, and in 1876 was elected to the National Academy of Sciences. He attended the International Congress of Astronomers, held in Paris during April, 1887, under the auspices of the French Academy of Sciences, and at that time was made a chevalier of the Legion of Honor by the French government. The results of his researches were published in various scientific journals, but chiefly in the *Astronomische Nachrichten.*

Although a specialist, Dr. Peters was learned in many branches of science, and was a linguist of rare ability. This knowledge made him a favorite at social gatherings. He never married, and his habits were simple to the extreme. Among the students he was known as "Twinkle," but he was a strict disciplinarian, and always demanded that the dignity of his office be respected.

On Friday, July 18, he asked the college janitor to arrange the college astronomical apparatus so that he might make some observations during the evening. The next morning they found him seated on the stone steps leading to Hungerford Hall, where his apartments were. In the night death had come to him, and when daylight broke his soul was far away in the heavens among, those starry bodies whose study had ever been his constant delight while he was on earth.

A JET-PROPELLED STEAM LIFEBOAT.

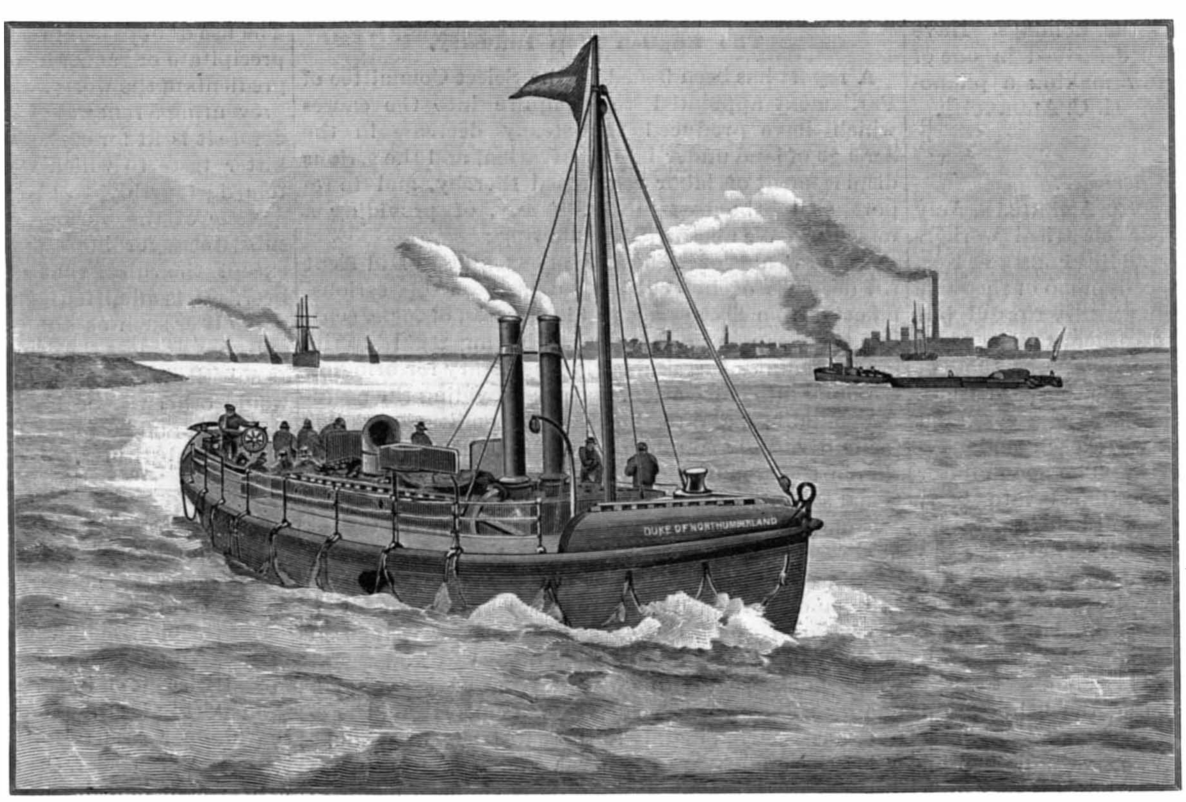
The Royal National Lifeboat Institution, after many years of effort, has at length succeeded in obtaining a lifeboat which may be mechanically propelled. At the beginning of 1888 a proposal for a steam lifeboat was submitted to the Institution by Messrs. R. & H. Green, well known shipbuilders at Blackwall, which, having passed through various modifications as the result of consultation with the committee and their professional officers, was accepted by the Institution, and a steam lifeboat, constructed of steel and propelled by a turbine wheel, has now been completed. Such a boat, if successful, will necessarily only be able to be used at a limited number of stations. Our engraving is from the *Illustrated London News*, and the accompanying particulars from the London *Graphic*. The details of this novel lifeboat, which has been named the Duke of Northumberland, and is to be stationed for the present at Harwich, are as follows:

Length, 50 feet; beam, moulded, 12 feet; breadth, extreme, 14 feet 3¾ inches; draught, loaded (extreme) with 3 tons of coal, 30 passengers, 9 crew, and full outfit, 3 feet 3 inches; displacement at this draught 21 tons; indicated horse power, 170. The propulsion is effected by a jet of water which issues from the stern, and which is impelled by a turbine wheel or pump.

It may be interesting to state the reasons for the decision given in favor of a hydraulic boat, as on the mere face of it the waste of power would appear to be a serious objection. This, however, is not really the case if the principle is compared with other methods of propulsion, and, as a matter of fact, there is no other possible way of accomplishing the task.

A paddle vessel in such a service is, of course, out of the question, as she is so easily disabled by the slightest obstacle, and under no circumstances could she be used as a sailing vessel.

A screw propeller in smooth water is the most efficient way of absorbing the power developed, but in heavy seas it would be continually out of the water, and half the time practically useless, to say nothing of



A JET-PROPELLED STEAM LIFEBOAT.

the danger involved, for it must be remembered that the racing of the propeller is a most frequent source of danger in a screw engine, besides the risk of breaking the main shaft and consequent total disablement of the boat. Further, there is continual risk of fouling the screw with wreckage, or breaking it when taking the ground, and, lastly, the auxiliary power derived from the sails would be greatly reduced by the dragging of the screw propeller through the water.

Therefore both these types of steam vessels, admirable as they are in their own particular spheres, must be always impracticable for lifeboat service, and having this in view, it was considered that the hydraulic principle alone remained. This type, therefore, having been finally adopted, it only remained to fit the machinery into a vessel sufficiently strong, light, seaworthy, handy, and fast. Neither time, pains, nor expense was spared in order to obtain a boat with the greatest possible strength compatible with lightness. The very best steel procurable was employed in her construction, having been first submitted to the severest cold tests. The riveting is a special feature, being far in excess of that usually employed in torpedo boats and similar vessels. This is attested by the fact that in this little vessel, only 50 feet in length, there are no less than 72,000 rivets, exclusive of screw bolts and fastenings in connection with the machinery. The strength and seaworthiness is further amplified by a complete system of subdivision of longitudinal and transverse watertight bulkheads, giving in all fifteen watertight compartments, each of which can be rapidly drained by bilge pumps and steam ejectors.

Great attention was paid to insure stability, and several tests were made, one being of a very practical nature. All the weights were placed on board, and a heavy parbuckle was passed completely round the vessel. The end of this was fastened to a powerful steam crane furnished with a dynamometer, and the boat was then inclined until she lay entirely on her beam ends. In this position lack of stability would have been apparent by her turning completely over, which she was quite free to do, but so confident were the designers of the accuracy of their calculations (which showed that the boat possessed righting powers to 110°), that two members of the firm of contractors remained on board during the whole experiment.

The well, perhaps the most important feature to a shipwrecked crew, is capable of comfortably accommodating thirty passengers, and is situated abaft the machinery space. The bottom and sides of this well are furnished with ten large freeing valves, which will promptly clear it of water in the event of its being flooded. It is surrounded by substantial teak lockers, forming seats, and its deck is covered with teak gratings. Under this deck are two water tanks, holding one ton each, and which represent the weight of a shipwrecked crew. When leaving for a wreck they will be full, but on returning the water can be pumped out if necessary by the donkey engine.

A number of visitors, among whom were Mr. Charles Dibdin, the secretary of the Lifeboat Institution, and Capt. the Hon. H. W. Chetwynd, R. N., Chief Inspector of Lifeboats, recently made a trip from Blackwall in the new boat, with a view to inspecting her capabilities. The measured mile sea trials gave a mean speed of 8·424 knots. Tests were also made with her maneuvering power, which proved to be remarkably good, both by rudder and turbine. Going at full speed, she made with rudder a half circle in thirty-five seconds, and the full circle in fifty seconds. Going slowly, with rudder and turbine, she made the full circle in forty seconds, and with turbine alone in fifty-two seconds. By working the levers on deck the boat was brought from full speed to a dead stop in thirty-two seconds, and from a dead stop to full speed in four seconds.

These tests, which were conducted with the greatest accuracy, proved conclusively how entirely the vessel is under the control of the officer on deck, without necessitating any communication with the engine room.

THE ELECTRIC RACE COURSE.

Whatever may be the opinion that is held as to horse races and their moral influence, it is none the less certain that they offer an irresistible attraction to a large number of persons, and that this growing passion prevails equally in all the degrees of the social scale. Bold innovators have seen a vein to be exploited in the racing mania, and the game of the miniature horse race, an always popular pastime at bathing resorts, is only one of the more happy forms given to true races with a view of prolonging the excitement of betting, of the unexpected, and of chance, at times when genuine racing could be done only with difficulty and would attract too small a number of persons. The electric race course that we are now going to present to our readers occupies a place just between genuine races and the miniature horse race. It is, in fact, a happy alliance of genuine races, the game just mentioned, hobby horses and electricity. Taken as whole, it consists of a certain number of hobby horses, half natural size, each moving over a circular track under the influence of an individual motor and receiving the current of a single generator, but in an independent manner, thus securing a perfect autonomy to each courser, qualified, moreover, by the surveillance of the electrician who directs the steeds and makes a sort of despotic anarchy of them. The horses are ridden by children and even by grown persons, and it is in this that they resemble hobby horses, although the possibility of imparting different speeds to them permits of their being passed by competitors and of passing the latter in turn, thus increasing the excitement of the riders. Bets may be made, of which the chances are just as certain as those of the play of odd and even upon the numbers of the hacks traversing the boulevards.

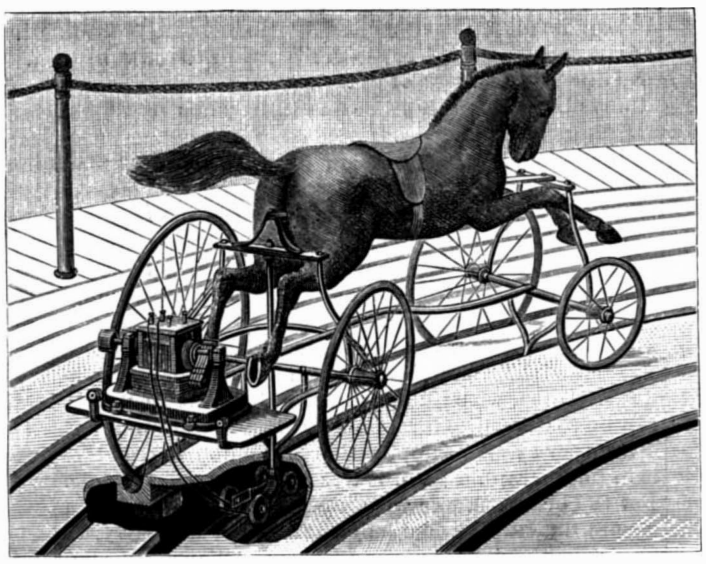


Fig. 2.—MECHANICAL HORSE.

Mr. Salle's race course constitutes an interesting application of the carriage and of the distribution of motive power by continuous currents. The installation realized at Nice (shown in Fig. 1) comprises a 12 horse power gas engine that actuates a Rechniewsky dynamo with double winding, which sends the current into six electric motors of a power of 1,000 watts each, mounted in derivation upon the machine and setting in motion a horse on wheels whose speed, starting and stopping, is, for each one, entirely independent of all the others.

About the motor and dynamo there is nothing peculiar. The electric motor—a dynamo of small size—is arranged behind each horse (Fig. 2). When the circuit of the dynamo is closed, all the horses start at once and take on relative speeds that are so much the greater in proportion as the circle upon which they are placed has a greater radius. The speed of each horse, moreover, can be regulated at will by means of a rheostat interposed in its particular circuit. An interrupter permits of stopping any horse whatever without interrupting the movement of all the others. All the motions are controlled from the post of the electrician, who, standing upon a lateral stage, overlooks the entire track, and can watch and regulate what takes place upon it, for, upon a horizontally arranged board, he has all the maneuvering pieces necessary for the play. These pieces are, in the first place, a main commutator that cuts the circuit from all the horses at once, then six individual commutators for each of the horses, six rheostats interposed in the respective circuits of the six motors and permitting of regulating the angular speeds of each horse, and finally an exciting rheostat of the dynamo machine that permits of varying the speeds of all the motors at once in the same ratio.

It is, therefore, possible, by maneuvering these different pieces, to regulate the general or particular gait of each horse, and to stop any one of the horses almost instantly if an obstacle falls upon the track or if one of the riders becomes suddenly indisposed.

The driving of the motive wheel by the motor is done by direct contact. To this effect the large wheel is provided with a rubber tire, against which the pulley of the motor bears. The friction thus obtained is sufficient to carry along the vehicle, which, with the rider, weighs a little less than 650 lb. The mean speed is 13 feet per second, but the horses placed at the circumference can obtain a speed of 16 or 18 feet, a velocity that is not prudent to exceed, nor even reach, on account of the difficulty the rider would have in holding himself in equilibrium and the feeling of dizziness that he might experience.

The vehicle upon which each horse is mounted merits special mention, because of the arrangements made to prevent upsetting. Each of the four wheels has a different diameter. Their two axles converge toward the center of the circular track upon which each horse moves, and the axis inclines toward the center.

Each pair of wheels, therefore, constitutes a true rolling cone whose apex passes through the central point of the track situated upon the horizontal rolling plane. The inequality of the wheels naturally makes it necessary to employ but a single driving wheel, and to mount the four wheels loose upon the axles. Owing to these arrangements no tendency to derailment has shown itself, even with speeds of 22 or 16 feet per second upon curves of 13 feet radius.

Two small rollers placed upon the track tend to prevent an upsetting under the action of a lateral thrust or a strong impulsion. The track consists of a single tram rail, with which engage the two external wheels. This rail serves as a guide and suffices to prevent derailment. The current is led to each motor by two rollers moving over two circular metallic bands in direct communication with the poles of the dynamo, through the intermedium of the maneuvering board, thus permitting of varying the speed of each of the horses, and even of stopping the latter by interrupting the circuit.

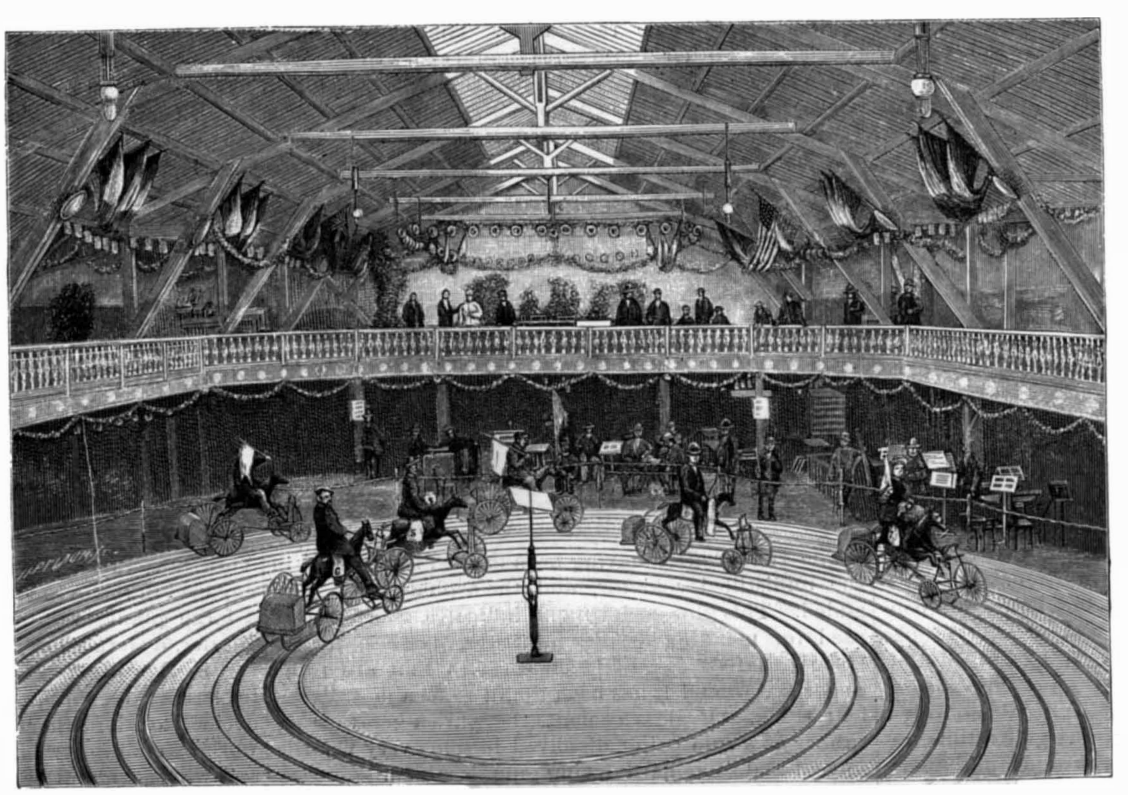


Fig. 1.—ELECTRIC RACE COURSE AT NICE.

In a course organized with a view to betting, we proceed as in the miniature horse race. The six racers having been started at full speed, the current is suppressed from all the horses at the same instant. They continue to roll by virtue of the velocity acquired, and stop successively in variable positions on the course. It is the horse that stops nearest the goal, but does not get beyond it, that wins the race.

Such are the principal arrangements of the electric race course that was operated at Nice last winter. Mr. Salle, in the presence of the success obtained, is constructing a larger model, which will form one of the attractions of the Exposition of Sciences and Arts that is to be opened next August at the Palace of Industry.—*La Nature.*

PHOTOGRAPHIC NOTES.

Correction of Eikonogen Formula.—We wish to correct a misprint in the first formula under "Various Eikonogen Developers," page 126 of the August 23d number, by substituting 40 for 4 ounces of water. The corrected formula will read:

Sodium sulphite (Merck's c. p. crystals)	2 ounces.
Eikonogen	1 ounce.
Water (distilled or rain water preferred)	40 ounces.

Belitzki's Formula for Removing Hypo from Gelatine Films.—A correspondent suggests a corrected formula which is said to work well:

Water	32 ounces.
Chloride of lime	300 grains.

Add to the milky liquid thus formed a solution of sulphate of zinc:

Sulphate of zinc	600 grains.
Water	3½ ounces.

Shake the mixture well and decant the clear solution. This supernatant solution of hypochlorite of zinc should be kept in a glass-stoppered bottle. One ounce mixed with sixty ounces of water will remove the last traces of the fixing soda. The solution remains active as long as it smells of hypochlorous acid.

The Photographers' Convention.—Among the papers read at the eleventh annual convention of the Photographers' Association, held at Washington, D. C., last month, was an interesting one on the "Automatic Operations of Photographic Apparatus," by Prof. D. P. Todd, Professor of Mathematics in Amherst College. He explained how a number of astronomical photo-instruments were automatically operated at different intervals by air pressure, regulated by valves which were called into action by the air passing through slits in a moving band of paper, very similar in appearance to the square holes and slits in music paper for small organs. By such means different instruments were given different exposures, and plates were automatically changed. Every second of time was utilized, and more exposures were made on one observation than would be possible if done in the old way.

Mr. G. Cramer, of St. Louis, read a paper on "Orthochromatic Photography," making the point that the best results in copying paintings, or colored objects, or in taking portraits of people with red hair and freckled faces, were obtained when the color dye was incorporated in the emulsion, and not when a yellow screen was used. The exposure required was twice as long as with the ordinary plate. Mr. T. C. Roche exhibited prints from orthochromatic negatives of a colored object, which demonstrated clearly their value. Plates thus prepared do not keep as long as those of ordinary manufacture.

Prof. Thos. Taylor, of the Agricultural Department, exhibited and set off, as against the usual magnesium compound, his new smokeless flash light compound, having for its principal ingredient the silky-like fibers of the milk weed plant. While his compound flashed with great rapidity, and could be flashed on a piece of tissue paper without burning it, the light emitted appeared to be more yellow in character and less actinic than the magnesium flash. Negatives were made separately by the aid of both lights.

C. H. Codman & Co., of Boston, were awarded a gold medal for the best photographic appliance. It consisted of a camera stand especially designed for studios. A platform is placed between two uprights hung by chains to coiled flat springs concealed in the top of each upright. The tension of the springs may be easily regulated to correspond with the weight of the apparatus put on the platform. Thus the same is balanced, and may be lowered to within thirteen inches of the floor or raised six feet high at will. In photographing children it is desirable to lower the camera sufficiently that the lens may be opposite their faces, and thus avoid a downward view.

Many varieties of hand cameras, backgrounds, photographic furniture, special exposing devices for bromide paper, lenses, camera shutters, burnishers, trays, and other useful things were on exhibition.

The display of photographs was not large, and consisted mostly of portraits. The grand prize, a bronze group, was awarded to Geo. W. Hastings, of Boston, Mass., for the best photographic representation of Tennyson's poem "Enoch Arden." A number of other prizes were awarded for the best foreign exhibits, retouching, enlargement, marine views, and landscapes.

Combined Celluloid Negatives.—According to the *Br. Jour. of Photo.*, more harmonious photographs can be obtained by making duplicate negatives of a given subject. It says:

"Celluloid films will frequently prove a great advantage for outdoor groups. Apart from the convenience with which an objectionable portrait in one negative can be exchanged for another from a different one, it often happens that a group has to be taken with a background that requires a different exposure from that for the figures; for example, a wedding party or team of cricketers in light costume against a background of dark foliage. Here we have the opportunity of taking one or more negatives, giving the exposure best suited for the figures, and afterward taking another in which the exposure is timed entirely for the background. Negatives thus taken are readily combined, and a harmonious whole secured; whereas, if only a single negative is depended upon, under the above conditions, unless exceptional skill is exercised in the exposure and development, either the background proves too heavy and lacks detail or the figures are too light or chalky.

"It is scarcely necessary to remind our readers when taking group negatives, which may afterward have to be combined, that neither the lighting nor the position of the camera should be altered between the taking of the different pictures, or that the same exposure should always be given; otherwise an incongruous result will necessarily obtain.

"Here is another direction in which celluloid films may prove of utility. In photographing the interior of a cathedral or church, for instance, the exposure necessary for one portion of the building, say the stalls or pews in the foreground, is generally widely different from that required for another, such as the chancel and windows. But one negative can be taken, exposing for the foreground, another with the exposure timed for the chancel, and even a third for the windows. Then, with judgment, the different negatives can be combined to form one harmonious picture."

Another excellent application of the double negative is in photographing a brook or rill under deep foliage. For the brook, expose with the shutter, then make a second time exposure of half a minute, if necessary, to bring out the details of the rocks and foliage. By combining the two negatives a harmonious picture is produced.

Proposed Convention of Amateur Photographers.—The Syracuse (N. Y.) Camera Club has undertaken the organization of a National Association of Amateur Photographers, the object of which, as stated in their circular, "is to diffuse a more widely spread scientific interest in the science of photography and to promote social intercourse among amateurs." Photography is now being practiced so universally, both for pleasure, profit, and in many branches of science, that it seems eminently proper for all thus interested to combine and support a national organization designed to promote the art simply as an art and science. We wish that the movement might be a success, and that under the fostering care of such an association there might be established an experimental "photographic college," where a reliable education in any one branch of photography can be obtained. Amateurs interested in the movement should address Mr. Arthur P. Yates, president of the Syracuse Club, Syracuse, N. Y.

Daguerre's Tomb—While in this country an enduring and artistic memorial has been erected to Daguerre, news comes that his tomb at Cormeil-en-Parisis appears to be quite neglected. Says Leon Vidal about it, in the *Photo. News*: "The cure of this commune has informed the Photographic Society of the fact. The painting executed by Daguerre in the choir of the church requires considerable restoration. The Photographic Society and other photo clubs should cause these restorations to be promptly made, and thus conserve for all time the memory of the discoverer of photography."

Cements of Rubber and Gutta Percha.

In making a cement, one should know pretty thoroughly, says the *Rubber World*, what is to be expected of it before they could advise upon it. For instance, an ordinary rubber cement will hold on a host of different surfaces and with the best of success, except where there is continued dampness. For holding to damp walls, or surfaces where there is a constant presence of moisture, there is nothing equal to Jeffry's marine glue, the formula for which has been published and republished all over the world. It consists of:

1 part India rubber.
12 parts coal tar.
2 parts asphaltum.

The rubber after having been massed is dissolved in the undistilled coal tar, and the asphaltum is then added. This glue, as its name indicates, is oftentimes used for mending articles at sea, or patches, for instance, that are to be laid on surfaces that are to be under water, and it has been found to be a most excellent thing. Of glass cements there are a great many, rubber as a rule being dissolved in some very volatile solvent and some hard drying gum is added.

A gutta percha cement for leather is obtained by mixing the following. It is used hot. Gutta percha, 100 parts; black pitch or asphaltum, 100 parts; oil of turpentine, 15 parts. An elastic gutta percha cement especially useful for attaching the soles of boots and shoes, as on account of its great elasticity it is not liable to break or crack when bent. To make it adhere tightly the surface of the leather is slightly roughened. It is prepared as follows: By dissolving 10 parts of gutta percha in 100 parts of benzine. The clear solution from this is then poured into another bottle containing 100 parts of linseed oil varnish, and well shaken together.

Good rubber cement for sheet rubber, or for attaching rubber material of any description or shape to metal, may be made by softening and dissolving shellac in ten times its weight of water of ammonia. A transparent mass is thus obtained, which, after keeping three or four weeks, becomes liquid, and may be used without requiring heat. When applied it will be found to soften the rubber, but when the ammonia is evaporated it forms a kind of hard coat, and causes it to become both impervious to gases as well as liquids.

Davy's universal cement is made by melting 4 parts of common pitch with 4 parts of gutta percha in an iron vessel and mixing well. It must be kept fluid, under water, or in a dry hard state.

A very adhesive cement, especially adapted for leather driving belts, is made by taking bisulphide of carbon 10 parts, oil of turpentine 1 part, and dissolving in this sufficient gutta percha to form a paste. The manner of using this cement is to remove any grease that may be present in the leather by placing on the leather a piece of rag and then rubbing it over with a hot iron. The rag thus absorbs the grease, and the two pieces are then roughened and the cement lightly spread on. The two pieces are then joined, and subjected till dry to a slight pressure.

A solution of gutta percha for shoemakers is made by taking pieces of waste gutta percha, first prepared by soaking in boiling water till soft. It is then cut into small pieces and placed in a vessel and covered with coal tar oil. It is then tightly corked to prevent evaporation, and allowed to stand for twenty-four hours. It is then melted by standing in hot water till perfectly fluid, and well stirred. Before using it must be warmed as before, by standing in hot water.

A cement for uniting India rubber is composed as follows: 100 parts of finely chopped rubber, 15 parts of resin, 10 parts of shellac; these are dissolved in bisulphate of carbon.

Another India rubber cement is made of: 15 grains of India rubber, 2 ounces of chloroform, 4 drachms of mastic; first mix the India rubber and chloroform together, and when dissolved the mastic is added in powder. It is then allowed to stand by for a week or two before using.

Cement for sticking on leather patches and for attaching rubber soles to boots and shoes is prepared from virgin or native India rubber, by cutting it into small pieces or else shredding it up; a bottle is filled with this to about one-tenth of its capacity, benzine is then poured on till about three parts full, but be certain that the benzine is free from oil. It is then kept till thoroughly dissolved and of a thick consistency. If it turns out too thick or thin, suitable quantities must be added of either material to make as required.

An elastic cement is made by mixing together and allowing to dissolve the following: 4 ounces of bisulphide of carbon, 1 ounce of fine India rubber, 2 drachms of isinglass, ½ ounce of gutta percha. This cement is used for cementing leather and rubber, and when to be used the leather is roughened and a thin coat of the cement is applied. It is allowed to completely dry, then the two surfaces to be joined are warmed and then placed together and allowed to dry.

Cement used for repairing holes in rubber boots and shoes is made of the following solution: 1. Caoutchouc 10 parts, chloroform 280 parts. This is simply prepared by allowing the caoutchouc to dissolve in the chloroform. 2. Caoutchouc 10 parts, resin 4 parts, gum turpentine 40 parts. For this solution the caoutchouc is shaved into small pieces and melted up with the resin, the turpentine is then added, and all is then dissolved in the oil of turpentine. The two solutions are then mixed together to repair the shoe with this cement. First wash the hole over with it, then a piece of linen dipped in it is placed over it; as soon as the linen adheres to the sole, the cement is then applied as thickly as required.

American Machinery at the Iron Gates of the Danube.

The Ingersoll-Sergeant Rock Drill Company, of New York, has just received an order, from the contractors engaged in removing the Iron Gates of the Danube, for a large plant of submarine drilling apparatus. Mr. Bessier, a German engineer, recently visited this country, in the interests of the work on the Danube. He investigated thoroughly our American methods, and decided to adopt them as the best for the purpose. The work extends for twenty miles along the Danube River, and will cost about $5,000,000.

The removal of these obstructions has been attempted many times, one of the Roman emperors having made an effort to remove the rock. Recently an Austrian empress made a similar attempt, but without success. We have every reason to believe that American machinery will do the work economically and well.

THE expenditure for pensions for the year ending June 30, as now officially stated, amounted to $109,357,534. In the previous year we paid $87,644,779.11, while in the year before that we paid $80,288,508.77.

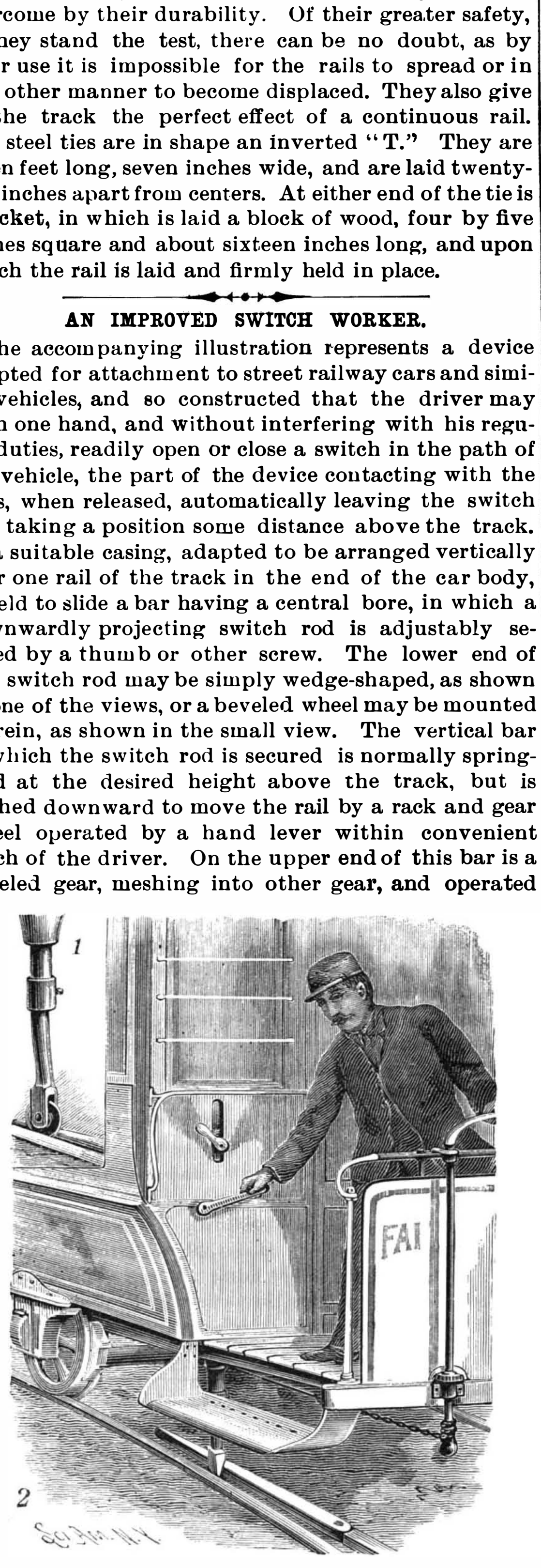
Steel Railway Ties.

Experiment is being made by the Delaware and Hudson Railroad Company to test the adaptability and superiority of steel ties for railroad uses. On a section of the road leading south from Ballston for nearly half a mile, the wooden sleepers have been removed and the track reconstructed with the steel ties. So far they give good satisfaction. As trains pass rapidly over this piece of road, a peculiar buzzing noise is noticeable, also the vibration caused by the wheels upon the rails is observably greater; but it is also the smoothest and pleasantest riding piece of road between Troy and Saratoga. The test of the safety and adaptability of the steel ties is being made under the supervision of A. J. Swift, chief engineer of the road, and they will be adopted or rejected upon his recommendation.

So far he regards the steel ties as a success; but no more will be laid until those now in use have had the test of the winter to see in what manner, if any, they will be affected by ice, frost, and snow, and if they are equally safe in clay and quicksand and gravel. If they stand all these tests, Mr. Swift has no doubt of the steel ties being speedily adopted for general use as the old wooden sleepers need to be replaced. The objection of their greatly increased first cost is fully met and overcome by their durability. Of their greater safety, if they stand the test, there can be no doubt, as by their use it is impossible for the rails to spread or in any other manner to become displaced. They also give to the track the perfect effect of a continuous rail. The steel ties are in shape an inverted "T." They are seven feet long, seven inches wide, and are laid twenty-two inches apart from centers. At either end of the tie is a socket, in which is laid a block of wood, four by five inches square and about sixteen inches long, and upon which the rail is laid and firmly held in place.

AN IMPROVED SWITCH WORKER.

The accompanying illustration represents a device adapted for attachment to street railway cars and similar vehicles, and so constructed that the driver may with one hand, and without interfering with his regular duties, readily open or close a switch in the path of the vehicle, the part of the device contacting with the rails, when released, automatically leaving the switch and taking a position some distance above the track. In a suitable casing, adapted to be arranged vertically over one rail of the track in the end of the car body, is held to slide a bar having a central bore, in which a downwardly projecting switch rod is adjustably secured by a thumb or other screw. The lower end of this switch rod may be simply wedge-shaped, as shown in one of the views, or a beveled wheel may be mounted therein, as shown in the small view. The vertical bar in which the switch rod is secured is normally spring-held at the desired height above the track, but is pushed downward to move the rail by a rack and gear wheel operated by a hand lever within convenient reach of the driver. On the upper end of this bar is a beveled gear, meshing into other gear, and operated



HEITMEYER'S SWITCH WORKER.

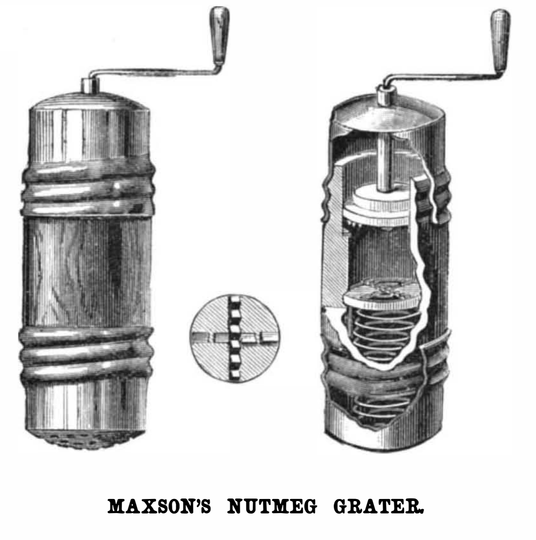
by another hand lever, whereby the vertical bar and its attached switch rod may be turned through one-half of a revolution. By this means the wedge-shaped end of the switch rod, or the beveled wheel thereon, may be turned to engage the switch rail of an open switch when it is desired to close the same.

For [further information relative to this invention, address the patentee, Mr. H. G. Heitmeyer, 474 Race Street, Cincinnati, O.

AN iron elevated railway, much like the New York pattern, six miles long, is now in process of construction in Liverpool. The cars are to be worked by electricity.

AN IMPROVED NUTMEG GRATER.

The illustration represents a simple device by which a nutmeg or similar substance may be ground as used and shaken as pepper is shaken from a common pepper box. It has been patented by Mr. Cassius M. Maxson, of Allentown, N. Y. The cylindrical part of the grater may be made of porcelain, glass, wood, or any other suitable material, and decorated to look neat and attractive. The ends are closed with caps, screwed or otherwise fastened on the body, one of the caps being perforated while the other forms a bearing for a small crank shaft, to the inner end of which is secured a



MAXSON'S NUTMEG GRATER.

grinding disk, shown in the small sectional view. The opposite grinding disk has a longitudinal movement upon ribs on the inner side of the body, and is held pressed against the nutmeg, and pressing the latter against the other grinding disk, by a coiled spring. A portion of the teeth in each grinding disk are arranged to cut grooves in the nutmeg, the other teeth cutting off the ridges thus formed, while in the lower disk are openings through which the grated nutmeg may pass to the openings in the lower cap. To insert the nutmeg, this cap, the spring, and the lower disk are removed, the parts being afterward returned to working position, as shown.

Spontaneous Combustion of Hay.

After a series of very careful experiments, Prof. Cohn, of Breslau, has found that the heating of damp hay to a temperature sufficient to cause the spontaneous combustion of it is due to a fungus. He first studied the heat-generating action of *Aspergillus fumigatus*, which has the bad reputation of heating barley in the course of germination and of rendering it sterile. Through the effect of the respiration of the little germ, that is to say, through the combustion of the starch and other hydrocarburets which the diastasic ferment converts into maltose and dextrine, the temperature is raised by about 40°. The heating of the germs to more than 60° occurs only through the intervention of the *Aspergillus*, which acts as a ferment. Under these conditions it reaches its greatest development and produces its maximum action. In this state it rapidly burns the hydrocarburets.—*La Petite Revue.*

Our Latest New Steel Cruiser.

The San Francisco, a sister ship of the Philadelphia, built at the Union Iron Works, San Francisco, had her trial trip in the Santa Barbara channel, on the California coast, on the 27th of August, with results which were extremely gratifying to her builders, as well as to the Bureau of Construction of the Navy Department, after whose plans she was built. The run was for four consecutive hours, during which time the average speed maintained was 19·516 knots per hour. During a portion of the run, however, the water got into the ducts which supply the current of air used in a forced draught, and the fans began to force water into the furnaces. This caused a material loss of speed, and it is claimed that, making a proper allowance for this accident, the average speed would exceed 19·7 knots per hour, which would make the record of the San Francisco higher than that of the Philadelphia. The contract for the vessel provided that the builders should receive $50,000 additional for each one-quarter knot attained over 19 knots per hour, and they therefore earn $100,000 over the contract price, which was $1,426,000.

This is the second vessel of our new navy which has been built upon the Pacific coast, the Charleston having had her trial trip a few months ago, and all the castings made there, and the finish and staunchness of the vessels have been declared to be as perfect as ever went into an American ship. Experts declare that the San Francisco has finer lines than those of any other vessel of the new navy, and that for this reason, and the strength of her boilers, she should also be the swiftest vessel among the new cruisers.

The dimensions of the San Francisco are: Length over all, 328 ft.; length on load line, 310 ft.; breadth, 49 ft.; draught forward, 16 ft. 9 in.; draught aft, 20 ft. 11 in.; displacement, 4,038 tons; horse power, natural draught, 7,500 horse, forced draught, 11,000 horse. The vessel has a protective deck for its full length, sloping down to its sides about four feet below the water line, the sloping sides being two and a half inches thick and the top portion one and a half inches thick. The machinery and all the vital parts of the ship are below this deck, under which, along the sides, the space is used for coal bunkers. The vessel also has a double bottom and many water-tight compartments. She is driven by two three-bladed built-up screws of fourteen feet diameter each, and two horizontal triple expansion engines. She has three hollow masts with two military tops for Gatling guns, and her armament will consist of twelve six-inch breech-loading rifled guns, four Hotchkiss revolving cannon, one one-pounder rifle, and two Gatling guns. She will require a crew of 300 men.

AN IMPROVED BOB SLED.

The illustration represents a novel construction of bob sleds, designed to provide for a uniform movement of both the forward and rear sleds in turning corners, and by which a minimum of strain will be exerted upon the several parts of the sled. It has been patented by Mr. Jesse Yenne, of Egan, Montana. The forward ends of the runners of each sled are pivotally connected by a cross bar, the cross bars having reduced ends seated in essentially dovetailed recesses, whereby the runners are capable of a limited independent longitudinal movement. Upon the upper face of each runner a rave is rigidly secured, of somewhat triangular shape, in the upper flat part of which is an elongated slot or opening. Directly under this slot a plate having a central opening is bolted to the upper surface of the runner, and in each runner, below the opening in the plate, is an essentially dovetail recess, the widest portion of which is at the bottom. In the main bolsters at each end is secured a pin, the upper end of which passes through and slides in the slot of the rave, while the lower end of the pin enters the dovetail recess in the runner. A sand bolster is pivoted upon the main bolster in the usual manner, but when the main bolster only is used, it is made in two sections, the upper surfaces of the raves then passing through recesses in the opposed faces of the bolster sections. The forward end of the reach bar connecting the sleds is connected to the front cross bar of the forward sled, its rear end passing through an opening in the main bolster of the forward sled, and having a slot through which passes the pivotal pin of the sand bolster. Each cross bar of each sled has a rigidly attached tongue, the tongue of the rear sled being attached to the rear end of the reach bar. Upon the cross bar of the forward sled, and also upon its tongue, a block is rigidly fastened with staples, one of which passes through the forward end of the reach. This attachment is designed to facilitate loosening the rear sled should its runners become frozen to the ground, by throwing up the tongue to turn the forward cross bar, and thus force the reach rearward to act as a lever upon the tongues of the rear sled. The construction is such that the bolsters have movement upon the raves and in the runners, while the reach is capable of lateral movement, the peculiar connection between

YENNE'S BOB SLED.

the cross bars and runners being designed to permit the runners of the sleds to run in parallel lines, one in advance of the other.

The Electrical Telegraph.

In 1747 Bishop Watson sent the discharge of a Leyden jar through 10,600 feet of wire suspended on poles on Shooter's Hill, and a plan for an alphabetical telegraph to be worked by electricity appeared in *Scots Magazine* for 1753, which, however, seems never to have been realized. At Geneva, in 1774, a telegraph line was erected by Lesage, consisting of 24 pith ball electroscopes, each representing a letter.—*M. Farrant, Science Gossip.*

Electric Launches.

An interesting essay on this subject has lately been contributed to *The Electrical Engineer* by Fred. Reckenzaun, from which we make the following abstract:

Electrical navigation was an experimental fact, not a mere idea, over half a century ago. Being first conceived and demonstrated by Prof. Jacobi in Russia, during 1838, his fascinating achievement was followed up in England by Robert Hunt early in the fifties, by G. E. Dering in the year 1856, and in France by Count De Moulins in 1866. In all these experiments electromagnetic motors and primary batteries of various descriptions were employed to actuate the propeller. The results obtained, although demonstrating the possibility of electrical navigation, failed, however, to prove its commercial feasibility. With the storage battery in place of the primary battery and a new type of electric motor in place of the old ones, the electric launch entered upon a new era.

Trouve availed himself of these improvements in 1881 in Paris, but also employed a primary battery of his own. His experiments were the first with storage batteries and the last notable ones on record with primary batteries. In 1882 the Electrical Power Storage Company, of London, brought out the launch Electricity, designed by Anthony Reckenzaun. During the years following, electric launch building gradually developed into a distinct branch of electrical industry, especially in England, where the advantages of this class of craft for pleasure purposes have met with such increasing appreciation and favor as to cause the establishment of a series of charging stations along the Thames River (by Messrs. Immisch & Co.), where a whole fleet is in use now, while a regular passenger service by electric boats has quite recently also been introduced at Edinburgh, Scotland.

The storage battery, on account of its superior fitness, is universally employed in connection with electric launches at present.

Since the power required to propel a vessel varies as the cube of the speed, and since the duration of the run varies inversely as the power (rate of delivery), it follows that the *mileage* covered by one charge of battery will vary inversely as the *square* of the *speed*. In practice, due allowance is to be made for the characteristics of the motor and for a falling off in the total output of the battery when pushed to a high rate of delivery. Where a maximum of speed is to be effected, the battery should have a maximum of active surface and a minimum of internal resistance, to facilitate a heavy discharge without an excessive drop of potential. Special care should be taken to render the cells acid tight, by the use of suitable covers, etc. Spilling may also be avoided by preparing the electrolyte in a suitable manner. The jelly electrolyte invented by Dr. P. Schoop offers in this respect a remarkable advantage. It is also advisable to line the battery receptacle with some acid-proof material, preferably an insulator, and to provide a bed for the cells to stand on containing a substance capable of absorbing and neutralizing acid. All wires or cables employed about the boat should have a good acid and salt-water proof insulation.

Where a continuous current incandescent lighting plant exists, current may be derived therefrom for charging purposes; suitable arrangements must, of course, be made in such cases for the proper application of the current, the E. M. F. of which may not always correspond with that of the battery.

Storage batteries, suitable for launch purposes, are, as a rule, capable of receiving their charge at a higher rate and in less time than the employment of most arc light currents would involve; this is one reason why incandescent light currents (continuous, low tension) are preferable. But arc light plants are the ones most frequently met with, and may often be the only source available. It should be remembered, however, that with a high tension current (say 1,000 volts and over) an electric launch, floating in water, would not unlikely prove an inducement to "grounding."

The battery may, of course, be charged either on the boat or may be removed for that purpose. While the former method is ordinarily practiced, it is obvious that in order to avoid delay, a freshly charged battery may be substituted for the exhausted one. With suitable facilities for handling the batteries, such as a hoisting crane, or equivalent device for lifting and lowering the cells into and out of the boat, tables to receive the cells for charging, suitable cell crates with connections and lifting attachments, etc., the work of exchanging the batteries could be effected promptly and efficiently for a whole fleet engaged in continuous traffic.

The operation of an electric launch is the ideal of ease and simplicity. It consists, practically, of turning a switch and—letting her go. The pilot can act at the same time as engineer, for he can start, stop or reverse as easily as he may give a signal for that purpose, and need not wait for a response. Somebody, on noticing the incomparable facility with which an electric launch can be operated, suggested it was a veritable "buggy on the water." It certainly involves none of the jarring which inevitably accompanies a buggy ride on land, and there is no need for "cheering up" or "urging" the animal. Not one of the smallest advantages is the fact that there is no danger of explosion. The most reckless handling of the propelling apparatus would entail nothing worse than its disablement, and as to danger from shock, it is unnecessary to explain its absence here. The run may be continuous or interrupted; a landing may be effected and the boat left without attendance for any desired length of time, and the journey resumed at a moment's notice. Knowing the number of miles or hours the boat can run with one charge, the man in charge will be guided thereby, as is the engineer of a steam launch by his pile of coal, and probably more definitely. The disagreeable features of steam and naphtha launches (aside from their danger of explosion), such as smoke, smell, soot, ashes, dirt, grease, heat, noise and the jerking caused by the reciprocating motion of the engine, are totally absent in the electric launch. The propelling machinery has substantially but one moving part and the motion of that is rotary, insuring smoothness, quietude and ease, and involving but a minimum of wear, while the liability to a breakdown is very remote. There is no necessity for the grimy man with dirty overalls—his place is on shore, at the charging station. The battery, besides doing its regular duty in operating the motor, can, of course, be employed at night to furnish current for interior illumination, side and signal lights, head light—a search light, if you please—or for submarine illumination.

Where a fleet of electric launches is operated, the pro rata cost of plant and expense of operation can be brought within very reasonable limits. Instead of having an engineer for each boat (as in the steam launch), one station engineer can render equivalent service for a number of boats. The fuel item for one station engine need not exceed, and may be even smaller than, the aggregate consumption of several small engines (on steam launches), even allowing for the loss in conversion. The actual running expense would thus compare favorably with that of steam launches. There is another feature which should not be overlooked. In an electric boat, as pointed out before, the propelling apparatus occupies space which would be of little or no use for passengers, while in steam or naphtha boats from one-third to one-half of the entire space is devoted to the machinery, and the best part of the boat at that, crowding out a proportional number of passengers. For a given number of passengers, therefore, the electric launch would be smaller, require less power, and consequently would cost less to run. Under such conditions, it would hold its own even on the point of expense, taken all in all.

The estimate of cost of a fleet of 12 electric launches, each 28 feet long, 6 feet beam, carrying one ton of storage batteries, to run 6 miles per hour for 60 miles with one charge, is as follows:

12 hulls complete, with interior fittings (battery troughs, seats and lockers), fixed roofs, shades, flag staffs, steering wheels, etc.	$6,600
12 tons storage batteries (cap. 16,240 watt hrs. per ton) at $560 per ton	6,720
12 motors, at $400	4,800
12 screw propellers, shafts, couplings, thrust bearings and stuffing boxes	1,200
Switches, wires, incand. lamps (4 per boat), with fittings	480
Acid and labor of placing elec. outfit	1,200
Seat cushions, ropes, boat hooks, tools, pumps, etc.	300
Total, 12 boats complete, in running order or $1,775 each.	$21,300

CHARGING STATIONS.

Land and buildings (on suburb. water front) say	$4,000
Steam plant, 60 h. p. complete, erected	4,000
Dynamo, cap. 40,000 watts, with accessories, erected.	2,000
Charging circuits and appliances, erected	250
Mooring facilities, tools, etc.	500
Total cost of station, say	$10,750
Grand total cost of 12 launches with charging facilities and real estate	32,050

ESTIMATED COST OF OPERATION.

It is assumed that each of the 12 launches makes a daily run of 60 miles, divided into 6 trips of 10 miles each (3 round trips), during 5 *months* in the year:

12 pilots at $2.50 per day each, for 5 months	$4,500.00
1 station engineer, at $3 per day for 5 months	450.00
1 station fireman at $2 per day for 5 months	300.00
1 station laborer at $1.75 per day for 5 months	262.50
Coal (4 lb. per h. p. hour, 60 h. p. for 7 hrs. daily), 112½ tons (for 5 months) at $4 per ton	450.00
Oil, waste, miscell. supplies and incidentals for 5 months, say	200.00
Labor, etc., putting boats in running order at beginning and storing same at end of season, say.	360.00
Depreciation, per annum, on boats and propelling apparatus, at 10 per cent on $21,300	2,130.00
Depreciation of station machinery and appliances, at 6 per cent per annum on $4,750	285.00
Interest, per annum, at 6 per cent, on interest of $32,050	1,923.00
Total operat. expense, deprec'n and interest. or $905.04 per boat per annum.	$10,860.50
Total mileage run per boat per month (60 per day)	1,800 miles.
Total mileage run per boat in 5 months	9,000 "
Total mileage run, 12 boats, at 9,000 miles each.	108,000 "

Cost of operation, including running expenses, depreciation and interest, as per above estimate, = $10\frac{5}{100}$ cents per boat mile. The boats assumed can seat 20 passengers and over. If an average of only *one-half* of this number is constantly carried, paying fare at the rate of *one cent per mile* each, the receipts will equal the operating expense, depreciation and interest on investment, as above.

The boats, in this instance, run at intervals of about 17 or 18 minutes (allowing for short stops), 1⅝ miles apart, along the entire distance of 10 miles.

The cost and operating expense of electric launches will, of course, vary with different sizes and speeds, which the conditions and requirements of each distinct case contribute to determine.

A Terraced Mountain.

During the recent visit of Jesse R. Grant and Chas. J. Whimple to Sonora, Mexico, they were much struck with the sight of a terraced mountain. It was located about fifty miles southwest of Magdalena. The mountain is circular in form, about three-quarters of a mile in diameter and terraced from base to peak. The height of the terrace is from ten to twelve feet, and in many places is built of solid masonry. At many other places it is cut out of the solid rock. The roadway is from fifteen to twenty feet in width, starting at the base of the mountain and coiling itself spiral-like to the peak of the mountain, which is not less than 1,200 feet higher than the base of the mountain. The cost of the construction and cutting out of the solid rock of this terraced road must have been enormous, and the remarkable feature of this wonder is the state of its preservation. Here and there masonry has yielded to the crumbling influences of time, but these are exceptions.

At the base of this terraced mountain is a mighty rock, which has the appearance of having been hewn out of a solid rock, and weighs 100 tons or more. It is placed at the mouth of what appears to be the entrance to this terraced mountain. Here another query is suggested. Does this door to the mountain open the way to mineral treasure or to the shrine of ancient religious devotees? Again, does the terraced road which coils itself to the peak of the mountain lead to the shrine of the ancient vestal virgin who kept eternal watch on the sacred fire which was never suffered to die?

One thing is certain, there is a wide field for those near at home who wander far into Egypt and Persia to study the mysteries of the hidden past.—*Tucson Sun.*

Progress of the Niagara Falls Water Power Scheme.

Prof. Coleman Sellers was made consulting engineer of the Cataract Construction Company, some six months ago, and is now in England in consultation with some of the most prominent engineers, constituting a commission to decide upon plans for utilizing the water power of Niagara Falls.

Of this international commission Sir Wm. Thomson is the president; Prof. Sellers represents America; Prof. Mascart, France; and Theo. Tourit, Switzerland.

This Cataract Construction Company has secured a large area of land (several square miles) on the Niagara River, beginning a mile and a half above the falls, and all rights of way for carrying a tunnel under Niagara Village to a point below the falls.

The general plan is to construct a tunnel about 27 feet in diameter from a point below the falls to the upper limit of the secured property.

This tunnel will have lateral branches at a depth of about 100 feet from the surface, into which will be sunk numerous vertical shafts at the points where power will be required. A system of surface canals will bring the water of the river to the heads of these shafts, and its action on turbines at the lower ends of the shafts will develop the power, estimated we believe, in the aggregate, at about 150,000 horse power. The amount of water diverted for this purpose will be a small fraction of one per cent of that going over the falls.—*Stevens Indicator.*

A Luminous Buoy.

Experiments with a luminous buoy invented by M. Dibos have been made at Havre. By improvements, effected since a previous experiment, in the arrangement of the phosphuret of calcium in the apparatus, the inventor has obtained fewer intermissions in the production of the light and a prolongation of the duration. A first buoy, thrown into the channel opposite the semaphore, emitted a powerful light upon coming in contact with the water. During this time a boat left the harbor, and when about a mile and a half out, another of the buoys was thrown into the water, which lit up the sea within a very large radius. The power of the light was such that the men at the lighthouse, two miles and a half distant, saw it clearly with the naked eye. It has, besides, been proved in former trials that the light can be seen at a distance of five and a half miles. The French authorities intend making trials of lighting the channel on the Seine, from the Amfard Bank to where the dikes commence, by means of decked boats with masts about two meters high, on the top of which will be placed a light of this kind.

RECENTLY PATENTED INVENTIONS.

Engineering.

THROTTLE VALVE. — Edward Leslie, Orangeville, Ontario, Canada. This valve has a movable gate with a closed recess, and a port connecting the recess with the steam inlet, in connection with an auxiliary valve, whereby the gate will be held locked on its seat by the full boiler pressure, of which the gate is relieved at the time the operator desires to open the valve.

EQUALIZER. — Edward Leslie, Orangeville, Ontario, Canada. This device consists of a tube or casing arranged for connection with both ends of a cylinder, and having an automatic valve in a valve chamber from which an auxiliary tube leads to the main tube, so that when the throttle is closed, and the cylinder once filled with air, the air is forced backward and forward and no undue suction is brought to bear on the valve, the cylinder and steam box not being cooled off, as when a fresh supply of cool air is drawn in and forced out at every reciprocation of the piston.

PROPELLER SHAFT AND MECHANISM. —Francis W. Pool, St. Paul, Minn. This invention relates to means designed to rapidly drive a propeller shaft with but little friction, the shaft having spirally arranged grooves in opposite directions on its surface, and a sleeve thereon having fixed heads with teeth on their inner faces, while loose rings in the sleeve have teeth on their outer edge, the inner surface of the rings having lugs engaging the grooves of the shaft, and reciprocating piston rods being attached to the outer surface of the sleeve.

Electrical.

PORTABLE SIGNALING DEVICE.—Peter Pearson, New York City. This is a device embodying a bell and mechanism to operate it intermittently when electrical connection is established and broken, the apparatus being held in a box, the lid of which must be closed to complete the connection between a bell on the lid and a battery in the box, insulated wires extending from the box to any point from which signals are to be sent in open circuit, which is closed and opened at proper intervals by a transmitter of peculiar construction.

Mechanical.

SAW HANDLE.—Richard W. Clemson, Middletown, N. Y. This handle has a straight hand grip and a straight finger extending below the hand hole and body of the handle in line with the hand grip, to permit of placing the hand in various positions relative to the cutting edge of the saw, give ample room to the hand, and allow for using on small saw handles having a size bearing a proper relation to the width and length of the saw.

SAW GUIDE.—John E. Bill, Evansville, Ind. This is a guide for circular saws in which an adjusting sleeve is turned by a hand wheel, whereby the guide arms can be separately and quickly adjusted to get the exact required distance between them, the guide arms, when properly adjusted, being held parallel by a movable pin secured in place by a thumb screw.

PIPE WRENCH. — James L. Taylor, Memphis, Tenn. This is a self-adjusting wrench in which the fixed jaw has combined with it a pivoted serrated jaw controlled by a spring and adapted to slip or yield when working the wrench back, but having a firm grip when operated in the opposite direction, and being without the disadvantages of a ratchet wrench, the device being inexpensive, strong and durable, and adapted for a wide variety of work.

ROD PACKING.—Wesley H. Richmond, Cadillac, Mich. This invention covers an improvement in that class of metallic rod packings in which a beveled split ring surrounds the sectional packing rings proper, and serves to press them inward, and thus hold them in close contact with the piston rod.

CRUSHER AND PULVERIZER.—William H. Howland, Bergenfield, N. J. This is a stone and ore crusher designed to provide for the bodily adjustment of the movable jaws and of their lower edges, and to equalize the strain upon the driving shaft, the machine being adapted to crush and pulverize the material to any required degree of fineness without becoming impregnated with metallic particles torn from the surface of the operating jaws.

HYDROCARBON BURNER. — Ethan Rogers, Ballston Spa, N. Y. This is a burner more especially adapted for burning crude oil as a fuel for forges, and combined with the inclosing tube or casing is a longitudinally corrugated tubular lining open at both ends, and an oil supply pipe provided with a spreader located at the inlet end of the corrugations.

Agricultural.

STALK CUTTER. — Paul E. Erickson, Scandia, Kansas. This cutter consists of a carriage to the axle of which a gear wheel is fixed, a pair of vertically rotating intersecting cutters being mounted in a suitable frame suspended from the axle, with a lever mechanism for fixing the position of the cutter frame, and a gathering device, the machine being designed to rapidly cut the standing stalks in a field in such manner that they may be easily plowed under.

COTTON CHOPPER.—James Casey and Stephen A. Morgan, Lehigh, Indian Ter. This is a machine specially designed for chopping new cotton to a stand in a row, and has a rotating shaft carrying a fixed block, with knives arranged to slide therein and rotating therewith on the shaft, in combination with an operating lever and connections between the knives and lever for operating them from the lever, the stalks being cut nearer to or farther from the ground as desired.

FEED TROUGH. — Francis O. Reed, Paris, Texas. This invention provides a stock feeder designed to permit of the feeding of a measured quantity of food from a point remote to cattle in the barn or stable, whereby the farmer or his family may feed the cattle from the dwelling, the invention covering a novel construction of food and hay apartments, with valves and tripping devices, in connection with one or more wire pulls leading to the house.

HOG PEN. — William McDaniel, Bearden, Ark. This is a portable pen, simple in construction and made of light timber, with doors to slide vertically in guideways formed by cleats, whereby the pen may be readily formed into a combined pen and trap, the doors falling by gravity when the hog enters the pen.

Miscellaneous.

COIN OPERATED MACHINE.—Frederic B. Cochran, Brooklyn, N. Y. This invention provides for the construction of a music-producing mechanism having a motor combined with a coin-controlled device operative from outside the machine casing, and adapted when actuated by the deposit of a coin to start the motor and produce music.

CASH INDICATOR AND RECORDER.—Lloyd M. Mills, Grand Rapids, Mich. This is a device in which a series of radially arranged type bars are mounted to slide, in connection with a tape to be printed on thereby and an indicator, to automatically and accurately stamp numerals corresponding to the keys on the tape directly over or below each other in due numerical order to form a column of figures, the sum of which can be readily totalized.

EYEGLASSES. — Herbert D. Martin, Philadelphia, Pa. This invention relates to the spring and nose clamps of eyeglasses, by which the lenses may be carried laterally in either direction or vertically, as desired, the invention being an improvement on a former patented invention of the same inventor.

EXERCISING MACHINE. — William E. Forest, New York City. This invention provides a machine with sheaves, cords, and weights, in which the resistance weights are guided by a strained endless cord running over the sheaves, the arrangement being such that the machine may be used for either a downward or an upward pull.

SEPARABLE BUTTON. — Charles E. Perry, Forsyth, Montana. This is a button which may be readily attached to clothing without sewing or injury thereto, and is designed to be of simple construction and capable of rapid production from sheet or cast metal.

EXERCISING MACHINE. — Daniel L. Dowd, New York City. This is a machine operated by ropes attached to rotatable pulleys, in which the desired resistance is furnished by springs attached to the pulleys, the amount of resistance being easily varied and regulated, and the machine being designed to develop all the muscles of body, arms, legs, and neck, and strengthen the chest and lungs.

REEL FASTENER FOR FISHING RODS. —John G. Landman, Brooklyn, N. Y. According to this invention the rod has a seat for retaining the reel-attaching plate, and also a spiral thread or groove, a nut on the rod being adapted to the thread or groove and to the reel plate, while a stop prevents disengagement of the nut from the spiral thread or groove next the reel plate or socket, the device being simple and inexpensive and making a quickly adjusted fastening.

BAG HOLDER AND TRUCK.—John H. Reckford, Belair, Md. In this device the bag is intended to rest between upright standards, through which pass ropes to the inner ends of which spreaders are loosely connected, to be inserted in the mouth of the bag to hold it open, the device being portable and adapted to carry bagged grain, the bag being quickly attached to and detached from the holder.

SPRING BED BOTTOM. — Joseph P. Leggett, Carthage, Mo. This is an improvement in bed bottoms in which coiled wire springs are supported upon and attached to crossed wires that form the base of the bed bottoms, stout or thick iron or inelastic wires, arranged parallel to the sides of the frame and attached to its end portions, being employed in connection therewith.

TABLE OR OTHER LEGGED ARTICLE. —William B. Pellett, Flint, Mich. This invention relates to articles having legs or posts to support them, and consists in a special knockdown construction of detachable legs, with a special construction of the corners or portions of the articles to which the legs are attached, including the means to secure the whole together.

HOLDER FOR COVERS. — Edward W. Stone, Chicago, Ill. According to this invention the vessel cover is made with a shank depending vertically from its lower side, the lower end of the shank being bent outward and upward to form a hook whereby the cover may be held horizontally on the rim of a shallow or deep vessel, and serve as a temporary shelf.

STOVE POLISH. — Stephen A. Kingsland, Middletown, Conn. This is a composition designed to be applied to a stove and left to dry and harden, without any rubbing or scrubbing whatever, and thus forming a fine enamel or polish, the composition being applicable to the stove at any time, whether the stove is cold or hot.

PAINT. — Jacob G. W. Martens, New York City. This is a paint principally intended for coating the bottoms of ships to prevent barnacles from fastening thereon, and also to prevent iron and other metals from rusting, while when applied to trees, wood and other substances, it is designed to preserve them from the elements and from insects.

NEW BOOKS AND PUBLICATIONS.

A SECRET INSTITUTION. By Clarissa Caldwell Lathrop. New York: Bryant Publishing Co. 1890. Pp. 339. Price 50 cents.

This novel treats of insane asylums somewhat in the vein of Wilkie Collins. The legal aspects of the case of lunatics receive consideration, and the whole is graphically put.

FLIRT. A story of Parisian life. By Paul Hervieu. Translated by Hugh Craig, with illustrations by Mme. Madeleine Lemaire. New York: Worthington Co. 1890. Pp. 273.

TO INVENTORS.

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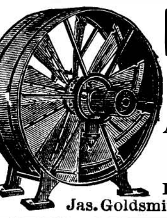

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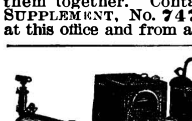

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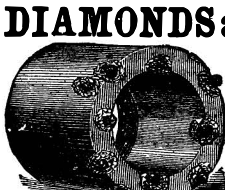

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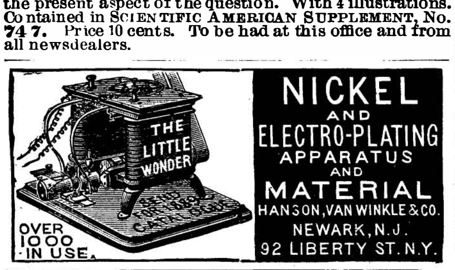

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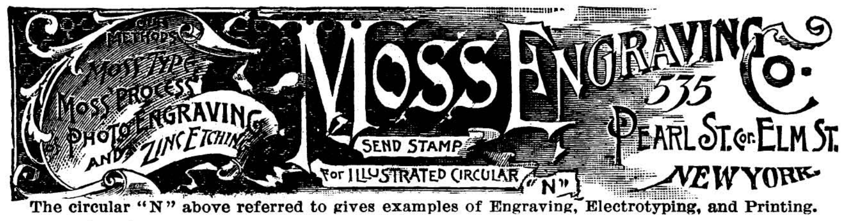

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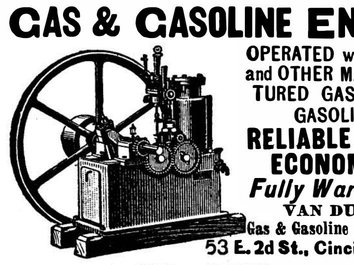

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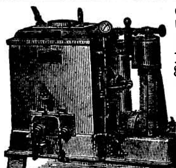

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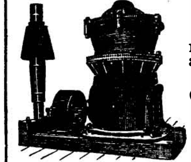

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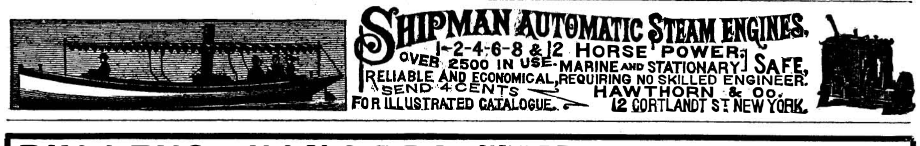

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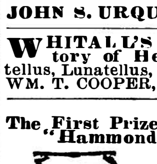

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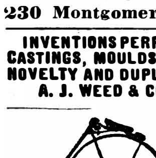

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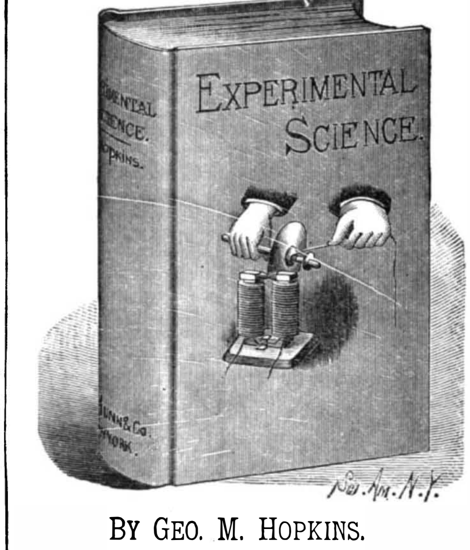

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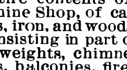

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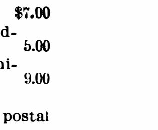

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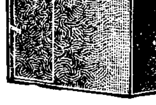

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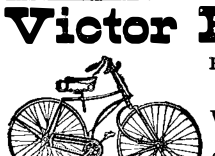

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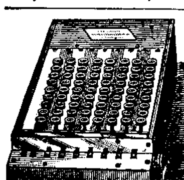

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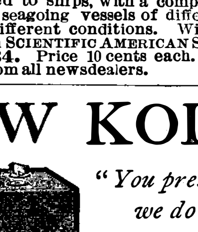

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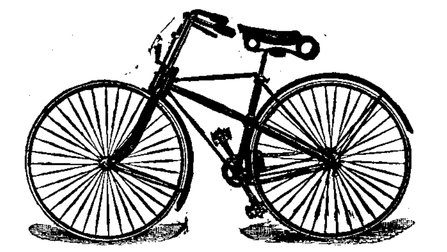

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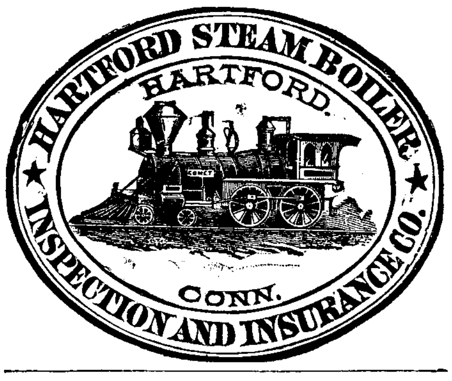

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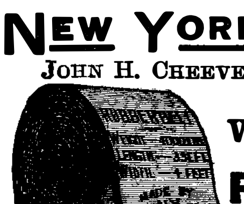

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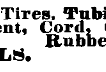

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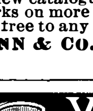

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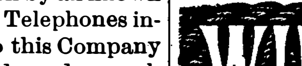

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