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THE PROGRESS OF ELEVATED RAILWAYS.

The ancient story of the intruding camel, who begged a shelter for his head in his master's tent and ultimately crowded in his unshapely body, to his master's great discomfiture, is paralleled in the history of elevated railways in this city.

The main reason for the adoption of this form of rapid transit was the cheapness with which it could be supplied. The camel's head was not attractive, but it was easily let in, and promised an easy removal should such an issue prove desirable. Fig. 1, page 258, shows what an early form of the original West Side elevated road was like; not the earliest form, however, for that was of considerably lighter construction. The large engraving presented below gives a hint of the enormous possibilities of the structure which has taken possession of so much of the city. As a specimen of bold, clever, and original engineering it is admirable. Its effect upon the fine avenue it overshadows is quite another matter. So, too, is its probable influence upon the region it traverses as a site for dwellings. The utter inadequacy of any cheap structure of slight capacity (such as the elevated roads were at the start) to meet the wants of a city like New York, and the fallacy of the assumption that such a rapid transit road was advisable on the score of economy, were repeatedly enlarged upon by the SCIENTIFIC AMERICAN in the early days of the system; and the result has more than justified the position then taken. During the past five years, indeed during the past three years, the system has expanded from four or five miles of roadway of the lightest description, supported by single posts, to ten times as many miles of massive and costly structure already in operation, and nearly twenty miles more approaching completion—structures which almost monopolize four of our principal avenues and large portions of several down-town streets, and represent an investment of $43,000,000.

The system which has attained such stupendous results began in an extremely modest way in 1868, and for several years it was represented by half a mile of experimental road on Greenwich street. The New York Elevated Railway Company was organized in 1872, and during the summer of 1873 the road slowly crept up Greenwich street and Ninth avenue as far as 30th street. In 1876 it extended from the Battery to 61st street, and during the succeeding years it was further extended to Central Park, and to a considerable extent was made a double track. Though the new road was heavier than the parts of the line first constructed, the system of single supports was adhered to, and the general character of the road was sustained. During the early part of the current year the track was extended to 83d street, and the original track on Greenwich street has recently been replaced by the heavier structure of the later road.

In 1878 the Gilbert, afterwards known as the Metropolitan road, was completed to 59th street—a double track occupying the whole of the narrower streets down town and the middle of the wide Sixth avenue, and surpassing in solidity and cost anything previously dreamed of in the way of high level road making. The cost of constructing and equipping the five miles from Morris street to 59th street, with half a mile of road from Sixth avenue to Ninth avenue, through 53d street, was officially reported in March last as $10,300,000.

During the same year the New York Elevated Railway

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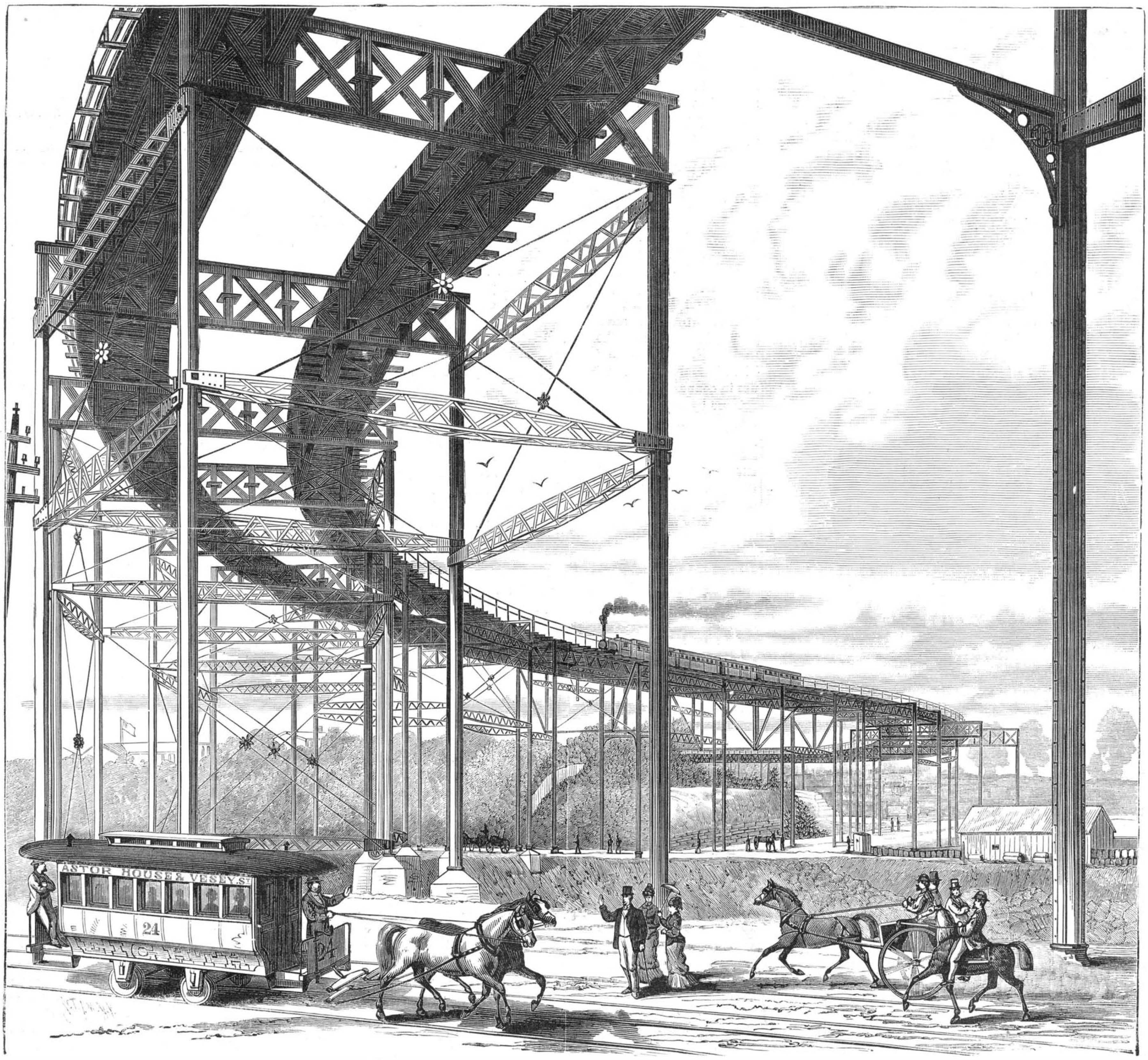

THE ELEVATED RAILWAY AT 110TH STREET AND EIGHTH AVENUE, NEW YORK CITY.

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VOL. XLI., No. 17. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, OCTOBER 25, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 199,

For the Week ending October 25, 1879.

Price 10 cents. For sale by all newsdealers.

THE AMERICAN INSTITUTE FAIR.

There is probably but one department in which this year's exhibit will especially impress the visitor accustomed to these annual displays, and that is the section devoted to china-ware. The potteries of New Jersey and New York are abundantly represented, and their exhibits will be a surprise to many. The variety and excellence of the work done by our makers of china and stone ware are neither so well known nor so highly appreciated by the public generally as they deserve to be; and this exhibition will do much to convince all beholders that we may be, and in all probability soon will be, able to stand with the best in this department of industrial art.

In most other respects the fair is a counterpart of those which have gone before it, though quite unlike them in many respects. Agricultural machinery is not so abundantly represented as it has been, and there are fewer pumps, looms, printing presses, washing machines, and, not to speak disrespectfully of the foregoing, fewer catch-penny shows.

Rapid transit comes in for a good deal of attention. Col. Payne shows a large model of the apparatus to be employed in the traction of cars on the East River Bridge. The Winters Improvement Company have, in an obscure section of the machinery annex, a large display of tanks and apparatus for compressing and storing air for pneumatic motors. In another corner is shown the steam motor which the Third Avenue Horse Railroad Company have been trying as a substitute for horses. Mr. Louis Leypoldt offers a combination rail which promises to make no noise and seems likely to fulfill the promise through lack of opportunity. Mr W. W. Riley exhibits a model of his safety center rail elevated road, which presents several ingenious features likely to make it useful where a cheap road of small capacity is needed.

The Tarbox automatic railway switch is worthy of critical examination. It is simple, strong, and direct in its action; and while placing the switch under the control of the engineer, it seems to obviate most of the current risks from misplaced switches by making the locomotive or car wheel mechanically set the switches ahead for the main track. The switch points move vertically instead of horizontally, and there appears to be nothing in the machinery which operates them that is likely to fail in working or to give any shock to a rapidly moving engine. The Greenway automatic switch, illustrated in a late number of this paper, is also shown in working model.

Among the notable engines in the exhibition, the Otto silent gas engine makes its first appearance at these fairs. Its smooth and quiet working attracts no little attention. It is exhibited by H. S. Manning & Co., 111 Liberty street. The engines supplying power in the annex are a Buckeye engine, with whose excellence our readers are all familiar; and a Whitehill engine, furnished by the Newburg Steam Engine Works. Joseph C. Todd, of Paterson and New York, exhibits several forms of the Baxter marine engine, and the Herreshoff Manufacturing Company, of Bristol, R. I., have an interesting display, including their patent safety coil boilers, and the new form of compound condensing engine which has proved so advantageous and economical for steam yachts, launches, and the like. In this connection may be mentioned also the fine display of Hancock inspirators, by H. S. Manning & Co. These inspirators may also be seen in use in connection with the exhibition boilers.

Close by the boilers will be seen the interesting exhibit of the Pierce Well Excavator Company, including the Pierce portable hand rock drill, and the company's improved artesian well drilling and mineral prospecting machine. Opposite are the well known Blake's challenge rock breaker, and the improved stone and ore crushers of the Farrel Foundry and Machine Company, of Ansonia, Conn. The latter are particularly prompt, powerful, and certain in their action. Adjoining will be seen a large variety of Tunatill's improved ice crushers, exhibited by the New York Plow Company. In the same vicinity are the Union Stove Company's exhibit of emery wheels and machinery, and a variety of celluloid emery wheels, grindstones, hones, sharpening rifles, and the like, made by the Celluloid Emery Wheel Company and shown by Mr. E. D. Bassford. The Empire State Brick Company have near by several of Gregg's improved brick machines, lately described and illustrated in this paper, and a fine display of pressed and ornamental bricks.

As usual the display of wood-working machinery, especially of the lighter sorts, is abundant. J. H. Blaisdell, New York, has an attractive assortment, including band saws, shaping machines, pony planers, spindle shapers, saw tables, and the like; also a novel sand papering machine with a traversing cylinder. Another good collection of wood-working machinery is shown by H. B. Smith & Co, of Smithville, N. J., who are also strongly represented by iron-working machinery. Another exhibitor of wood-working machinery is Mr. P. Pryibil, of West 40th street.

Among the other exhibits worthy of attention may be mentioned the Keith dynamo-electric machine and the Fuller electric lamp, shown by the Fuller Electric Light Co., 20 Nassau street; the leather belting of J. B. Hoyt & Co., also of this city; Knight's perfection rudder for small craft; the foot, hand, and power presses of the Peerless Punch and Shear Co., 52 Dey street; Main's patent milling attachment for lathes, shown by Wm. Main, of Piermont, N. Y.; the Rhyston mangle, for ironing clothes without heat, described and illustrated a short time since in this paper; the pulsating pen of Ward & Drummond; the new economizer agricultural engine of the Porter Manufacturing Company; and an important exhibit by the American Vegetable Fiber Company, of Philadelphia. The last includes De Landtsheer's improved machine for breaking and dressing flax, hemp, and other fiber plants, and a growing specimen of the abutilon—the newly discovered fiber plant of the Middle States—with samples of the fiber in its raw and manufactured states; also a great variety of products of this new American jute, bleached, dyed, spun, and woven.

As usual there is an interminable display of sewing machines and attachments, and other contrivances for saving (or increasing) domestic labor. There is also a good show of furniture; and the National Stove and Foundry Company display some fine castings in connection with their heaters and ranges.

A ZOOLOGICAL GARDEN FOR NEW YORK.

There is in preparation, at the upper end of New York island, a semi-educational pleasure resort that promises to add materially to the city's resources in that direction. The project is in the hands of a number of wealthy citizens, who have purchased 33 acres of ground lying between 155th and 159th streets, St. Nicholas avenue and Harlem River, to be laid out as a pleasure park, including botanical and zoological gardens, a large music hall, and other structures. The situation is admirably adapted for effective landscape gardening, and is accessible by water as well as by land.

The plans contemplate a grand arcade, 1,100 feet long, facing 8th avenue, and extending 450 feet on 155th street. The approaches to the arcade through the surrounding gardens will be by stairways, and from St. Nicholas avenue by paths descending to the upper section of the building. The arcade, to be devoted to shops (excluding barber shops, cigar stands, saloons, and the like), is to be of iron and glass throughout. It will be 40 feet high and 75 feet deep, and cost about $275,000. Along its top, extending over 1,100 feet, will be a promenade overlooking the garden and the river.

The zoological garden will be back of the arcade, the cages to extend from the 157th street entrance to the foot of the bluff on 155th street. The monkey pavilion will stand between 155th and 156th streets, and the bird pavilion between 157th and 158th streets. In an artificial lake within the park will be an island carrying a large octagonal concert and dancing hall, two stories high. Back of the lake will be the bear pits, cut out of solid rock, 75 feet deep and 50 feet wide, visible from the lake side and also from the bluff above. Near by will be a house for antelopes and a bath for seals. Animals and birds that require darkness are to be sheltered in a deep ravine, to the north of the tower of the main building.

The main building, to stand near the corner of St. Nicholas avenue and 155th street, will contain a large concert hall and lecture room, seating 40,000; a botanical conservatory, 100 feet by 500 feet, with towers at the ends for birds and flowers. There will be besides a capacious restaurant, billiard rooms, bowling alleys, and the like. The grand tower will be used as an observatory. At the upper end of the park ten acres are reserved for out-door sports. A considerable amount of work has already been done upon the grounds, and the collecting of zoological and botanical specimens has been begun. One of the projectors (Mr. Crosby, of the law firm of Fullerton & Crosby) informs the *Herald* that they will soon have 500 men at work on the grounds, under the direction of Mr. Martinez, well known through his connection with the Philadelphia Zoological Gardens, and Mr. Hugo Kapka, engineer and landscape gardener. The company which has undertaken the enterprise is styled "The Universal Conservatory and Zoological Garden Company," with a capital of $2,000,000, three-fourths of which have already been raised.

THE ORIGIN OF MACHINE-MADE PENS.

Joseph Gillott, the first to employ machinery in the manufacture of steel pens, was originally a maker of buckles and other "steel toys," working alone in a garret in a Birmingham "slum." At this time he was engaged to a young woman in his own rank in life, whose two brothers were working, in about the same style as himself, on hand-made pens. Gillott thought he could better the processes employed, and worked secretly in his garret until he had made a press and other appliances, by which he could make twenty times as many pens in a day, and better pens, than was possible under the old methods. He found ready sale for them, and soon the demand outgrew his power of production. At this juncture his sweetheart agreed to his proposal that they should marry and work together, little dreaming of the ultimate issue of their enterprise. In after years Mr. Gillott used to tell how, on the very morning of his marriage, he began and finished a gross of pens, and sold them for £7 4s., before going to church.

Ivy Poisoning.

Recently Chief Justice Noah Davis, of New York City, was badly poisoned by the creeping vine known as poison ivy, which infests every fence corner and waste place in this part of the country. He was gathering bright autumn leaves, while in the country about sixty miles up the Hudson, and did not know that poison ivy leaves were not to be safely handled. In view of the general prevalence and abundance of this vine, it is astonishing that any native of the country should be ignorant of its appearance and poisonous properties. The fact that Judge Davis did not know the plant is, however, only another evidence of the prevailing neglect, even among educated people, of attention to common objects in nature.

NEW TORPEDO EXPERIMENTS BY CAPT. ERICSSON.

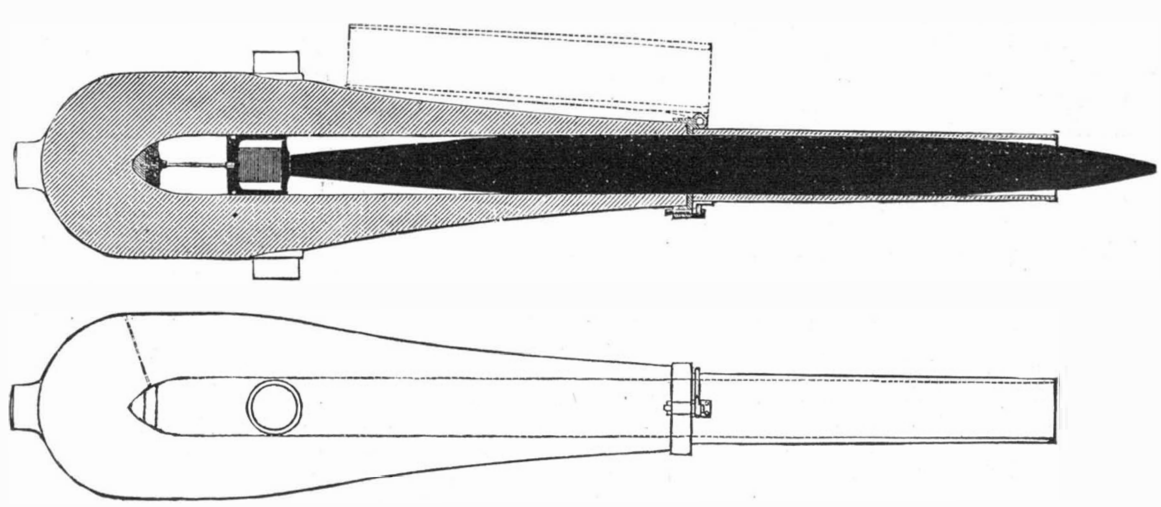
In the discharge and propulsion of torpedoes from a vessel, at a point below the water line, the use of compressed air has heretofore been employed. But the great expense of the apparatus and the difficulties attending the use of air under the enormous pressures required, has led Capt. Ericsson to seek for a substitute for the air. With this view he has made experiments with gunpowder in connection with a projectile of peculiar form and a gun with a novel appliance. We derive from the *Army Journal* the following particulars of the experiments.

By the direction of the Secretary of the Navy the Chief of the Bureau, Commodore Jeffers, caused a navy 15-inch gun and carriage to be mounted on the gun scow belonging to the Ordnance Department, at the New York Navy Yard. He also instructed the Inspector of Ordnance, Capt. Matthews, and his assistants, Lieutenants Hanford and West, and gunners, to assist during the experiments. The gun being thus placed at his disposal, Captain Ericsson applied to it a hinged cylindrical extension secured to a muzzle ring bolted to the termination of the chase, as shown by the annexed illustration, representing a sectional plan and side elevation of the piece. The principal object of this cylindrical extension (partially open at the top during the preliminary trial) is that of sustaining and directing a torpedo nineteen feet long, pointed at both ends, and proportioned to carry an explosive charge of 250 lb. at the head, the tail being provided with a cast iron armature to balance the weight of the charge and receive the thrust produced by firing the gun. The object of the hinge is that of enabling the gunner to swing the extension to one side for the purpose of facilitating the sponging of the piece. The sectional plan, on which the outline of the torpedo is marked, shows the propelling piston, composed of cast iron, employed to transmit the initial energy of the charge and the gradually diminishing energy of the expanding powder gases. The tail end of the torpedo is made blunt in order to withstand the crushing effect of the great pressure brought to bear upon it. An elastic cushion, composed of disks of pasteboard, is inserted between the bottom of the piston and a loosely fitting disk applied between the cushion and the blunt end of the torpedo. It will be observed that the propelling piston is placed at a considerable distance from the charge, the latter being located near the termination of the chamber and contained in a flannel bag supported by a conical piece of wood held by a slender iron rod inserted in the bottom of the piston. A charge of eight pounds of powder, composed of hexagons weighing 96 grains each, was employed during the entire series of experiments, its volume being 216 cubic inches, while the actual volume of the explosive body (weighing eight pounds) was only 135 cubic inches, and the unoccupied contents of the chamber 2,997 cubic inches. It will thus be seen that the air space was 2,997-216ths =13·83 times greater than the volume of the charge, and 2,997-135ths=22·20 times greater than the actual volume of solid power. Notwithstanding this extraordinary disproportion of charge and air space, it was found during the trial that a bright flame issued from the muzzle of the gun at each discharge, following the expelled propelling piston for a distance of nearly eight feet. This circumstance becomes the more remarkable when the fact is taken into consideration that the total internal contents of the gun in rear of the propelling piston, at the instant of leaving the bore, is 24,377 cubic inches, or nearly 112 times greater than the volume of the charge. The internal pressure, indicated by the flame issuing from the gun after such an extraordinary expansion of volume, can only be accounted for by assuming the combustion of the powder gases to be perfect owing to the presence of a large volume of atmospheric air. Obviously the great compression of the air in the chamber at the instant of explosion brings the particles of the oxygen of the confined air into closer contact than even in pure oxygen gas under atmospheric pressure. This consideration accounts satisfactorily for the perfect combustion indicated by the bright flame issuing from the gun, notwithstanding an expansion in the ratio of 112 to 1 as compared with the volume of the charge, and 178 to 1 compared with the actual volume of the explosive body. Experts cannot fail to regard the foregoing facts as very important, proving as they do that the explosive energy of gunpowder is not, as generally supposed, a mere momentary development of energy. The result of the trial is conclusive in this respect, and shows that the developed power may be controlled, and to some extent regulated, as we regulate the expansive force of permanent gases.

As already stated, the torpedo employed during the experiments is made of wood, nineteen feet long, exactly fitting the bore of the 15-inch gun, its weight, including that of the propelling piston, being 1,281 lb. It should be mentioned that the flight of the torpedo during the trial presented several remarkable features, especially in regard to the position of its axis, which, in place of retaining parallelism with the axis of the gun, gradually changed its inclination, corresponding exactly with the curvature of the trajectory near the termination of the course. On the other hand, no deviation whatever was observed in the vertical plane of the trajectory, the course being perfectly straight.

The experiments were commenced on the west side of the Hudson, but as the bottom there proved very soft, the gun scow was towed to the Horse Shoe, near Sandy Hook, where the bottom is very firm, being composed of fine sand. It should be mentioned also that during the experiments on the west side of the Hudson two torpedoes were lost by striking the water at a considerable angle, and entering the soft bottom at nearly full speed. The entering force, estimated at upwards of one million foot-pounds, caused both torpedoes to disappear completely. At Sandy Hook, however, the bottom proved to be so firm that the torpedo, the weight of which is somewhat less than its displacement, invariably floated to the surface at whatever angle it struck the water.

It will be asked, What became of the propelling piston which, being composed of cast iron, of course dropped into the sea after having parted company with the torpedo during its flight through the air? The answer is, that owing to the firmness of the bottom the piston was recovered at each discharge of the torpedo, excepting the one which terminated the trial. It is scarcely necessary to mention that spare pistons were provided, and at hand, in case of such accidents.



The recent trial has shown that the angle of the axis of the torpedo on striking the water at the end of its course coincides with the angle of fall of the trajectory. Again. the original torpedo experiments on the Hudson, before referred to, showed that when the torpedo, after a short flight through air at a small elevation, is laid flat on the water, it proceeds at a high rate of speed in a straight course near the surface. Our professional readers will be interested to learn that Commodore Jeffers thinks that this mode of projecting torpedoes towards an enemy's ship will prove very effective.

As we are only dealing with the question of substituting powder for compressed air in manipulating aggressive torpedoes, it has not been our intention to present a record of the experiments conducted at Sandy Hook to determine the flight of the torpedo through the air, nor its behavior on striking the water; but we deem it proper to mention the interesting fact established by the trial, that by attaching to the head on opposite sides in the horizontal plane, thin disks placed at an angle of 13° to the axis, the inclination of the torpedo during the flight can be regulated very accurately by simply changing the width of these disks. It will be well to mention, that no recoil of the gun has been experienced during the trials, although the friction gear applied to the slide has been but slightly tightened. Captain Ericsson has accordingly offered to build, for the Ordnance Department, rotary gun carriages without slides, suitable to be placed on the decks of vessels, for expelling torpedoes in the manner before explained.

It remains to be stated that, apart from the possibility of attack by throwing aggressive torpedes from the decks of vessels, the dispensing with the internal propelling machinery employed by Whitehead opens a wide field for the application of the submerged torpedo tube. Such a tube may be suspended from the sides of vessels of all classes, and submerged at any desirable depth. Nautical experts can best determine the utility of aggressive torpedoes expelled from such tubes in a naval action.

The Proposed International Park at Niagara.

A conference between the Ontario Government and the New York State Commissioners was held recently at Niagara Falls, relative to the setting apart of the grounds on both sides of the Falls for an International Park. It was estimated that Canada would have to purchase properties valued at about $400,000, and New York would have to expend something like $1,000,000 for like purposes. The desirability of the proposed scheme was generally agreed upon, provided it should not cost too much. The boundary of the contemplated reserve would run from the Clifton side of the Bush property to beyond the burning spring. On the American side it could run from the new suspension bridge along Canal street to a point above the rapids. The islands of course would be included in the reserve.

The programme of the conference suggested, 1st, that no effort be made to make the lands into a park, but rather that the natural characteristics of the locality be restored and preserved, as far as practicable, and that the grounds be thrown open to all, subject to such regulations as may be deemed requisite; 2d, that the islands in the river and a strip of land on each side of it should be acquired, and that the latter should be planted with trees so as to form a belt sufficiently dense to shut out all incongruous objects; and, 3d, that a toll to defray cost of improvements and maintenance should be levied, but that such other fees as are at present collected —unless, perhaps, for special services, such as guides— should be abolished.

METALLIC FENCES.

It is nearly fifty years since experiments with wire fencing began to be made, and twenty-five years since it began to be much used. The method promised great economy, both in first cost and in the saving of ground space. Besides, the wire fence was less liable to be blown down, and it would not occasion snow drifts. On the other hand, it was soon found that it was rapidly corroded by the weather, and being inconspicuous was liable to be run down by cattle and horses. When "galvanized" the wire was more durable and more easily seen; and in spite of its inability to stop unruly cattle, wire fencing became widely adopted, particularly in the West, where, it is estimated, as many as 150,000 miles of plain wire fencing have been set up since 1850. To make wire fencing stock proof several devices have been invented and patented during the past ten years, to provide for arming the fence with cattle-repelling spines or barbs of metals.

The *Holyoke Manufacturer* states that during the four years since the first barbed wire was put upon the market, the sales have amounted to between fourteen and fifteen thousand tons, and the demand is rapidly increasing both at home and abroad. There are several manufactories, and in one instance the works cover three acres and give employment to 1,200 men. The wire is made from Bessemer steel, and is drawn in the usual way. The "galvanizing," or zinc coating, is done by heating the wire in suitable furnaces, and drawing it from them, first through tanks of acid, and then through tanks of boiling zinc. A thin and even coating of zinc adheres to the wire, giving it both a handsome finish and a perfect protection from the chemical action of the atmosphere. The barbing is done by automatic machinery. These machines, as described by the *Manufacturer*, are good specimens of American mechanism, and do their work with lightning-like rapidity, yet with mathematical accuracy. One of the main wires passes through the machine longitudinally. A second wire is fed into the machine at right angles to the first. At each revolution of a certain disk or wheel, the sharp end of wire number 2 is twisted firmly around number 1, and cut off so as to leave a sharp point on the incoming wire as before, while the bit of pointed wire cut off remains as a steel thorn attached firmly to wire number 1. This wire, thus armed with barbs at regular intervals, passes on to a revolving reel, where it is met by wire number 3—a plain wire without barbs—and by means of the reel motion is loosely twisted with it. The completed fence wire is thus really a two-strand steel rope, armed with barbs projecting in every direction. The great advantage, besides additional strength, that is secured by the second strand and twist, is an automatic adjustment to changes of temperature. When heat expands the metal the twist simply loosens, and when cold contracts it the twist tightens—all without altering the relative length of the combined wires. The reels upon which the finished product is woven are light, strong, wooden ones, suitable for shipping, and provided with cross pieces at the ends, on which they can stand, and the barbed wire be protected from injury. Each of these barbing machines turns off 1,200 pounds of barbed wire a day.

At present wooden posts are usually used as supports for the wire in putting up the fence. But it is believed that iron posts will sooner or later supplant the wood. For study, with a view to new and useful improvements the subject of metallic fences is a promising one for inventors. The demand increases not only with the decay of the old wooden fences, but also with every acre of new land that is opened up to cultivation.

AT a recent meeting of the New York Chamber of Commerce, Mr. E. F. Shepard (who had just returned from Europe, where he had made special inquiries into the cost of handling and storing grain abroad) said that the grain charges in the port of Liverpool amounted to one dollar a ton. In Havre the charges surpass the original cost of the grain. In New York the elevator charges aggregate only nine and one third cents a ton.

THE PROGRESS OF ELEVATED RAILWAYS.

[*Continued from first page.*]

Company constructed their east side or Third avenue road from the Battery to 129th street, with branches to City Hall, to 34th Street Ferry, and to the Grand Central Depot at 42d street, making some nine miles of double track, the character of which is shown in Fig. 2.

During the year ending Sept. 30, 1878, the New York Elevated Road carried 4,000,000 passengers; during the next six months, owing to the enormous traffic on the Third avenue branch, there were carried nearly 14,000,000 passengers.

On the 20th of May, 1879, the Metropolitan and the New York Elevated Railways were leased to the Manhattan Company, thus bringing both roads under one direction. Since that date the extension of the system has gone on rapidly. On the west side the continuation of the New York road above 59th street has been merged in that of the Metropolitan, and above 83d street the road is continued in the style of the Metropolitan. Trains are now running as far as 135th street and Eighth avenue, and in a little while the road will have reached its northern terminus at 158th street and Harlem River. The splendid illustration on our front page shows the road as it curves from Ninth avenue and traverses 110th street eastward to Eighth avenue. Fig. 3 is a view in the same neighborhood. It is to such imposing dimensions that the original "cheap and simple" elevated road has grown. The posts in the foreground are 57 feet in height above the massive iron shoe on which they rest. This is raised on a tower of masonry rising some twenty feet or more above the original level of the land (the avenue having been filled in nearly to that height), and the masonry rests on a foundation of piles driven in to the depth of 40 feet. The engineering features of this gigantic, though seemingly slight and airy road-way, we purpose giving in a later issue. It is enough to say here that even those who are most familiar with high level transit can scarcely help a feeling of awe as the train sweeps out over the valley in its sinuous course in mid air. From the 110th street curve to 135th street and beyond, the road is perfectly straight, and the grade slowly descends to the normal altitude. Fig. 4 shows the construction of the base of the supports under ordinary conditions; those in the foreground of our large illustration are much deeper, pyramidal in form, and, as before mentioned, are supported by a pile foundation. The hollow iron columns are painted within with a waterproofing compound, and then filled with cement to exclude moisture and lessen the possible weakening of the structure by internal corrosion.

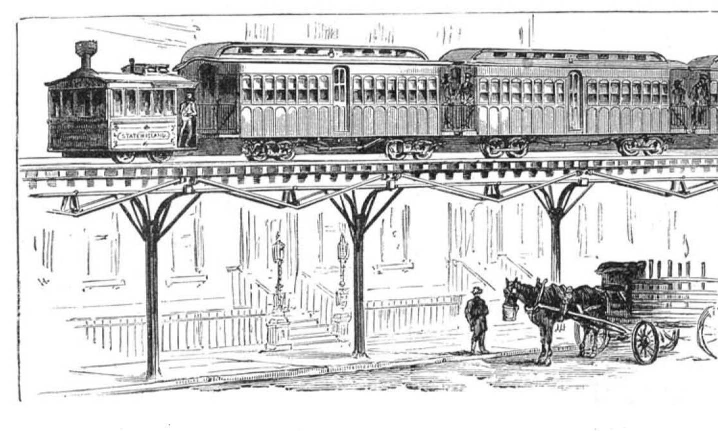


Fig. 1.—THE FIRST ELEVATED ROAD, WITH ITS LINE OF SINGLE POSTS.

While this work has been progressing on the west side, the new east side or Second avenue elevated road has been under construction. The work of erection was begun in the early part of the current year, and for a large part of the time 6,000 workmen have been employed upon it. The chief difficulties encountered were in the construction of the piers.

For a distance of four miles a perfect network of gas, water, and sewer pipes was encountered, making a special plan necessary for each foundation. The most troublesome pier of all was that at 108th street, where the center of the pier was directly over a large sewer which received two large inlets within the area of the foundation, and the problem was further complicated by the presence of a 30 in. gas main and two croton water pipes. Though twenty piles were enough to carry the piers under ordinary conditions, it was necessary at this point to drive 82 piles to get proper bearings, and to use 130 cubic yards of concrete, a massive cast iron bed plate, and 80,000 bricks.

In all nearly a thousand tons of iron are said to have been required in arching over pipes in the 2,400 foundations for piers. In making these foundations 60,000 cubic yards of rock had to be blasted and removed under the most exacting conditions, and 80,000 cubic yards of earth. Five steam pile drivers were employed in driving 300,000 lineal feet of piles for foundations in marshy places. The engineer in charge gives the amount of lumber used in the piers at 800,000 feet board measure; there were required, in addition, 50,000 cubic yards of sand for mortar, 30,000 cubic yards of broken stone for concrete, 70,000 barrels of cement, and 21,000,000 bricks. One contract for iron for the superstructure called for 80,000,000 pounds.

Fig. 2.—VIEW OF THE ROAD AT COOPER INSTITUTE.

This road, which is nearly completed, is intended mainly for through passengers, the local east side traffic to be given to the Third avenue road. The amount of travel on these elevated roads can be partly estimated from the figures already given. The regular time on the Third avenue road is 42 minutes from the Battery to Harlem, $8\frac{1}{2}$ miles, including stoppages. Trains are run every four minutes, and commonly include four cars. The time of the Metropolitan (Sixth avenue) line is 20 minutes from Rector street to 58th street, about five miles. The time to 104th street is 32 minutes, to 135th St. about ten minutes more, allowing for slackened speed around the 110th street curve. Trains run to 58th street at intervals of two to four minutes, according to the hour; and to 104th street and beyond at intervals of six minutes.

The fare is ten cents, except during two hours in the morning and two in the evening, when it is five cents. During the workingmen's hours a passenger may ride on the Metropolitan division, ten miles, for five cents, in palace cars fitted up in the finest style. Of the favorable and unfavorable influence of these elevated roads upon property along their routes, and on the convenience and comfort of living in the city, it is not our purpose here to speak.

Fig. 3.—PORTION OF THE ROAD BEYOND CENTRAL PARK ON POSTS FIFTY-SEVEN FEET HIGH.

Nordenskjold's Discoveries.

The discoveries of Professor Nordenskjöld in the Arctic regions are full of interest from a geographical and commercial point of view. The explorer in a recent letter states that the coast of Siberia west of the Lena River is a vast, treeless plain. There are no islands to prevent the wind from driving the ice floes down upon the shore, and the points where rivers empty into the Polar Ocean, and with their warmer currents maintaining open spaces, are separated usually by enormous distances.

For several hundred miles in the vicinity of the Lena, however, there are several great rivers, and a chain of islands acts as a barrier to the ice. Toward Behring Strait the frozen floes crowd closer to the shore, and are liable in the autumn and winter to bar the way to shipping.

The most important of Professor Nordenskjöld's discoveries, from a scientific standpoint, is that of a group of islands off the Siberian coast.

These islands, the New Siberian, open the book of the history of the world at a new place.

The ground there is strewn with wonderful fossils. Whole hills are covered with the bones of the mammoth, rhinoceros, horses, uri, bison, oxen, sheep, etc. The sea washes up ivory upon the shores. In this group is possibly to be found the solution of the question of the ancestry of the Indian elephant and important facts with regard to the vertebrates which existed at the time of man's first appearance on earth.

How came horses and sheep in a region now locked in the fetters of an eternal winter, uninhabited by man, not now supporting animal life in any form, and almost impossible of access?

Professor Nordenskjöld was unable to solve the question himself, and he suggests that it is of the utmost importance to science to send a light draught steel steamer to those islands for a thorough exploration.

The natives seen along the coast belong to a hardy, jovial race, dressing in furs, keen at barter, but ignorant of the value of money. They live in double tents, and expose themselves to very low temperatures with little clothing.

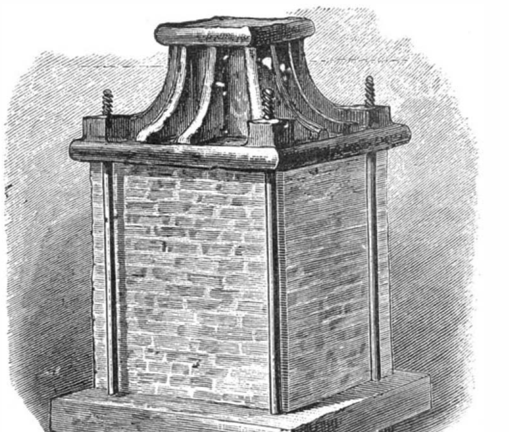


Fig. 4.—BASE OF COLUMN UNDER GROUND.

There is a great resemblance between the people and the Esquimaux or the North American Indians. Though armed with stone and bone weapons, and though wild and itinerant, they evidently have a history. They drove off the original inhabitants of the region 200 years ago, the Onkilons, whose houses, places of sacrifice, circles of moss grown bear skulls, and weapons are still to be found almost everywhere on the coast.

There is no trace of any religious belief in their customs. East of the Lena the explorers found scattered blocks of stone, bearing evidence of glacial action and pointing plainly to the presence of land to the north. Another peculiarity of the Siberian coast is the gradual elevation of the land above the level of the sea, so that the inhabitants have been obliged to shift their villages nearer to the water's edge, which is gradually receding. Professor Nordenskjöld's explorations when published in full will undoubtedly excite much interest, and lead to the anticipation of possibly more valuable discoveries on the part of the Jeannette.—*Boston Traveler.*

MECHANICAL INVENTIONS.

Mr. Karl Müller, of Fordham, N. Y., has patented an improvement in turning implements for use with lathes in turning articles with straight or tapered surfaces, and consists in certain novel features of construction, whereby the tool is especially adapted for small work, and for obtaining uniformity to a given pattern when the articles are produced in large quantities.

Messrs. Samuel Rather and Daniel Rather, Jr., of Holly Springs, Miss., have patented an improvement in smoke and cinder conductors for railroad trains. This is an improved device for attachment to the cars of railroad trains to receive the smoke and cinders from the locomotive and conduct them to the rear of the trains, to prevent the passengers being annoyed by the entrance of the smoke and cinders into the cars.

Mr. Charles H. Brazeal, of Tye River Depot, Va., has patented an improvement in smut machines which is intended to remove the closely adhering smut as well as that which lies loose among the kernels.

An improved safety hook has been patented by Mr. Henry Blakeman, of Jefferson City, Montana Territory. The object of this invention is to prevent the bucket or other object suspended from the hook from slipping therefrom. It consists in providing the hook with a keeper sliding on the shank to and from the point thereof, and a spring for locking it in place against the end of the hook.

Messrs. Vestus P. Willcox and Orrin Ranney, of Corry, Pa., have patented an improved machine for boring brush blocks and other work in wood or metal requiring straight and inclined holes to be bored close together or in groups.

An improved hay and cotton press, patented by Mr. Jacob Huffaker, of Gap Creek, Tenn., consists of an upright standard rigidly fixed in a suitable base frame, and carrying the follower secured upon its top, while inclosing the follower is a movable press box, that is elevated by shores whose lower ends are provided with rollers, and drawn down or depressed by ropes and rollers and winches; and it further consists in so connecting the rollers and winches and compounding their forces that the operative power may be most advantageously applied.

Mr. Joshua Henshaw, of St. Hyacinthe, Quebec, Canada, has invented an improved machine for extracting stumps and raising stumps, stones, and other heavy objects. The invention consists in the combination of a slotted ratcheted bar arranged to slide on a bar which supports a lever carrying two pawls, which work in the ratcheted bar. Two fixed pawls are provided for retaining the ratcheted bar.

Mr. Royal R. Piper, of East Saginaw, Mich., has patented an improvement in that class of pipe wrenches in which a chain is employed in connection with a serrated jaw and a handle or lever.

Mr. Francis H. Young, of Stanhope, N. J., has patented an improved station indicator for railroads. This invention, although quite simple, cannot be described without engravings.

An improved lifting-jack, patented by Messrs. Joseph S. Blackburn and Samuel G. Brosius, of Beloit, O., consists of a lifting bar having on its lower end a socket piece, which is passed over the standard, while at the upper end of the standard is a pivoted strap, through which the bar is passed.

Mr. Andrew Dilts, of Dallas, Iowa, has patented an improved spoke setting machine. It consists of a frame for holding the hub firmly on a pivot, so that it can be turned freely, and an adjustable gauge for holding the spoke while being driven.

Mr Joshua W. Jones, of Harrisburg, Pa., has patented an improved evening-up table provided with a device for smashing the head and back folds of the sheets to take out the swell, so that the sheets may lie more solid and compact, thus greatly facilitating the handling of the work in book binding.

Mr. John D. Graves, of Wichita, Kan., has invented an improved windmill, in which the wheel is held to the wind by a vane, and turned more or less at an angle to the direction of the wind by horizontal adjustment of the vane, which adjustment is automatically performed for regulating the speed and power of the wheel by the endwise movement of the wheel shaft acting upon an elbow lever connected to another elbow lever, which in turn is connected to the vane; or it may be done by hand by a rope attached to the first named elbow lever and passed over a pulley.

Mr. Isham M. Rosier, of Jonesville, Va., has patented an improved reciprocating sawmill, which is so constructed as to saw the logs from end to end, reverse the motion of the carriage automatically at the proper time, and saw the log in both directions, thus saving lumber, time, and labor.

SHEARING AND RIVETING MACHINERY.

The engravings on this page represent two machines made by Messrs. Sellers & Co., of Philadelphia, Pa.

A heavy plate shearing machine for trimming the edges of long plates, or for cutting plates of 5 feet in width or under to length, is shown in Fig. 1. This machine was designed to meet the requirements of modern ship building or bridge construction. It is provided with a bed for holding the plate, and clamping it if necessary, and will shear plates 1 inch thick with exceeding exactness. The upper blade is guided vertically, and is driven downward by a pitman as wide as the blade is long, receiving its motion from a long

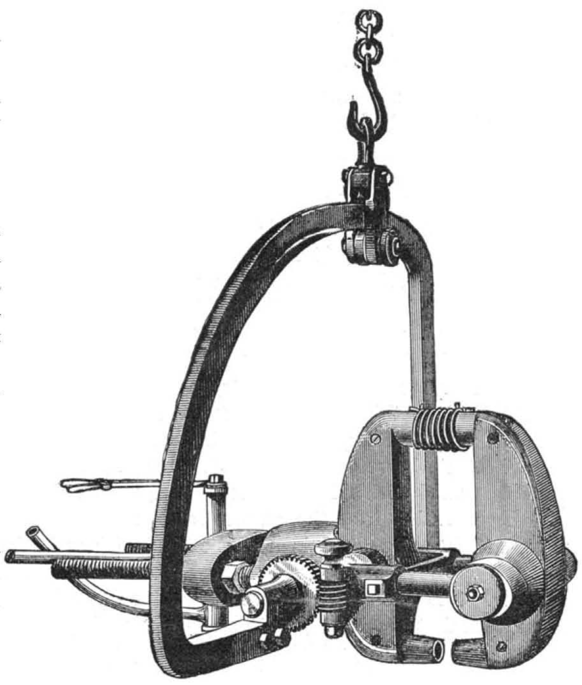


FIG. 1.—PORTABLE RIVETING MACHINE.

rocking shaft above it, which is operated by an arm or lever in the rear of the machine and not seen in the engraving. This arm has a segmental rack working into the teeth of a spiral pinion driven by a bevel wheel and pinion, and open and crossed belt similar to the method adopted by this firm for their planing machines. The driving arrangement is exceedingly efficient, and an automatic adjustment is provided to the belt-shift motion gauging the length of stroke. The blade after making the down stroke immediately ascends again at double its descending speed, and stops up ready for the next cut. It is at all times under the control of the operator, and can be made to cut to any fixed point in its length, and then stopped or raised, the hand rod in front, operated from either side, being used for shifting the belts and starting or stopping. Curved blades can be placed in the vertical slide if desired, and the bed plate connected with the

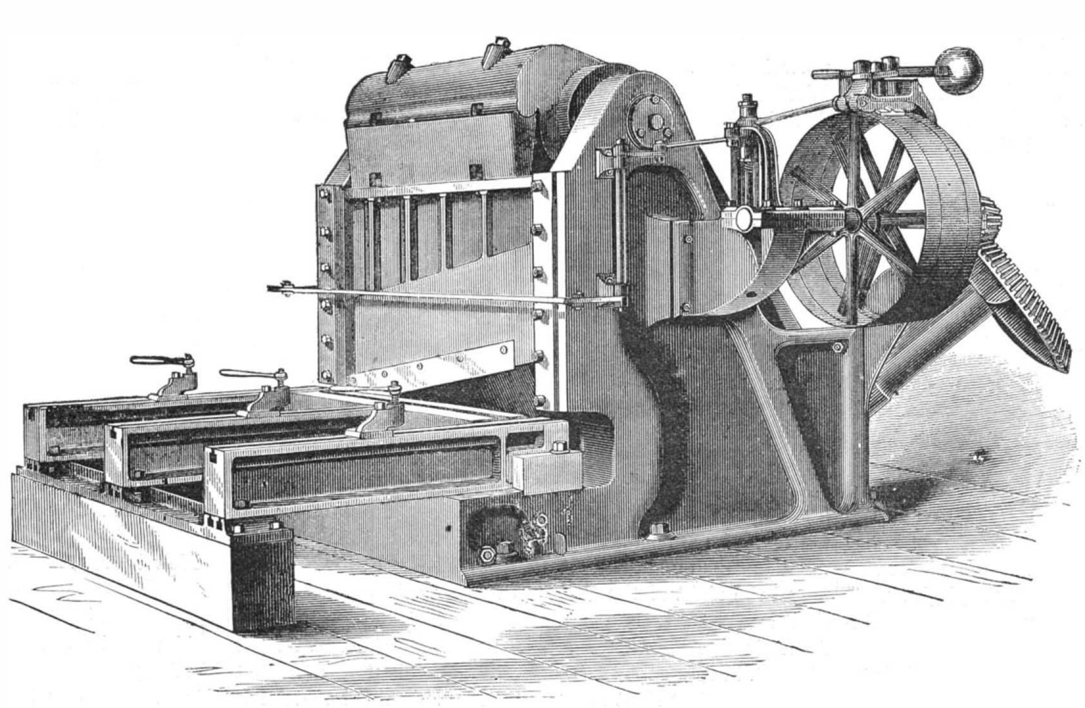


FIG. 1.—PLATE SHEARING MACHINE.

lower blade may readily be removed to receive a curved bed plate, with shear plate bent to correspond with the curve of the upper blade.

The subject of riveting by power has for some time attracted the attention of mechanical engineers, and steam riveting machines have been used with considerable success. There are objections, however, to the use of steam which have been most effectually met by the application of hydraulic power.

Fig. 2 shows a portable riveting machine possessing many new features, and arranged with convenient overhead carriage and hoisting machinery to facilitate its use. The essential point of this invention consists in the use of an accumulator, from which a continuous regular pressure may be obtained as wanted. The adjustable accumulator is arranged with weights suspended below the main casting, and easily released, if required, to adjust the pressure to the kind of work being done, each weight representing 250 pounds per square inch on the ram of the riveting machine, and the maximum pressure obtainable being 2,000 pounds per square inch. A double acting pump is connected with it, operated by crank motion, and taking its water from a reservoir in the upright column to which it is attached. The pump is arranged so that when once started for work it is never stopped while the machine is in use. By an improved relief valve, as soon as the accumulator is full, the direction of the water coming into it from the pump is changed back into the same reservoir from which it was taken, and it continues so to flow until wanted in the accumulator, when the action of the valve directs it back again. The pump is maintained in motion ready for immediate action, and yet relieved from strain when not required for work, avoiding all risk of delay at starting or of loss of water and entrance of air in the chamber while standing.

The portable riveter is suspended from a hoisting machine and overhead carriage, having both longitudinal and transverse motion. The water under pressure is carried by jointed or flexible pipes from the accumulator to the machine, and passes into a compressing cylinder in which a piston works.

The Hotchkiss Magazine Gun.

The Hotchkiss magazine gun, which is now made in part at the armory, is a modification of the French chassepot. The magazine, which is in the butt, contains six cartridges, which are forced forward by a string. The barrels, ramrods, bands, stocks, and some other parts are made here. The patented parts are made by the Winchester Repeating Arms Company, of New Haven, who have expended about $30,000 in preparations for their manufacture. The machinery at the armory is not adapted to the manufacture of these parts; and, as the appropriation of Congress is only $20,000, and the whole thing is an experiment, the plan of obtaining the small parts from the Winchester company serves the interests of economy, and will result in the production of eleven hundred guns, while otherwise only five or six hundred could be made. When completed these guns will be distributed to the army for practical tests.—*Springfield Union.*

Photography of Flashing Signals.

Army telegraphing by means of flashing signals has been successfully done, between stations fifty miles apart, by the British in Africa. The London *Photographic News* suggests that a camera be employed to photograph the signals by the heliograph, as it would be possible to signal much faster, for the receiver, instead of requiring time to puzzle over the message as it was transmitted, need pay no attention until the complete sentence was before him. No doubt there would be certain practical difficulties to be overcome in adapting the camera to the heliograph, but applications of a like nature are practiced every day by scientific men. The Mance heliograph, first submitted to the British Government by Mr. Mance in 1869, as now used, is a very simple contrivance, and as photographers are interested in all that pertains to light, they might like to know how the apparatus is worked. It consists simply of a tripod, upon which stands a mirror. This mirror is usually ten or twelve inches in diameter, and a glass of this size is capable of reflecting a ray visible to the naked eye at a distance of fifty miles, and even more in clear weather. The mirror is movable, swinging like an ordinary toilet looking-glass, but it has, moreover, a pivot at top and bottom that permits it also to be turned sideways. In this way it is possible, whenever the sun shines, to reflect a ray in any direction, unless it should happen that the sun is too far behind, when the difficulty is at once obviated by bringing into play a second mirror, which reflects the rays on to the first. But if the distance to be signaled is fifty miles off, it is necessery that the signaler should aim perfectly straight, and to do this he handles his mirror after the manner of a rifle. He gets behind it, and looks through a hole in the center (where the quicksilver has been removed), and having sighted the station afar off, he brings up in a line with his eye and the station a small stud that slides on a sighting rod, some ten yards in front of the mirror. When this stud covers the distant station, the aim of the mirror is correct, and all the signaler has to do is to see that the reflection of his mirror shines upon the stud. So long as this is the case he may be sure his brother afar off will see the reflection too. A key to be pressed by the hand is in connection with the mirror, and throws the reflection on and off the stud, and by pressing this key for short or long intervals, short or long flashes are produced. This is the whole story of the heliograph; and now, says our contemporary, that our readers may have learned its *modus operandi*, we hope some of them will set to work and apply a camera to it in such a way that the flashes may be recorded and true light impressions produced by its means.

AGRICULTURAL INVENTIONS.

Mr. Joseph W. Hobson, of New York City, has patented an improved horse hay rake, in which, by the adjustment of the rake teeth points forward and backward, together with the integral vertical adjustment, a great number of positions for the rake can be obtained to suit the requirements of the land or crop, or the views of the operator.

Messrs. Samuel Scott and Winfield Scott, of Floyd Court House, Va., have patented an improvement in the class of devices attached to trunks of trees for the purpose of protecting them from injury by worms, borers, and other insects or animals. The device is made of sheet metal in conical form, and is adapted for adjustment in diameter or size.

Messrs. Mortimer B. Mills and Christopher E. Dinehart, of Chicago, Ill., have patented an improved apparatus for generating steam for cooking food for cattle. It has a large area of heating surface within a small cubical space, and is adapted to economize heat to a high degree.

Mr. John W. Blackhart, of Wells' Tannery, Pa., has patented a fork for hay and like material, furnished with a weighing apparatus, by means of which each fork load can be weighed as it is handled.

Mr. John T. Greenfield, of Uniontown, Ky., has invented a plow, the cutting parts and gauge wheel of which can be conveniently lowered or raised, as may be necessary, on account of hardness or unevenness of the ground, by a person seated on the plow, and also to provide a plow, the cutting parts of which can be easily sharpened.

An improvement in plows has been patented by Mr. John M. Martin, Jr., of Ocala, Fla. The invention consists in the arrangement of a plowshare provided with a detachable mould board or wing, for the purpose of throwing more ground over the grass in the middle of the rows.

Photography in Natural Colors.—Printing Photo-Collographs.

After referring to the fallacy of producing natural colors by the camera, as put forth by Rev. L. L. Hill, of this State, whose alleged discoveries were published in this paper as long ago as 1850, a writer in *Chambers' Journal* says:

"It would be a triumph of optics and chemistry if photographs could be made to represent the natural colors of objects. Attempts toward this result have hitherto ended for the most part in disappointment. But Captain Abney, in a short paper 'On the Production of Colored Spectra by Light,' read before the Royal Society, makes known that he has succeeded in producing, approximately in the natural colors, pictures of the solar spectrum on silver plates, and also, but less brilliant, on compounds of silver held in place by collodion. 'I reserve for the present,' the Captain writes, 'the exact details of the production of these pictures, but may say that they are produced by oxidation of silver compounds when placed in the spectrum, an exposure of two minutes being amply sufficient with a wide slit to impress the colors The coloring matter seems to be due to a mixture of two different sizes of molecules of the same chemical composition, one of which absorbs at the blue end, and the other at the red end of the spectrum, and the sizes of these molecules are unalterable while exposed to the same wave lengths as those by which they were produced.' And he is of opinion that 'the colors may be preserved unchanged when exposed to ordinary daylight.' From this it will be understood that Captain Abney has made a step in advance of high importance."

To this the London *Photographic News* adds:

We should be very sorry indeed to appear to underrate the work of Captain Abney in this direction; but, unless our memory misleads us, M. Becquerel obtained an image of the solar spectrum in natural colors early in 1849. Niepce Victor and others have since secured still greater results. On a film of sub-chloride we ourselves have obtained very approximate natural colors. But in all these cases the colors were evanescent. Captain Abney is of opinion that his colors will remain unchanged when exposed to ordinary daylight. This is a decided step in advance. Our own results were gradually destroyed by daylight. We shall look for further details of our friend Captain Abney's operations with interest.

The writer in *Chambers'* proceeds to refer to the interesting experiments of Herr Albert in printing colored photo-collographs, which have, however, no connection with photography in natural colors. He says:

"In connection with this we mention improvements in color printing by which Herr Albert, court photographer at Munich, produces chromo-photographs of surprising excellence. The process commences by the taking of three photographs, each being exposed to the action of different and definite portions of the spectrum. This is effected by causing the light, before it reaches the sensitized plate, to pass through colored glasses, or suitable colored liquids, and, moreover, by employing in each case special solutions for the development of each negative. A positive printing plate (a glass plate gelatinized) is then produced for each negative; and, if the absorbing media and the developing preparations have been correctly chosen, it is only necessary to color one of these plates with red, another with yellow, and the third with blue, in order, by successive printings, to obtain a picture which exhibits more or less resemblance to the original. Success appears to depend on the skill and nicety with which the absorbing materials are employed, for mixtures of colors and of coloring materials are quite different things; and, to quote the technical description, 'for the negative belonging to the blue plate we must employ such absorbing media and preparations as will prevent green from producing any influence on it, and at the same time will render blue and violet quite inactive, inasmuch as these tints must appear only on the positive plate.'

"Specimens of landscapes and of decorative panels printed by Herr Albert's process were exhibited at scientific receptions in London during the past session, and were deservedly admired. The details were shown: a plain yellow picture; then on the yellow a blue, and on the blue a red; and with these three the effect of a well-finished water color drawing was produced."

Launch of the Agamemnon.

The Agamemnon, four, double screw iron armor-plated turret ship, 8,492 tons, 6,000 horse power, was launched at Chatham on September 17. She has a length of 280 feet, compared with 325 feet for the Inflexible, and a breadth of 66 feet compared with 75 feet, while the displacement in tons of the Inflexible is 3,500 greater than that of the Agamemnon. Her two revolving turrets, which will be plated with iron 1½ inch thick, will be placed *en échelon*, and will contain each two 38-ton guns, all four being revolving. Her power of attack, however, is not confined to ordnance, for she will be armed with Whitehead torpedoes, means of ejection being provided from the armored sides of her citadel. Her water-tight compartments are to be filled with cork, the object being to prevent her from sinking if struck below the water line. She is an ironclad of the center citadel type, which means that she is built with an invulnerable citadel, or central compartment, which is kept afloat by two unprotected ends of the vessel. Within the walls of this citadel are inclosed the magazine, engines, boilers, and ordnance, with its hydraulic loading gear. The armor protecting this citadel is 18 inches thick, and that on the turrets 16 inches; on the citadel is two thicknesses. The outer or face armor will probably be of steel, strengthened by vertical angle iron girders 11 inches wide and 3 feet apart, the space being filled with teak. Behind this backing and these girders will be riveted the rest of the armor, which will, in its turn, be backed by horizontal girders and another thickness of teak. In addition to the ordinary decks there is a superstructure, running lengthways with the keel and erected above the upper deck, for working the vessel. In the "unprotected" portion of the vessel horizontal armor is largely used. This is no less than 3 inches thick on the upper deck, and on the lower deck, both before and in the rear of the citadel, 6 feet under water, the same thickness of plating is used. The Agamemnon is calculated to realize a speed of 13 knots an hour.

How they Attract Custom to the American Produce Stores in England.

Within the last few months, consequent on the large importations of American produce into Bristol by the Great Western line of steamers, a great many stores for the sale of American provisions have been started in different parts of the city, especially at Laurence Hill and Russell Town, in the eastern portion, and in Bedminster, the district of Bristol in Somersetshire. The go-ahead character of these stores is manifested in many ways, and one store at East street, Bedminster, has lately been rendered notorious by a large flag suspended from a pole above the shop. Other grocers and provision merchants in the neighborhood made a display of bunting likewise; and the police, not partial to this flourish of finery, brought the matter before the magistrates, who on Tuesday were called to adjudicate in a summons taken out against Mr. Frederick Wm. Leach, proprietor of the American Stores. He was charged under the 18th Section of the Bristol Street Encroachment Act with projecting from one of the windows of his premises a pole and flag to the inconvenience and danger of the public. Mr. Clifton, who appeared for the defendant, admitted that the defendant had exhibited a flag from his premises, and contested the right of the police to interfere. Police Sergeant Smith said that, in consequence of instructions received from his superintendent, he called on the defendant on the 30th ult. in reference to the flag, and defendant asserted that he had a perfect right to exhibit it, and declined to take it in. The chief constable (Mr. E. Coathupe) said that, on August 13, he was driving through Bedminster, and his horse caught sight of a string of flags suspended across the carriage-way, and started off, and it was with the utmost difficulty he could control the animal. Witness, understanding that several of the flags were only exhibited as trade advertisements, communicated with the town clerk, and, being advised that the practice was illegal—in fact, an encroachment on the public rights—communicated with the divisional superintendent. Mr. Clifton, interposing, said he understood on that day there was a parochial garden party at Bedminster, and that the string of flags did not belong to his client at all, but were thrown across the road in honor of the event. Superintendent Harris deposed that in the second week in August the flag shown from the defendant's premises was lower than it was now. The defendant kept an American store, and one or two provision dealers also hung out flags in opposition, until one hoisted a string of eleven. He called on them, and, having complained, all of them discontinued exhibiting their flags with the exception of the defendant, who said he should contest the question whether or not he had a perfect right to do what he was doing. Mr. Herbert Thomas, magistrate, said the Bench were of opinion that no obstruction or nuisance had been proved, and they therefore dismissed the summons. A summons against another tradesman was, after this decision, withdrawn by the police. As several shopkeepers in Bristol, desirous of hanging their banners on the outer walls of their premises, have been awaiting the issue of this test case at Bedminster, the streets of Bristol will no doubt ere long assume a gala appearance, and the flags about shops will rival in number the "flags" of the pavements.—*London Grocer.*

Division of Electric Light.

Referring to the division of the electric light, the *Mining and Scientific Press* says:

"We give the result of experiments, of which we were an eye-witness, at the *atelier* of Messrs. Molera & Cebrian, in this city. The light used by them was a 4,000-candle electric light, inclosed in a chamber, on one side of which was a 24-inch Fresnel lens, from which the light is projected in parallel lines. The whole or any number of these lines or rays of light may be collected on a mirror or reflecting surface of any kind, and distributed in any greater or less intensity through secondary lenses without additional loss. In the experiment hardly one-half of the main light was collected, but it was divided into 16 separate lights, equal to 80 candles each. The secondary lenses were of small size, and situated in the ceiling, the light being thrown down. The quality of the light was equal to pure diffused daylight—in fact, several hundred shades of silk, arranged upon cards and placed side by side, could be distinguished as readily as by sunlight. Had it not been for the loss of light, occasioned by the size of the reflecting mirrors, we believe the light could have been subdivided to its fullest extent and into at least 50 separate lights. The whole light from the main lamp can be divided and subdivided, and distributed down to a single ray even, at pleasure. The dispersing lenses and reflectors are arranged inside the building so as to illuminate every part without any obscure corners. In the open air the rays of light thrown upon objects over a mile away in the darkness of night brought them into view with startling distinctness."

This system of electric lighting was recently illustrated and fully described in the columns of the SCIENTIFIC AMERICAN.

St. Paul (Minn.) as a Milling Center.

The *Pioneer Press*, of St. Paul, Minn., states that there are now building at the Falls of St. Anthony, five large flouring mills, of which one will probably make from 2,500 to 3,000 barrels a day, another 2,000, another 1,000 to 1,200, and the others from 500 to 800. In addition to this, Gov. Washburn is tearing out the inside of his old "B" mill in order to put in improved machinery, so that when completed it will have a capacity of from 1,500 to 2,000 barrels. It is worthy of note, in this connection, that it is but a little while since a 300 barrel mill was considered a large one, and 500 barrel mills were rare.

The *Press* estimates that when all the new mills are finished and running on full time, the daily production of flour in St. Paul will be over 12,000 barrels, which, with the mill-stuff made, will load seven trains of twenty-one cars each. At this rate the yearly production will be over 3,000,000 barrels, requiring 15,000,000 bushels of grain.

Nitrate of Silver Stains on Clothing.

To the Editor of the Scientific American:

In your issue of October 11 is a paper on the removal of silver stains from clothing. The salt recommended to be used is stated as bichromate of mercury. This is an error; it should be *bichloride* of mercury, known commonly by the name of corrosive sublimate.

Its solubility is greatly increased by first dissolving a little chloride of ammonium in the water.

GEORGE WILSON.

New Haven, Conn.

Pine Cones for Fire Kindling.

Almost the universal article used on the Continent for kindling fires are dry pine cones. A couple of these is usually enough to start a fire of dry wood, and several of them contain enough resinous material to start a coal fire without other kindling. They are readily ignited with a match, and are free from dust and insects. In Paris, and other large cities on the Continent, scarcely any other than pine cones are used for kindling purposes in the hotels, and it is a wonder to us that they have not been introduced for the same purpose here. We believe a large and profitable business might be made from gathering the cones in pine growing regions and selling them in our cities.

The Purification of Memphis.

A very earnest effort has been made by the National Board of Health to thoroughly disinfect Memphis. In this important work there had been used, by the end of September, upward of 170,000 pounds of copperas, 9,000 barrels of lime, 40 barrels of sulphur, 15 barrels of carbolic acid, 1,215 pounds of sulphate of zinc, and 1,200 gallons of zinc iron.

Powder-Post Producing Insects.

Our excellent contemporary, *The Hub*, publishes the following account of the wood destroying beetle *Lyctus*, which Charles Evans, of Cleveland, Ohio, communicates to that paper:

Of the multitude of insects which devour plants and trees, some attack only the leaves, others the trunk, and others the roots or various other parts. The nettle is infested by no less than forty species of insects, which are born, live, and die on its stems. The oak alone has one hundred and eighty-four species, and the hickory is the exclusive home of numerous tribes of insects. One particular species which infests the hickory is the *Lyctus*.

Fig. 1, accompanying, shows a magnified illustration of the beetle of the genus *Lyctus*, which is called the *Lyctus opaculus* (Packard). It is allied to the death-watch beetle of England, which is assigned to the genus *Petmus* (Hogg).

This is the chief pest of the carriage wood shop, and causes more trouble than any other insect in shops where second growth hickory is used. This beetle is of a dark chestnut-brown color, and has eleven jointed antennæ, club-shaped at the outer end, as shown in drawing, Fig. 2. These antennæ are distinct from each other at the base, and are inserted immediately in front of the eyes.

Fig. 3 shows a magnified sketch of the foot and leg of this beetle. The small circle denotes the natural size, the beetle being about three-sixteenths of an inch long. It matures as soon as the warm weather of spring or early summer sets in. I have found them in the shop, says Mr. Evans, as early as the 1st of March, and as late as the 15th of July. In the lumber shed they are most numerous from about the 15th of May to the 15th of June, during which time they mate, and the female deposits her eggs in cracks and pores of the wood. They select freshly sawed second-growth hickory, or that which has the most sap, on which the female deposits her eggs, such timber apparently being the best adapted for the nurture and growth of the larva or worm when hatched, which takes place in about fourteen days; and then they begin to eat their way into any piece of wood on which they have been deposited, confining themselves to the most sappy portions. When hatched they are very minute, but increase in size as they continue to work their way into the wood; and they attain their full growth about the last of December, when they are about three-sixteenths of an inch long, as before stated. At the latter time they work close to the outside of the piece, leaving only a thin shell on the outside as a protection. They then undergo transformation, and eat through the shell, and return to the outside as perfect beetles, in the spring or early summer, to reproduce and carry on their work of destruction, leaving small pin holes in the wood as evidence of their exit. Some call this trouble the "powder post," and others simply speak of the timber as "worm eaten." Some think that the worms breed in the wood, but this is an error, as investigation clearly proves.

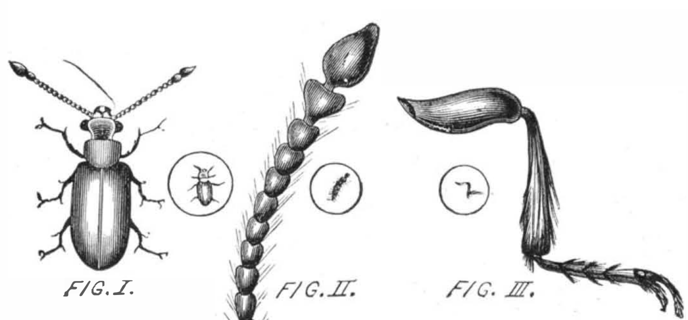


FIG. I. FIG. II. FIG. III.

The club shaped eleven-jointed antenna, shown in Fig. 2, is a mark of their identity, as it is a peculiar characteristic of the species, and can be defined with a small magnifying glass or any microscope.

The best method of destroying these pests is to destroy every piece of worm-eaten timber before the month of March. If any man in the shop finds the wood he is working is infected, instead of putting it in a corner and saving it, let him immediately use it for firewood, or otherwise destroy it; for if it be left in the shop it will surely help to continue the pests another year.

Timber cut in the month of August is less liable to be attacked by them, as it then has less sap than when cut in the spring or fall. With a little care in selecting timber, buying only that cut in August, and using caution and foresight in the shop and lumber shed, they may be almost if not quite got rid of; but if left to themselves, they will very soon spoil every piece of second-growth hickory about the establishment.

A New Fluorescent Body.

According to the *Journal of the Chemical Society*, C. O. Harz has discovered a new fluorescent body in *spergulin*. This product occurs in the seed coverings of the caryophyllaceous plants, *Spergula vulgaris* and *S. maxima* (Anglice "Spurrey"). It is produced at the time when the seeds blacken and are nearly ripe. Spergulin is very soluble in absolute and aqueous alcohol. Viewed by transmitted light the solution appears nearly colorless, with a shade of olive-green; by reflected light it exhibits a dark blue fluorescence. It has not yet been obtained in the form of crystals. It is very soluble in methylic alcohol, less so in amylic alcohol, and scarcely soluble in ether or petroleum. Concentrated sulphuric acid dissolves it, forming a dark blue liquid. The fluorescence of an alcoholic solution of spergulin is maintained for more than a year if the liquid be kept in darkness, but is rapidly destroyed by the action of direct sunlight, and more slowly by that of diffused light. Small quantities of caustic alkalies, or alkaline carbonates, added to an alcoholic solution of spergulin, transform it into an emerald green fluorescent body; and basic lead acetate produces a precipitate. The new compound contains 61·85 per cent of carbon, 7·05 of hydrogen, and 31·8 of oxygen. It appears to be related to chlorophyl, and is probably closely allied to phyllocyanin. An alcoholic solution of the product showed strong absorption, almost entirely in the violet; and in this respect differs considerably from chlorophyl, phyllocyanin, and phylloxanthin. Mr. Harz is disposed to regard spergulin as a feeble acid, the acid salts of which, as well as the acid itself, exhibit blue fluorescence, the neutral salts exhibit green fluorescence, and the basic salts are destitute of fluorescent properties.

Visit to a Pin Factory.

A correspondent of the *Evening Post* thus describes the mysteries of pin making:

"The pin machine is one of the closest approaches that mechanics have made to the dexterity of the human hand. A small machine, about the height and size of a lady's sewing machine, only stronger, stands before you. On the back side a light belt descends from the long shaft at the ceiling, that drives all the machines, ranged in rows on the floor. On the left side of our machine hangs on a peg a small reel of wire, that has been straightened by running through a compound system of small rollers.

"This wire descends, and the end of it enters the machine It pulls it in and bites it off by inches, incessantly, one hundred and forty bites to a minute. Just as it seizes each bite, a little hammer, with a concave face, hits the end of the wire three taps, and 'upsets' it to a head, while it grips it in a countersunk hole between its teeth. With an outward thrust of its tongue, it then lays the pin sideways in a little groove across the rim of a small wheel that slowly revolves just under its nose. By the external pressure of a stationary hoop, these pins roll in their places, as they are carried under two series of small files, three in each. These files grow finer toward the end of the series. They lie at a slight inclination on the points of the pins, and by a series of cams, levers, and springs, are made to play 'like lightning.' Thus the pins are pointed and dropped in a little shower into a box.

"Twenty-eight pounds of pins is a day's work for one of these jerking little automatons. Forty machines on this floor make five hundred and sixty pounds of pins daily. These are then polished. Two very intelligent machines reject every crooked pin even the slightest irregularity of form being detected.

"Another automaton assorts half a dozen lengths in as many different boxes, all at once and unerringly, when a careless operator has mixed the contents of boxes from various machines. Lastly, a perfect genius of a machine hangs the pin by the head, in an inclined platform, through as many 'slots' as there are pins in a row on the papers. These slots converge into the exact space, spanning the length of a row. Under them runs the strip of pin paper. A hand-like part of the machine catches one pin from each of the slots as it falls, and by one movement sticks them all through two corrugated ridges in the paper, from which they are to be picked by taper fingers in boudoirs, and all sorts of human fingers in all sorts of human circumstances. Thus you have its genesis:

"'Tall and slender, straight and thin,
Pretty, little, useful pin.'"

Preparation of Albumenized Paper.

Leicester, England, supplies very large quantities, and many of the largest firms in the kingdom are supplied by Messrs. Meadows & Son. No less than 5,000 eggs passed through the hands of those engaged, the whites only being utilized; and the enormous number of yolks are more than sufficient to supply Messrs. Dent's manufactory at Worcester, the yolks being in great demand for glove purposes. There is a demand for the yolks in Leicester for confectionery purposes; but the supply is more than being consumed, many being thrown away daily. Every sheet has to be bathed singly, and each pressed before the ream is allowed to pass out of the hands of the manufacturers. There are all kinds of tints; and the senior member of the firm being a practical chemist, and one of the best known among the members of the Pharmaceutical Society, brings his scientific knowledge to bear. It may not be uninteresting to know that a first-class hand—females only being employed, owing to their tender manipulation—can earn as much as 36s. a week; many can earn 20s., and even half timers can receive weekly as much as 8s., and this without having the disadvantage of being in badly-ventilated premises.

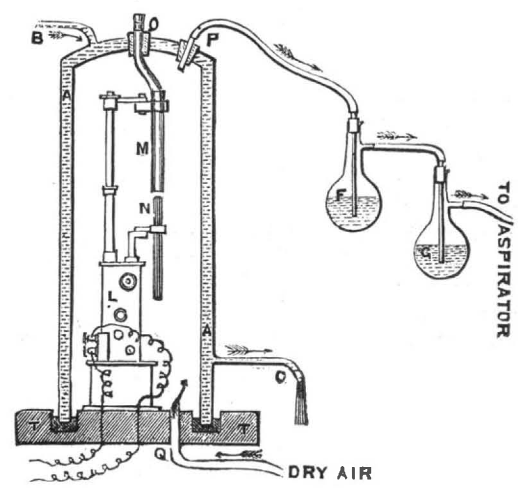
New Photo Printing Process.

A new method by Herr Schahl is to coat a thin zinc plate with chromated gelatine, which he then exposes under a negative. The film is then rolled up with some reducing substance, which adheres only to the parts affected by the light. Tracing paper impregnated with iron is then pressed against the plate, and the iron being reduced at those places, an image is obtained, which is said to be much more delicate than one produced by ordinary photo-lithography.

Acids from Electric Lights.

At the recent meeting of the British Association, Professor Dewar, F.R.S., read two very interesting papers, the one "On the Synthesis of Hydrocyanic Acid," and the other "On the Amount of Nitrous Acid Produced in Electric Illumination." In these communications, the subjects of which are closely connected together, Professor Dewar said that when carbon poles are used for the purposes of electric illumination in an atmosphere of hydrogen, acetyline is formed in a gaseous state, which readily condenses and combines with a large number of other compounds; but it does not combine with nitrogen, except at high temperatures. By passing powerful electric sparks through the mixture, combination with nitrogen takes place, and hydrocyanic acid is formed. [C_2H_2 (acetyline) + N (nitrogen) = 2HCN (hydrocyanic acid).] Professor Dewar expressed the opinion that what is generally called the carbon spectrum is in reality the spectrum of a hydrocarbon intimately related to acetyline and its compounds. When the electric light is produced between carbon poles in atmospheric air a mixture of acetyline and hydrocyanic acid is produced at the positive pole, which fact is of great interest, because if hydrocyanic acid and acetyline can be produced, almost all organic bodies can be produced artificially.

In the experiments which were made at the Royal Institution, Professor Dewar used a medium sized Siemens machine, absorbing about six horse power, and this was placed in circuit with a small sized Siemens lamp, by which the electric arc was produced in the interior of an air-tight chamber, fitted with arrangements for collecting and analyzing the air in which the arc was burning, and of measuring the heat produced by it. Professor Dewar thought that as the electric light is attracting great attention at the present time, it would be of interest, and perhaps attended with useful results, to make an examination of the impurities thrown into the air during the production of the electric arc; he therefore designed and had constructed the apparatus shown in the diagram, in which A A is a water jacketed bell cover, the mouth of which rests in an annular mercury trough cut in the circular wooden base, T T. Within this jacket a stream of water can be made to circulate by entering by the tube, B, and flowing away at the exit pipe, C. Within the chamber forming the interior of this bell receiver is placed the electric lamp or regulator, L, on which M and N are the upper and lower carbons respectively. The former of these, M, is a hollow tube of carbon, the latter being a solid pencil of the ordinary form. To the top of the upper hollow carbon pole is attached a short length of flexible tubing communicating with the outside of the chamber through a perforated cork at O, and, by connecting this with an aspirator, gaseous products may be drawn away from the center of the electric arc and subjected to analysis.



For examining the air surrounding the electric arc a stream of dry air is allowed to enter the receiver at Q, and by an aspirator is drawn away at P, and may be passed through any number of wash bottles, such as are shown at F and G, by which the air within the chamber, after having been subjected to the influence of the electric arc, may be analyzed. Professor Dewar, with this apparatus, found that with a Siemens lamp, adjusted to give a long arc, there was an average development of nitrous acid equal to half a gramme per hour, that is, between seven and eight grains; but with a short arc the amount of nitrous acid thrown into the air is very much less, not exceeding 0·08 of a gramme per hour. A similar series of experiments revealed the fact that the Jablochkoff candle discharges into the air a much greater quantity of nitrous acid than does the arc produced in the ordinary way; this amount is nearly double that produced by the Siemens lamp, being as much as one gramme per hour, that is, from twelve to fifteen grains, and this amount is still further increased if the insulating material (which consists of zinc with kaolin or plaster of Paris) be removed; the reason of this is that the lime absorbs some of the nitrous acid, nitrite of lime being produced.

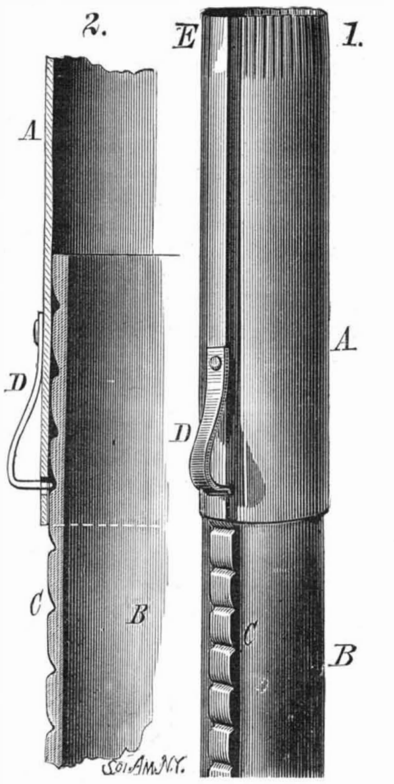
Professor Dewar's experiments show, says *Engineering*, that in places where the electric light is used, it should be placed under a ventilator, by which these deleterious compounds may be carried away, or it would have injurious effects on health as well as the binding of books. The substance produced Professor Dewar found to be nearly pure nitrous acid.

A New Therapeutic Agent.

A new method of treating cancerous growths, tumors, etc., consists in subjecting the parts to a stream of hot, dry air. This is proposed and has been successfully applied by Dr. G. A. Keyworth, of England. By means of a foot bellows he caused air to pass through a glass vessel containing calcic chloride, then through a heated iron tube, and thence directed the hot, dry air against the surface of a cancerous sore. The treatment was continued for an hour, the effect being to relieve the pain and cause the parts heated to shrink and dry up very considerably. It is believed that this new method will prove valuable when proper appliances are employed to maintain and direct the supply of the air.

AN IMPROVEMENT IN STOVEPIPES.

The inventor of the adjustable stovepipe shown in the accompanying engraving has endeavored to relieve those who are unfortunate enough to have to use stovepipe, from the trials and vexations incident to taking down and setting up stoves, by providing a single length of stovepipe which may be extended or contracted like a telescope, and which is formed at the ends so as to fit pipes whose sizes vary within reasonable limits.



PATTISON'S EXTENSION STOVEPIPE.

The section, A, is of sufficient size to permit the section, B, to slide freely in it, and it is provided with a spring pawl, D, that fits into notches formed in the seam, C, of the section, B. By means of this arrangement the two lengths may be held in any position relative to each other, and the compound length may be easily fitted into a space in a stovepipe of nominally the same size.

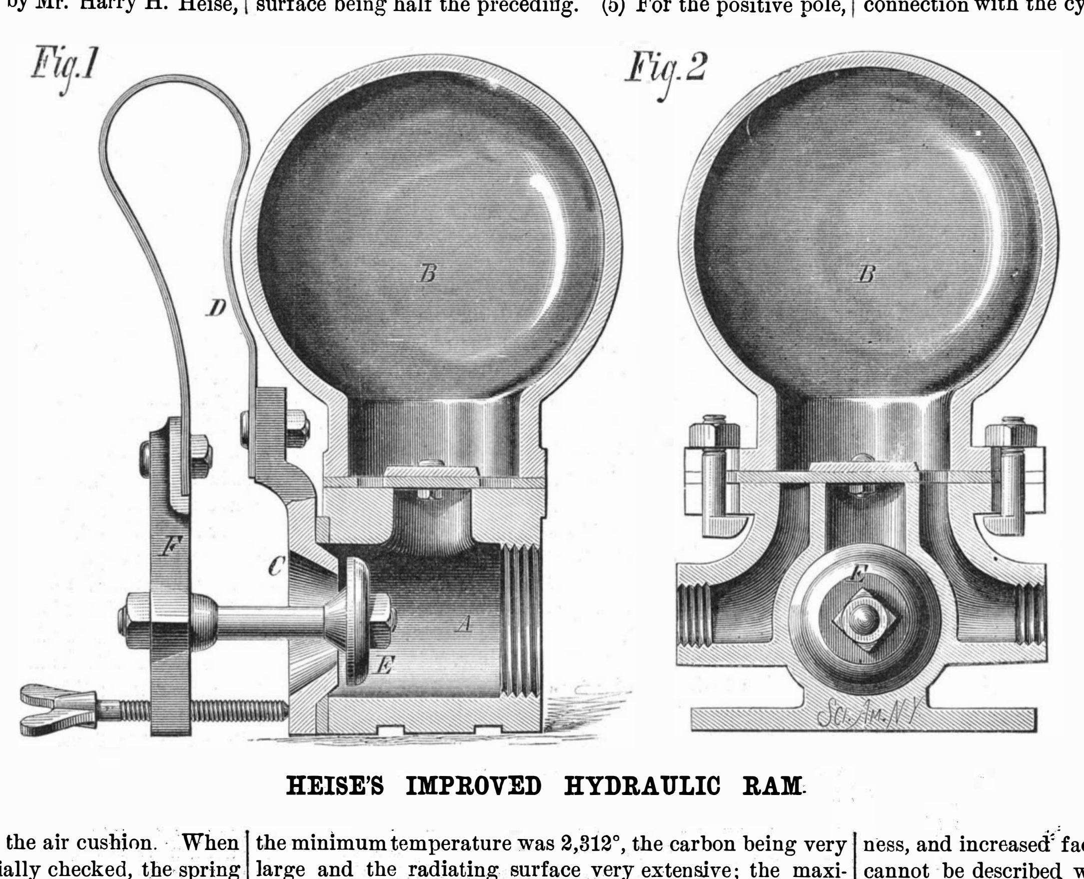
The exterior appearance of the pipe is clearly shown in Fig. 1, and the arrangement of the different parts will be seen in Fig. 2. The end of the outer section is corrugated to admit of easily contracting or expanding it to adapt it to various sizes of pipe.

For further particulars address the patentee, Mr. R. R. Pattison, 300 N. Fourth street, Terre Haute, Ind.

NEW HYDRAULIC RAM.

The accompanying engraving represents an improvement in hydraulic rams recently patented by Mr. Harry H. Heise, of Columbia, Pa. It is very compact and simple and seems well calculated for practical use.

The cylinder, A, is cast in one piece with the base that supports it, and is provided with three passages—a central one which discharges into the air chamber, B, and is covered with a check valve, and two lateral passages leading from the lower portion of the air chamber; only one of these is necessary, however, the two being formed merely for convenience in attaching the discharge pipes. The cylinder head, C, is apertured and provided with a valve seat fitted to the waste valve, E. This valve is supported by the spring, D, carrying at its lower extremity the bar, F. An adjusting screw passes through the bar, F, and bears against the cylinder head. The valve, E, is held open by the spring, D, until the water in the supply pipe attains sufficient momentum to close it, then the water escapes into the air chamber, where it is retained by the check valve, and is forced out through the discharge pipe by the air cushion. When the momentum has thus been partially checked, the spring opens the waste valve, E, and the operation is repeated.

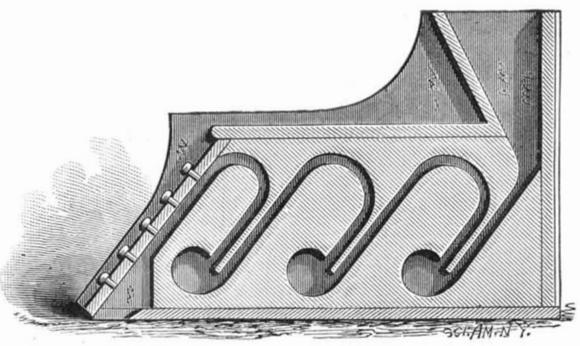


HEISE'S IMPROVED HYDRAULIC RAM.

ANALYSIS OF A PIECE OF MODERN ENGLISH CALICO.—Cotton, 53; china clay, 26; starch, 12; fatty matter, 2·5; chloride of magnesium, 2; chloride of zinc, 1·5; chloride of calcium, 0·5; moisture, 2·5: 100·0.

NEW AMALGAMATOR.

The novel and simple amalgamator shown in the engraving is the invention of Mr. Perry Dickson, of Spearfish City, Dakota Ter. The apparatus has a supply hopper, and


DICKSON'S AMALGAMATOR.

a series of downward and upward passages connecting with scroll-shaped chambers, arranged so that the pulp from the stamp mill is spread out in thin sheets, and the current is made to revolve with great velocity so as to bring the gold and quicksilver in the chambers into intimate contact. The amalgam remains in the chambers, but the lighter particles escape from one chamber to another, and are finally allowed to pass away through the discharge sluice.

The velocity of the water is regulated more or less by removing or inserting plugs in the side of the discharge sluice.

Photo Decoration of Metals.

Herr Falk's photographic method consists in coating the metallic surface with a photographic film, which is then exposed under a transparent positive; by this arrangement the parts lying beneath the dark places of the positive are not affected by the light, and are consequently capable of being etched. With curved surfaces a print taken in fatty ink on paper by a photographic method is transferred to the metal, and all the parts covered with the ink are by this means protected from the etching. It is a peculiarity of this process that the etching fluid colors all the etched places black, and this adds considerably to the effect of the whole.

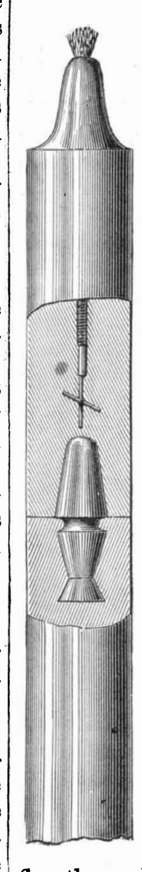
Heat of the Electric Light.

The temperature of the polar extremities of carbons giving the electric light has been recently investigated by M. Rossetti (*Jour. de Phys.*), using the same method and instruments as he used in measuring the temperature of the sun. (The face of a thermo-electric pile is placed at suitable distance to receive rays from a radiating surface of determinate size, and the thermal effect is measured by a very sensitive Wiedemann reflecting galvanometer; the temperature is deduced by means of a formula previously established.) We give, briefly, the author's conclusions: (1) The positive carbon pole, at the moment of production of the light, has always a higher temperature than the negative. (2) These temperatures vary according to variation of the current's intensity. (3) They are higher the smaller the radiating surface, provided, of course, it comprises the extremity of the point. (4) For the negative pole the minimum temperature was 1,910° C., the radiating surface being large, and, in part, of small brilliancy; the maximum 2,532° C., the radiating surface being half the preceding. (5) For the positive pole, the minimum temperature was 2,312°, the carbon being very large and the radiating surface very extensive; the maximum 3,200° when the carbon was thin, and the radiating surface nearly a quarter of that corresponding to the minimum temperature. (6) We may consider, says *Nature*, the temperature of the extreme negative polar point as equal to 2,500° at least; that of the positive polar extremity is not less than 3,200°.

Discovery of a Remarkable Cave.

The *Courrier de Tlemcen* (near Algiers) states that some miners occupied in blasting rocks in the vicinity of the picturesque cascades, discovered the entrance to a cave, the floor of which was covered with water. They ventured upon the subterranean river on a raft, and followed it for some 60 meters' distance, when it disappeared in a vast lake. Here the vault of the cave was very high and covered with stalactites. In many parts the miners had to steer their raft between colossal stalactites which reached down to the surface of the water; eventually they reached the end of the lake, where they noticed a canal extending toward the south, and into which the waters of the lake flowed. The workmen estimate the length of the lake to be 2 miles, and the breadth about $1\frac{1}{3}$ miles. They brought out a quantity of fish, which, they say, surrounded the raft, and which were found to be blind.

A NOVEL CANDLE.



In the service of some churches there are occasions when candles are employed; generally these candles are large, sometimes being thirty-four inches long and two inches in diameter; they are consequently quite expensive, and are never burned continuously for a sufficient length of time to exhaust them, but are lighted at different times, becoming shorter and shorter. It is desirable to have the candles of full length each time they are lighted. Mr. Francis Maguire, of Cambridge, Mass., has patented a novel device for renewing the tips, so that the candles will be full length whenever they are lighted.

The invention consists in securing in the upper end of the main body of the candle a tapering pin of sufficient length to steady and support the tip, the latter being cast with a conical socket for receiving the pin. The wick of the tip does not extend entirely through it, but is secured at its lower end to a small metallic anchor which holds the wick in the process of making the candle. The object of this device is to prevent the candle tip from being burned entirely to the socket.

What to Teach.

Rev. Charles Brooks, father of the State normal schools in America, was asked by a teacher this question: "What shall I teach my pupils?" He answered, "Teach them thoroughly these five things: 1. To live religiously. 2. To think comprehensively. 3. To reckon mathematically. 4. To converse fluently; and, 5. To write grammatically. If you successfully teach them these five things, you will nobly have done your duty to your pupils, to their parents, to your country, and to yourself."

ENGINEERING INVENTIONS.

An improvement in valves for steam engines has been patented by Mr. Albert F. Kirsten, of Orange, N. J. The object of this invention is to dispense with steam and valve chests in connection with the cylinders of steam engines, and operate the valves by direct action of the piston without levers or other intervening mechanism. For this purpose the inventor places the valves in slide ways within the cylinder, and moves them by contact of the piston head with lugs projecting from the valves.

Mr. Christopher Castle, of Cleveland, Ohio, has patented improvements in apparatus for cleaning boiler flues by directing a jet of steam through them. The object of the improvement is to prevent the wasting of steam and the blowing of the soot from the flues out into the boiler room. It consists in providing the nozzle of the apparatus with a conoidal head, provided with a sleeve fitting over the nozzle and bearing against a spiral spring, and a finger that operates the stem of the valve that shuts off the passage of steam through the apparatus.

Mr. Michael Condon, of Newark, N. J., has invented improvements in frogs and guard rails for railroads, designed to secure greater strength, cheapness, and increased facilities for repairing. The invention cannot be described without diagrams.

Mr. Henry Spindler, of East Saginaw, Mich., has invented a simple and effective clamp to be used in tubing or withdrawing tubes from salt, oil, or Artesian wells. It consists of a metallic frame in which is rigidly secured one jaw of a clamp, while the other jaw is secured to a nut that slides in the frame, and is worked by screw or lever.

ELECTRIC JEWELRY.

Among the specialties for which the French are noted there is nothing more curious than the electric jewelry, several specimens of which are shown in the accompanying cuts, which we take from *La Nature*.

The scarf pin represented in the left-hand figure consists of a small golden rabbit holding a liliputian mallet in each paw, with which it beats a roll on a small golden gong. The right-hand figure represents a golden skull, with movable diamond eyes and an articulated jaw. This is also a scarf pin, and its eyes and jaw are made to move in a singular manner. The bird shown in the center of the engraving is an ornament for the head dress. It is of gold, thickly studded with diamonds.

These pieces are connected by a fine concealed wire with a small battery carried in the vest pocket. When the battery is made to operate, the rabbit will strike the gong, the bird will move its wings, and the skull will roll its eyes and gnash its teeth.

The battery consists of a zinc and carbon couple contained in a hermetically closed vulcanite case, the zinc and carbon occupying the upper half of and the exciting fluid the lower half of the case. When the case is in a vertical position the exciting fluid does not touch the zinc or carbon, but when it is inverted or placed horizontally, the fluid comes into contact with the zinc and carbon, and the current traverses the coils of the diminutive magnets, which operate the mechanism of the pieces. The arrangement of the internal parts of both battery and scarf pin will be understood by reference to Fig. 2. The mechanism is much like that of an ordinary vibratory electrical bell.

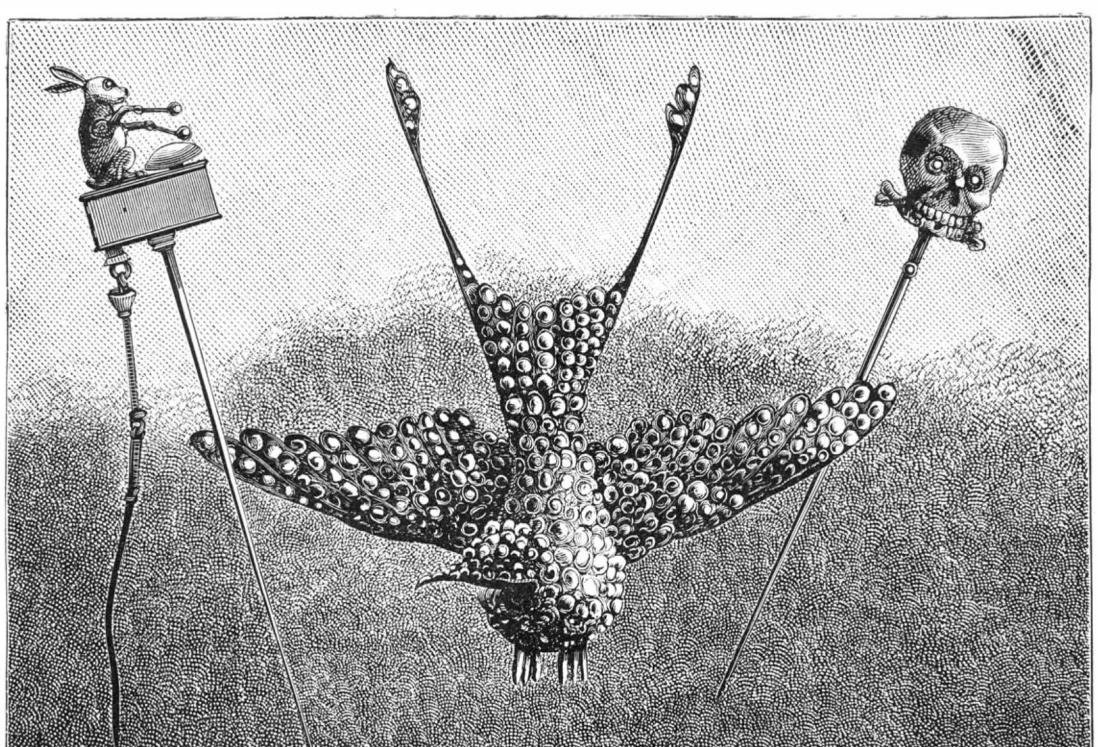
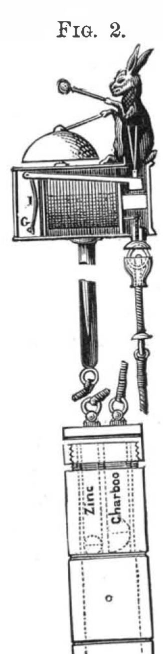


Fig. 1.—FRENCH ELECTRIC JEWELRY.

FIG. 2.



PALISSY PLATE.

The plate shown in the accompanying engraving is a copy of one of the rare and valuable productions of Palissy. It is painted in enamel colors, both opaque and transparent.

MISCELLANEOUS INVENTIONS.

Mr. Robert P. Lummis, of Altoona, Kan., has patented an improved clothes washer, which is simple in construction, convenient, and effective, washing the clothes very quickly and thoroughly. The invention consists in the combination of an air-forcing apparatus with the funnel or pounder of a clothes washer.

Mr. Charles W. Ball, of Macon, Ill., has patented improvements in axles for carriages, wagons, and other vehicles, the object being to more uniformly and efficiently lubricate the spindles, and to obtain a more perfect adjustment of the running gear. The axle has an oil reservoir, and in its spindle a recess separated by an apertured partition from the reservoir, so that the recess may be filled with packing that cannot work into and wrap around the spindle.

Mr Charles N. Pike, of Readsborough, Vt., has patented an improved machine for cutting grass and grain, which is so constructed as to have no down-draught upon the horses' necks.

An improvement in sewer gas consumers has been patented by Mr. William H. Ransom, of Philadelphia, Pa. The object of this invention is to prevent escape of sewer gas and vitiated air from sewers, cesspools, and holds of vessels into the house or vessel, by leading such gases to a chamber heated sufficiently to kill the virile matters, and afterward discharging the same to a chimney flue.

Mr. Benjamin Sniffin, of Sing Sing, N. Y., has invented a rowlock which is so constructed as to support the oars firmly when in use, and at the same time may be readily detached from the gunwale of the boat when not in use. It consists in a rowlock provided with a tapered dovetailed base plate and a set screw, in combination with a bedplate provided with a tapered dovetailed groove.

An improved apparatus for defecating cane juice has been patented by Mr. Lewis B. Hart, of Hope Villa, La. This improvement relates to sulphur machines for defecating cane juice, and are for the purpose of purifying and cooling the sulphur fumes before they enter the juice box, and to cause the complete mingling of the fumes with the juice in the box. It consists in the combination of a furnace, a water box, and a juice box, the latter being provided with corner strips, spirally arranged paddles, with their faces inclined to their shaft, and a connection with the furnace through the water box.

Messrs. Charles F. Leimer and Ludwig W. Kempf, of Deadwood, Dakota Ter., have patented a miner's knife having a compass arranged at the side, a pivoted magnifying glass at the rear end, and a pencil holder at the back.

Mr. John Dimelow, of Austin, Tex., has invented an artificial stone formed of hydraulic cement, hard clinker, soft clinker, and water.

An improvement in bake pans has been patented by Mr. Charles Jackson, of California, Ohio. The object of this invention is to improve the construction of the bake pans for which letters patent No. 204,975 were granted to the same inventor June 18, 1878. The invention consists in the combination, with the two pans, of fasteners provided with the handles, and made of tubes slotted longitudinally to receive and fit upon the wires of the pans.

An improvement in buttons, patented by Mr. Rudolph Liebmann, of New York city, consists in providing the button with a socket in which is inserted a spiral spring, and in applying it by causing the free end of the spring to engage the material and draw it up into the socket, so as to form a shank, which is held securely, and thus fastens the button to the clothing.

An improvement in bale ties has been patented by Mr. William Hill, of Henderson, Texas. The invention consists of a double hook, or a hook having a barb on the back of the shank near the eye, through which one end of the band is looped, while the other end of the band is provided with two slots, in which the hook and barb engage.

An improvement in earth closets has been patented by Mr. Richard W. Riddle, of Minneapolis, Minn. The invention consists essentially in a novel construction and arrangement of devices for operating the earth-carrying apron by the raising and lowering of the lid of the seat, whereby economy of space is secured, and the apparatus is adapted to be used either in connection with a stationary closet or a vault out of doors, or with a portable closet or commode used in the house.

Mr. John L. Petterson, of Brooklyn, N. Y., has patented an improved portable fire escape, which can be readily fitted for use, easily manipulated, and is especially adapted for carrying sick persons. It consists in a car inclosed on all sides by canvas, having top and bottom frames, entrance openings, and foot openings.

An improvement in raising and transferring hides in tan vats has been patented by Mr. Joseph A. Smith, of Rochester, N. Y. The object of this invention is to improve the construction of the machine for which letters patent Nos. 205,596 and 214,220 were granted July 2, 1878, and April 8, 1879.

Mr. Henry Smith, of Charlotteville, N. Y., has patented an improvement in the construction of the stools used by undertakers as a support for burial caskets, etc. It consists in pivoting the upper ends of the legs on one side to those on the opposite side, just below the top bar of the stool, and connecting the legs midway of the length of the stool by a jointed rod having its ends pivoted to opposite side bars, whereby the legs are capable of being folded together.

An improvement in combined pipe case and tobacco pouch has been patented by Mr. Rufus E. Dixon, of New York city. This invention relates to improvements upon the invention for which letters patent No. 35,305 were granted to the same inventor on the 20th day of May, 1862. These improvements relate to the construction of the opening through which the tobacco passes down into the bowl of the pipe, the slide or valve for closing the said opening, and the arrangement of the match box in the case.

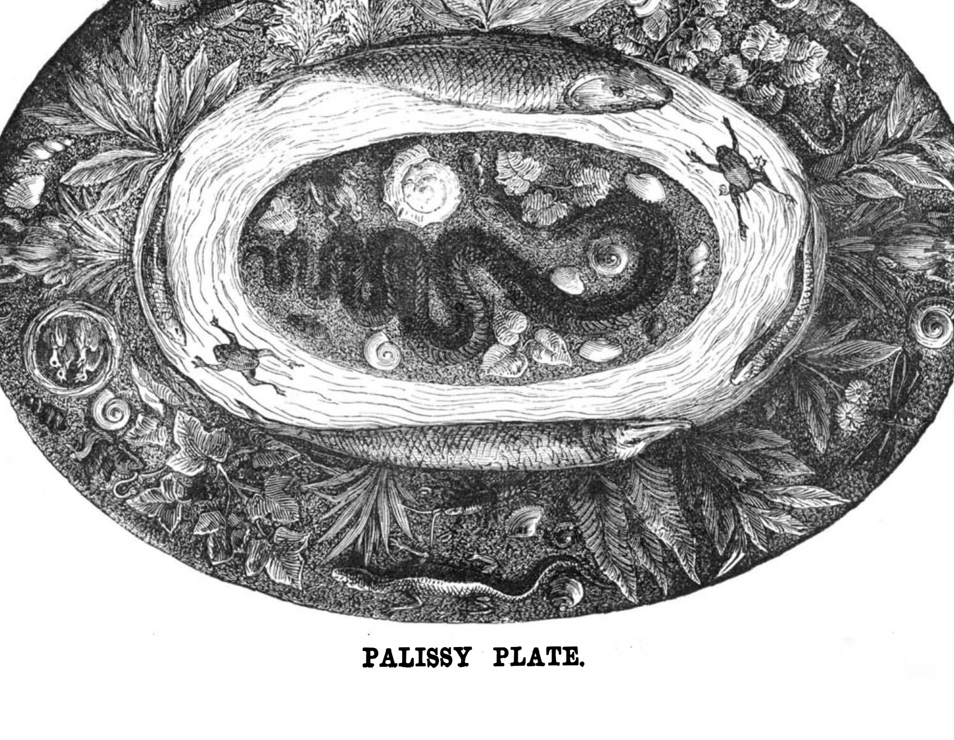
Mr. Henry McCue, of Terre Haute, Ind., has invented an improved kiln for burning brick, which is so constructed as to prevent the shriveling, cracking, breaking, or glazing of eye or jet bricks, to form less soft or clinker brick, to burn the brick to a more uniform size and color throughout the kiln, to use less fuel, to produce a better combustion, to allow the heat to be directed to any desired part of the kiln, and to require less labor in working the kiln.

An improved pendant for watch cases has been patented by Mr. Casimir H. Bisson, of Henderson, Minn. The object of this invention is to construct a watch case having all its joints air-tight, so as to thoroughly prevent access of dust to the works in the case. It consists in combining, in a stem-winding watch, a flanged stem, crown, and chambered pendant with a packing ring and nut.

An improved couch, patented by Mr. Benjamin F. Dare, of St. Louis, Mo., serves the double purpose of a seat and couch by day and a perfect double bed by night. It is simple in its construction and easily adjusted to its different uses. When the couch is unfolded it forms a bed of full dimensions, that rests firmly on its permanent support. It has ample room for bed clothing and pillows, and has the advantage of thorough ventilation and protection from dust.

Mr. John S. Gilbert, of New York city, has invented an improved discharge plug for wash basins, bath tubs, and other receptacles of water connected with a waste or discharge pipe leading to a sewer or other receiver, and it is so constructed that it may be tilted to allow obstructions to be removed from the upper ends of the discharge pipes, and may be detached to allow the pipe of a suction or force pump to be inserted for removing obstructions lodged further down.

An improved key ring, patented by Mr. John W. Jochim, of Ishpeming, Mich., is formed of the open ring having a notched flange



PALISSY PLATE.

formed upon one end, and a neck, a head, and a shoulder formed upon the other end, to interlock with each other.

An improvement in gas carbureters, patented by Mr. Horatio C. Train, of Kansas City, Mo., consists in the combination, with a carbureter, of a packing that consists of broken corn cobs.

An improvement in circular saws, patented by Mr. Daniel W. Weaver, of Blackshear, Ga., is designed to prevent dishing or buckling of circular saws by unequal expansion when heated; the invention consists in a saw made in two portions, the central portion being separate, and attached in a manner that permits radial expansion and contraction without effect on the outer portion or rim.

An improved animal poke has been patented by Mr. William Montgomery, of Amity, Pa. This device is for placing upon horses or cattle to prevent the animal from jumping fences or breaking them down; and it consists in a yoke adapted for resting upon the neck of the horse and attached by straps passing around the body, whereby the yoke cannot be thrown forward by movements of the head and neck, but may adjust itself to the position of the animal in feeding or lying down. The yoke is also fitted with spurs to prick the shoulders when pressure is caused by an attempt to throw down a fence, and with springs that prevent any pricking action by the weight of the yoke.

Mr. Wilson D. Scott, of San Francisco, Cal., has invented an improvement in bungs for barrels, kegs, etc., for holding beer and other similar liquids. It is so constructed as to admit air automatically to take the place of the liquid drawn out, and thus allow the liquid to flow freely while being drawn. It will close itself automatically when the outflow of the liquid stops, and will allow the valve to be locked when handling the cask.

Mr. Robert Kalbitz, of St. Louis, Mo., has invented an improved baking oven for stoves, arranged so that when the door of the oven is opened the dish containing the object that is to be baked is drawn out automatically, and in the same way is replaced when the door is closed.

An improved hame clip has been patented by Mr. William F. Beck, of Crawfordsville, Ind. It is made in two parts—a hook plate and a locking plate—of any suitable metal, preferably malleable iron, of a width corresponding with the width of the trace, and of suitable length to grasp a sufficient portion of the length of the trace.

Mr. Roy O. Crowley, of New York City, has patented an improved apparatus, by the use of which beer and other liquids, during the process of fermentation, may be kept at a uniform temperature automatically and without its being necessary to change the temperature of the room.

Mr. Edmund McKinney, of Key Port, N. J., has invented a simple and efficient fastening device for crates used in transporting fruit and other produce. It consists in a hasp secured upon the cover of the crate, and a socket piece fitted with a locking spring tongue, secured upon the box for holding the hasp, in connection with a screw for clamping or locking the parts to prevent their disconnection.

An improved combined door bolt and check has been patented by Mr. Walter S. Burnham, of Ashtabula, O. The object of this invention is to provide a chain bolt that, when applied to a door, will serve to securely hold it closed or partly open, as may be desired.

Messrs. Robert Jones and Lewis S. Bonbrack, of Waynesburg, O., have patented an improved metal roofing, which consists of an anchor provided with a short and a long prong, so arranged that the short prong is bent over the flange of one of the roof plates, and the long prong is passed through and passed over the flange of the adjoining plate. The flange of the latter plate is then bent down and over the flange of the first plate, so as to form the cap of the roll joint.

Mr. John W. Lewis, of Lester Manor, Va., has invented an improvement in ventilating pads for horse collars, breast straps, saddles, back bands, and other parts of harness, to give elastic pressure on the animal, furnish ventilation to prevent galling, and permit the use of the harness upon galled animals without hindering the healing of the sores. It consists in a harness pad formed of parallel perforated rubber tubes, secured together in position by similar tubes attached at right angles thereto.

The Cape of Good Hope.

The Cape of Good Hope lies at the end of a long, narrow promontory, running nearly north and south, and forming between itself and Cape Hanglip, on the east, a large bay known as False Bay, while at its point of origin from the mainland and on its east side is Table Bay, with Cape Town at its head.

The promontory has a sort of backbone of mountains, which in some places come right down steep into the sea; in others, are flanked by more or less extensive sand flats.

The mountains are highest toward the northern extremity of the ridge, which terminates in the far-famed Table Mountain, 3,550 feet in height. Constantia Berg, about one quarter of the distance from this point to the Cape, is 3,200 feet high. The remaining mountains range from about 2,000 to 1,500 feet.

The sandy flats are, toward the southern part of the promontory, almost confined to its western side, the steep slopes of the mountains on the False Bay side being for the most part washed directly by the sea, but at the head of False Bay a wide extent of flat sandy plain extends right across the head of the bay and round the foot of Table Mountain northwards. This plain is known as the "Cape Flats."

The Cape of Good Hope is at the tip of the promontory, and is not (says Mr. Moseley, in his Challenger Notes), as I used to think, the southernmost point of Africa. Cape Agulhas, to the eastward, is far south of it.

The mountains are entirely composed of a hard metamorphic sandstone, passing in many places into a white quartzite, which is disposed in perfectly horizontal strata. This perfect and remarkably uniform horizontality of the rock beds is the cause of the peculiar form of the Cape land surface, and forms the chief feature in the landscape.

Everywhere the mountains rise by a series of steps, with flat intervening surfaces. Table Mountain itself derives its name from its horizontal flat top, bounded by perpendicular cliffs rising straight up from the flats; and the same formation being continued for hundreds of miles inland, the country continually rises in steps, forming successive table lands, known as the Karroo Plains, about 2,000 feet above sea level, and beyond these the Ruggefeld, 3,500 feet in elevation.

The hills about the Cape district have all an exactly similar appearance as far as their clothing with vegetation is concerned. They look not unlike Scotch moorland, being covered everywhere with low bushes without trees. The vegetation has a general brownish or grayish tint; there are no bright greens in the landscape. This arises from the fact that the plants are nearly all evergreen, and have, as a rule, either narrow needle-like leaves, like the pines, or leaves covered with gray downy hairs, in fact, all sorts of contrivances for resisting their great enemy the drought.

The most characteristic feature, however, in the landscape is the showing through, in all directions, of the red soil between the bushes and clumps of vegetation; the interspaces not being filled in with grasses, and no continuous covering of vegetation being formed.

Above Wynberg are the talus slopes and débris mounds of Table Mountain, covered with the wonderful silver tree, whose leaves shine like burnished metal, and which is found nowhere else in the world but about the slopes of this mountain and its immediate neighborhood. It does not even grow at Simons Bay. Nowhere on the earth but just round this one mountain. The silver tree (*Leucadendron argenteum*) is one of the Proteaceæ, which natural order is characteristic of the flora of the Cape and South Australia, the genera being nearly equally divided between the two regions, and found scarcely anywhere else.

A few only are found in tropical Australia, in New Zealand, South America, and equatorial Asia. Another group of plants, the Restiaceæ, serve further to connect the Cape with Australia, and there are other marked alliances. The wide difference between the West and East Australian flora has been treated of by Sir Joseph Hooker, and the greater resemblance of the Western Australian flora to that of South Africa.

Sir Joseph Hooker thinks it probable, from botanical grounds, that Western Australia was connected with the Cape district by land at a time when it was severed from Eastern Australia.

The American Trade Revival.

Up to the present time the fears expressed that the great revival of trade in the United States should prove a "flash in the pan" must certainly be pronounced groundless. Our advices this week are full of remarkable statements as to the business actually in progress, and the most buoyant and cheerful anticipations as to the near and fairly distant future. Producers in all directions appear to have been literally taken by storm by the sudden inrush of orders, and to be absolutely unable to cope with the current requirements of the market. The upward wave is apparently in no sense local or confined to any particular area, but broad, general, and progressive. The East is not busier than the West, nor is the North less brisk than the South. From every leading business center the reports are alike hopeful and bristling with the records of actual sales.

Taking the trade reports of the *Iron Age* for September 4, we find abundant evidence of the plenitude of work and of the upward course of prices. General hardware is therein said to be "booming" in New York, and values were steadily growing stronger. Nails had sold largely, and it was an accepted conclusion that a further advance would be immediately adopted. The spoon manufacturers had just enhanced prices by decreasing discounts; the makers of vises, picks, mattocks, etc., had advanced prices about 5 per cent; horse and mule shoes had put up quotations to the extent of 25 cents per keg; wrought butt hinges had been advanced by some houses; the American Screw Company had declared a rise in coach screws, rules and levels had gone up; the Douglas Ax Company had increased prices 50 cents per dozen; and quite a host of other similar changes were in progress.

As regards American pig iron the market was strong, the demand being far in excess of the visible supply, and prices hardening. About 2,200 tons of Scotch had arrived at the port of New York in a week, and other large lots had been brought forward. At Philadelphia the market was still advancing, every description of iron being eagerly sought for, and only obtained at higher prices. There was not the slightest sign of a retrograde movement, and a leading importing house there reported sales of as much as 100,000 tons of pig iron in England on American account. In finished iron everything was active, and a magnificent fall trade was looked forward to.

In steel rails a large business had been done for deliveries in 1880, at as high as $50 per ton. Old rails were sought for at rates, which it was expected, would be reduced by large importations from Europe. From Pittsburg it was reported that the business done in August was larger than ever before in one month, and at prices which advanced almost as rapidly as in the war times. Pig makers were very firm and producers of Bessemer iron had "an excited and unsettled market." The two largest buyers in the vicinity were stated to have contracted for a good deal of hematite pig in Europe. The Western Iron Association had held another meeting, and had put up prices to a "two and a half dollar card," the mills having to refuse orders even at that enhanced rate. All the rail mills were sold up close for the year's production, and the market appeared utterly bare of old rails. In steel more was doing. From Chattanooga an excited and rapidly advancing market was reported, with good prospects, owing to the excellence of the crops in the locality. Boston communications spoke of an active demand for pig, with a constantly hardening tendency in prices. All kinds of manufactured iron were brisk, and galvanized kinds had been more than once raised. Steel, too, was more sought after, and at higher figures.

From Cincinnati the current reports were hopeful, with very light stocks and a strong market. At Baltimore trade ruled very active, with values firm and advancing. At Louisville the market was quite excited, most of the furnaces being sold forward for several months, and nobody having any stock. At Richmond there was a firm market, and prices were moving upward. From other quarters the same state of things was spoken of. Under such circumstances and conditions as are here briefly epitomized it is scarcely possible to doubt any longer that the revival is real and strong in the United States. That market is apparently far from able to supply its own wants. The surplus demand naturally and necessarily comes here. We have already experienced some of its first fruits. Within the past few weeks we have sold quantities of iron which are almost beyond belief to American buyers—probably in the aggregate over 150,000 tons. Our own markets are beginning to show signs of renewed vitality; indeed, as regards pig iron there is a clear rise. Our rail mills are fully engaged, and many of our other industries—the engineering branches, for instance—are better engaged. These are all good signs, and, although the harvest is against us, may possibly be taken as a far more rapid and more thorough revival of trade than most of us at present would pretend to predict. So mote it be!—*London Ironmonger*.

Building in New York.

There has been a marked increase in the number and value of the buildings constructed in this city during the past eight months over the corresponding period last year. The Superintendent of the Department of Buildings gives the statistics as follows: First eight months of 1879—Number of buildings constructed, 1,450; cost of construction, $16,351,512. First eight months of 1878—Number of buildings constructed, 1,128; cost of construction, $10,707,200. Increase in number of buildings constructed, 322; increase in cost of construction, $5,644,312.

Record of Great Fires.

History is full of accounts of the devastation caused by fire in the cities and towns of nearly every country of the civilized world. A record of these conflagrations, says the *Fireman's Journal*, cannot but be of interest.

In the year 798 London was almost entirely destroyed by fire, and again in 982 the greater part of the city burned. In 1086, all houses and churches from the East to the West gate burned. What is known as the "great fire" occurred in 1666. It began September 2, and continued three days, burning over 436 acres. Houses to the number of 13,200, including many public buildings, were destroyed; and six persons were killed. The loss was estimated at $50,000,000. In 1794, 600 houses burned, loss over $5,000,000; in 1834 the Houses of Parliament were destroyed; 1871, Tooley street wharves burned, entailing a loss of $10,000,000; in 1873, Alexandria Palace destroyed. The great fire at Edinburgh occurred in the year 1700. At Brest, France, in 1784, explosion and fire in a dockyard caused a loss of $5,000,000. Paris (Communist devastation), 1871, $160,000,000. A fire at Rome, in the year 64, lasted eight days, and ten of the fourteen wards of the city were destroyed. Venice, Italy, was almost wholly destroyed by fire in 1106, and in 1577 the greater part of the city was ruined by an explosion during a fire at the arsenal. Leipsic, Germany, in 1420, lost 400 houses; 1491, Dresden, Germany, destroyed. In 1811, forest fires in Tyrol destroyed 64 villages and hamlets. 1842, Hamburg, fire raged one hundred hours, May 5–7. During the fire the city was in a state of anarchy; 4,219 buildings destroyed, one fifth population homeless, and one hundred lives lost; total loss, $35,000,000. After the fire contributions from all Germany came in to help rebuild the city. At Copenhagen, in 1728, 1,650 houses burned; 1794, Royal Palace, with contents destroyed; 1795, 1,563 houses burned. At St. Petersburg, in 1736, 2,000 houses were burned; the great fire occurred in 1862, when the loss was $5,000,000. In 1752, at Moscow, 18,000 houses were burned. On September 14, 1812, the Russians fired the city to drive out Napoleon. The fire continued five days, and nine tenths of the city was destroyed. The number of houses burned was 30,800, and the loss was $150,000,000. At Constantinople, in 1729, a fire destroyed 12,000 houses and 7,000 persons. In 1745 there was a fire which lasted five days; January, 1750, 10,000 houses burned; April, same year, loss $10,000,000;

later, same year, 10,000 houses destroyed; 1751, 4,000 houses; 1756, 15,000 houses and 100 persons; years 1761, 1765, and 1767, other great fires; 1769, 1771, and 1778, great fires; 1782, fire burned three days, 10,000,000 houses and one hundred lives lost; February, same year, 600 houses; June, 7,000; 1784, 10,000 houses; 1791, between March and July, 32,000 houses burned, same number in 1795; 1799, in suburb of Para, 13,000 dwellings and many magnificent buildings destroyed; 1861, August 16, 12,000 houses and 3,000 shops in finest quarter were destroyed; 1818, August 13, fire destroyed several thousand houses; 1826, 6,000 houses; 1848, 500 houses, 2,000 shops, loss estimated $15,000,000; 1865, great fire destroyed 2,800 houses and public buildings, 22,000 persons left homeless; 1870, June 5, the suburb of Para, occupied by the foreign population and native Christians, swept by a fire which destroyed over 7,000 buildings, many of them among the best in the city, including the residence of the foreign legations; loss estimated at nearly $25,000,000. Scutari, Greece, 1797, 3,000 houses burned. Smyrna, Greece, 1763, 2,600 houses consumed, loss $1,000,000; 1772, 6,000 houses; 1796, 4,000 shops; 1841, 12,000 houses. Yeddo, Japan, 1872, 6 square miles burned over, 20,000 persons homeless; 1873, 10,000 houses destroyed.

At Boston, Mass., 1679, all the warehouses, 80 dwellings, and vessels in the dockyards, were consumed, loss $1,000,000; 1760, fire caused loss of $500,000; 1787, 100 buildings destroyed; 1794, 96 buildings burned; 1872, great fire November 9 and 10, the richest part of city destroyed, an area of 65 acres burned over, 776 granite and brick buildings consumed, loss $75,000,000. Charleston, S. C., 1778, fire caused the loss of $500,000; 1796, 300 houses burned; 1838, one half of city burned, loss $3,000,000. Savannah, Ga., 463 buildings, loss $4,000,000. New York, 1835, 530 buildings in business center of city destroyed, 52 acres burned over, loss $15,000,000; 1845, 300 business blocks, 35 persons killed, loss $7,500,000. Pittsburg, 1845, 300 buildings destroyed, loss $10,000,000. Albany, 1848, 600 houses burned, loss $3,000,000. St. Louis, May 17, 1849, 15 blocks, 23 steamboats, loss $3,000,000; May 4, 1851, three quarters of the city burned, 2,500 buildings, loss $11,000,000; same year, 600 houses, loss $3,000,000. Philadelphia, 1850, July 9, 400 buildings burned, 30 lives lost, loss $7,000,000; 1865, 50 buildings burned, 20 persons killed, loss $500,000. Washington, 1851, part of Capitol and whole of Congressional library burned. San Francisco, May 4 and 5, 1851, 2,500 buildings and a number of persons burned, more than three fourths of city destroyed, loss $10,000,000; June, same year, 500 buildings, loss estimated at $3,000,000. Chicago, 1857, 14 lives, $500,000; 1859, September 15, $500,000; 1866, August 10 and September 18, $500,000 each; 1871, the greatest fire of modern times, October 8 to 10, 2,124 acres, or 3½ square miles, burned over in the very heart of the city, 250 lives lost, 98,500 persons made homeless, and 17,430 buildings, one third in number and one half in value of buildings in city consumed, loss estimated at $190,000,000. Troy, N. Y., 1862, nearly destroyed by fire. Portland, Me., 1866, great fire July 4, one half of the city burned, 50 buildings blown up to stop the progress of the fire, loss $11,000,000. Quebec, 1815–16, $1,000,000; 1845, May 28, 1,650 houses burned, one third population made homeless, loss $3,000,000; another fire June 28, 1,300 dwellings, 6,000 persons made homeless, loss $1,000,000; 1866, 2,500 houses and 17 churches in French quarter burned. St. John, N. B., 1837, January 13, 115 houses and nearly all the business part of the city burned, loss $5,000,000; 1877, June 21, 200 acres burned over, 1,650 dwellings, 18 lives lost, total pecuniary loss $12,500,000. St. Johns, Newfoundland, 1846, loss $5,000,000. Montreal, 1850, June 7, 200 houses in finest part of city burned; 1852, July 9, 1,200 houses burned, 10,000 persons destitute, loss $5,000,000. Santiago, South America, fire in the Jesuit church, 2,000 persons perished.

Improved Electric Candle.

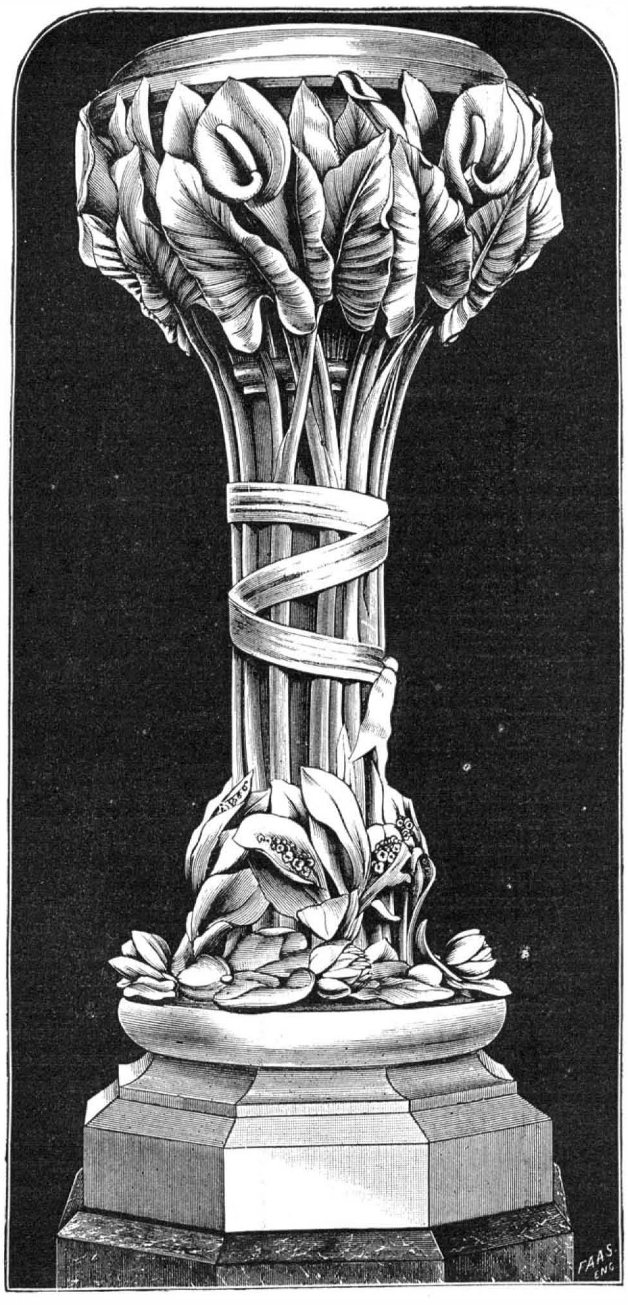
An improved form of electric candle has been produced by Mr. S. Cohné, of London, for which the following advantages are claimed: Up to the present time all electric candles in use have been made from pure carbon or carbon mixed with other substances, such, for example, as kaolin or plaster of Paris, all which have the great disadvantage of burning too quickly away, and producing in a greater or less degree a flickering light. Such candles, therefore, require controlling mechanism to regulate their distance from each other. Mr. Cohné's invention consists in making or forming a candle of ultramarine, or the substances which when united together form or produce ultramarine. The ultramarine may be green, blue, or of any other color in which it is produced. It may be either used in its pure state or mixed with carbon, kaolin, plaster of Paris, molasses, or with any metal reduced to powder so as to be in a finely divided state. The metal preferred is copper, and it is ultramarine, carbon, powdered copper, and molasses that the patentee employs. To about four parts of carbon he adds one part of ultramarine and one part of the finely divided metal, and as much molasses as will, when mixed with the other materials, be sufficient to form the whole into a paste which can be moulded or otherwise formed into the shape desired.

The candle thus formed is dried and heated for a sufficient time by fire, by whose action all the moisture is evaporated, the sulphur is burned away, and the molasses, as well as all other organic matter, becomes carbonized. The patentee does not confine himself to the exact proportions above named, and it will be understood that the mixture alluded to is only one of those in which the candle may be made. When these candles are put into use, the resistance and the current in the arc are to a very great extent less varying, and controlling mechanism to regulate the distance is nearly unnecessary, because the candle is consumed very slowly in comparison to those heretofore in use.

BAPTISMAL FONT.

The marble baptismal font shown in the engraving is from the establishment of Messrs. Struthers & Sons, Philadelphia. In simplicity and grace, in purity of sentiment and harmonious blending of ornament, it is comparable with anything we have seen.

From a plain octagonal base rises a slender, round shaft,



MARBLE BAPTISMAL FONT.

on which rests a circular basin, with receding mouldings lessening toward the rim. Around the foot of the shaft are strewn numbers of pond lilies, their round, flat leaves disposed on a horizontal plane, while here and there among the group are sprays of delicate lilies of the valley, the blossoms half hidden in their sheltering sheath-like leaf. Rising above these, almost to the rim of the basin, is a sheaf of beautiful white water lilies, their long, smooth stems bound to the shaft of the column by a ribbon band, their broad leaves and graceful flowers encircling and completely hiding the lower portion of the basin.

The Influence of Temper on Health.

Our English contemporary, *Capital and Labor*, which is generally correct in its assertions, thinks that, while excessive labor, exposure to wet and cold, deprivation of sufficient quantities of necessary and wholesome food, habitual bad lodging, sloth, and intemperance, are all deadly enemies to human life, none of them are so bad as violent and ungoverned passions. Men and women have survived all the former, says the writer, and at last reached an extreme old age; but it may be safely doubted whether a single instance can be found of a man of violent and irascible temper, habitually subject to storms of ungovernable passion, who has arrived at a very advanced period of life. It is, therefore, a matter of the highest importance to every one desirous of preserving "a sound mind in a sound body," to have a special care, amid all the vicissitudes and trials of life, to maintain a quiet possession of his own spirit.

Powerful Guns.

Exceptionally satisfactory results have been obtained at the proof butts in the government marshes, adjoining the Royal Arsenal, Woolwich, with one of the 80 ton guns constructed for H. M. S. Inflexible. The gun has just been increased from 15½ inches to 16 inches, and has had its chamber enlarged for the effectual and deliberate consumption of the comparatively slow gunpowder, which experience has proved to be of the greatest service in enormous charges, at the same time that the powder was carefully compounded, and particular attention paid to the air spacing of the cartridge. At the first round, which was simply a warmer, with 428 lb. of powder, the velocity of the projectile was 1,603 feet per second, the projectiles weighing rather above 1,709 lb. The full charge of 445 lb. of powder was then fired, and the electric recording instrument marked a velocity at muzzle of 1,657 feet per second, or a fraction of 9 feet in excess of the German gun's velocity under almost precisely similar conditions. The officials engaged in the trial, to satisfy any doubt which might exist as to the accuracy of the test, again had the gun loaded exactly as before, and again the speed of the great bolt was given in the instrument room as 1,657 feet per second, which would enable the projectile to pierce and destroy an enemy's vessel coated with 32 inches of iron plating. It will be remembered that at Meppen, firing a projectile of 1,712 lb. with a powder charge of 451 lb., Krupp registered a muzzle velocity of 1,648 feet per second, which is calculated to be equivalent to an energy of 32,242 foot tons or the penetration of 32 inches of iron armor. The three other 80-ton guns of the Inflexible have to be tried under similar conditions as the one lately tested.

There seems to be no intention of submitting a tube of Sir Joseph Whitworth's so-called compressed steel to the New Gun Committee for consideration and report. Fresh from his recent victory in the United States gun competition, Sir William Palliser proposes to bore out the steel tube of a large Woolwich gun to relieve the strain on the casing, and then to insert a very long loose coiled wrought iron barrel on his well known plan. Notwithstanding the fact that no burst has taken place out of two thousand such guns which are in constant use in the British Empire and the United States, and that the Director of Ordnance of the United States Navy has proved that his guns can be fired with large charges without affecting their casings, it has been decided, as one of our daily contemporaries is informed, that nothing from Sir William Palliser shall be permitted to appear before the new Gun Committee for their consideration and report.

The Italian Government have just ordered eight more 100-ton guns to be made by Sir William Armstrong & Co. They are to be breech-loaders, and as there will be no departure from the coil system in the construction of these weapons, the question will be brought to a practical issue whether large breech-loading guns can be made on the coil system to compete with the steel breech-loaders of Herr Krupp. Eight 100-ton guns represent a tremendous armament. Each shot will start from the powder chamber with a pressure of about 5,000 tons at its rear, and the energy stored up in the projectile as it leaves the muzzle will be equal to the raising of 44,000 tons a foot high. The penetrating force will be equal to 3 feet of armor at close quarters, with proportionate reductions according to distance. There will be eight 100-ton muzzle-loaders for the armament of the Duilio and Dandolo, those vessels carrying four each, and there will be eight breech-loaders for the Italia and Lepanto. The muzzle-loaders already supplied are characterized, like the Krupp guns, by great length of bore, and, of course, this feature will be maintained, if not further developed, in the breech-loaders. While the Woolwich 80-ton gun has a bore only 18 calibers long, that of the Armstrong 100-ton gun is between 20 and 21 calibers in length; but even the 80-ton gun is proportionately longer than the Woolwich 38-ton gun, the latter having a bore of only 16 calibers.

The four 100-ton muzzle-loading guns, made by Sir William Armstrong for the Italian Government, but purchased by the British Government out of the vote of six millions, are destined to be employed for the coast fortifications, the localities specified being Malta and Gibraltar.—*The Engineer.*

The Dominion Exhibition.

The Dominion Exhibition at Ottawa was closed September 27, and though a success as an exhibition, it was financially a failure. The total gate receipts were only a little over $9,000—less than half as much as was taken in at the Toronto fair last year.

ERRATUM.—In the description of the performance of Mr. Edison's electric generator last week, the figures showing the number of lights and the power required to produce them were omitted from a portion of the edition. The clause referring to these points should read: It requires but five horse power to drive the machine, and the current generated is sufficient to produce forty lights of sixteen candle power each. Mr. Edison has since informed us that the generator may be forced to do much more.

Scientific Discoveries the Basis of Invention.

Had not the steam engine been developed, it is likely that railways, steamships, and all the numerous uses to which that instrument is now applied, would have been comparatively unknown. The discoveries of nitric acid, hydrochloric acid, oil of vitriol, and washing soda, by the alchemists, led to the erection of the numerous great manufactories of those substances which now exist in all civilized countries.

The discovery of zinc has led to an improvement in telegraphy. The discovery of nickel has led to the great modern use of German silver in the construction of electro-plated and other articles. The discovery of chlorine formed the basis of nearly all our modern processes of bleaching cottons and other fabrics. The discovery of oxygen has enabled us to understand and improve in a great number of ways the numerous manufacturing, agricultural, and other processes in which that substance operates.

There is probably not an art, process, or manufacture, which is not largely due to scientific discovery; and if we trace them back to their source, we nearly always find them to have originated in scientific research. The great pecuniary benefits arising from the application of science are generally reaped in the first instance by all great manufacturers, agriculturists, merchants, and capitalists. Countless fortunes have been made by means of processes and manufactures based upon scientific discovery. In a general way, however, the greatest pecuniary benefits arising from science, sooner or later go to enrich the possessors of land.

THE BASIS OF INVENTION.

Discovery is usually the basis of invention. Science has shown that it is by means of inventions based upon new discoveries that the greatest utilities are obtained, rather than by the exercise of invention upon knowledge acquired long ago. A man cannot invent an improvement unless he possesses scientific knowledge. The discovery of a single substance, such as oil of vitriol, a washing soda, has led to the formation of many valuable inventions, patented or otherwise. Nearly every manufacturer in this country is deriving, from scientific discoveries, advantages for which there have been made little or no payment to the discoverer.

For instance, the makers of coal tar and the dyers of wool and silk are using the discovery of nitro-benzine; manufacturers of picric acid and "French purple" have enjoyed the fruits of the labors of a well-known Englishman; the various telegraph companies, copper smelters, and makers of copper wire are using the discovery of the influence of impurities on the electric conducting power of copper. The makers of electro plate and of German silver are deriving great profits from the labors of Faraday; makers of Bessemer steel enjoy advantages derived from the spectrum discoveries of Kirchhoff; iron and copper smelters, metallurgists, dyers, calico printers, bleachers, brewers, makers of vinegar, white lead, varnishes, colors, soaps, phosphorus, oil of vitriol, and many others, are deriving benefit from the discoveries of Priestley. Added to all this, there are the pecuniary advantages of the use of even only a few of these scientific discoveries where gains are enormous.

ADVANTAGES OF SCIENTIFIC RESEARCH.

There is not a person in the United States who has not derived some advantage, in one way or another, from scientific research. For instance, the advantages of gaslight, rapid postal service and transmission of goods, railway traveling, cotton goods, photography, improved medicine and surgery, preserved meats, condensed milk, etc., etc., have been reaped more or less by every one, even the pauper coming within the pale of the advantages.

Science has also by its developing process given employment to the whole army of workmen in numerous arts, manufacturers, and occupations. In the United States scientific research gives employment, in manufactures alone, to almost 3,000,000 persons, whose wages it is estimated aggregate $775,000,000 annually, and the products of whose work is valued at $4,500,000,000 annually.

Hence the importance of scientific research. As has already been intimated, discoveries produced inventions, inventions give rise to processes and manufactures, the employment of workmen and others, and the erection of workshops and dwellings, towns and cities, and increase in the value of land—and all those great additions to the value of land are largely due to the unpaid labors of scientific discoverers; and it may be said that this nation, as well as England, has largely gained its wealth by, and is still living in a great degree on, the product of those labors.

In other words, a very great amount of the wealth of this nation has been obtained by the application of scientific knowledge to the substances and forces by which we are surrounded.

INVENTION MARKS NATIONAL PROGRESS.

Inventions differ from discoveries, just as a newly found truth in science differs from a newly discovered process. A discovery is not in the form of a salable commodity; an invention is a combination and application to some useful or desired purpose of scientific truths which have been previously discovered. A new discovery soon finds itself incorporated in a text-book, and the inventor is left to apply it to some useful purpose, "without money and without price."

Apropos, the patent law, originated in the statute of James I. (1625), called the statute of monopolies, because it abolished patents for monopolies and only allowed patents for new inventions, holds out in advance a prospect of reward in order to induce inventions. The first Congress passed a patent law in 1790. An invention nowadays is equivalent to a patent, and the granting of patents has not only affected industry, but encouraged art. In fact, our manufactured product is now double our agricultural product; figures from the census show this, and in showing this the West now manufactures more than New England, and this is the result of the last twenty-five years.

The manufactured product of the six grain growing States of the West is greater than the agricultural product. This growth in the whole country coincides in time and extent with the growth of patents; and the change of relation between the East and the West has followed the change of relation in the number of patents taken out by the different sections.

CURIOSITIES OF INVENTIONS.

As has already been noticed, there is a vast difference between scientific discovery and the practical application of such discovery. Scientific discoverers may be considered the most practical men in existence, but it was three hundred years before the form of pin introduced for the benefit of the infant portion of the community was invented, after the ordinary pins were introduced.

No one would imagine that this infantile pin—a wire pointed at one end, and cunningly twisted, so that one end serves as a shield for the point of the pin—involved invention, and yet, although the need always existed, it was not until some happy thought brought it to the mind of some lucky inventor that it was brought into the world. Again, there were once eighteen operations to be performed in the manufacture of pins; twelve pounds of pins were made in a day, but invention has produced a machine that turns out 160 pins a minute, and puts them on papers without the aid of human fingers. Again, go through the streets of a city like Boston, and it will be seen that clocks are cheap by the bushel. Those clocks will keep good time, are tasteful in appearance, and serve all the purposes of the domestic clock. Price $1.25.

America, by the way, is seizing the watch manufacture of the world. Switzerland went home from here in 1877 in dismay at the prospect that this industry of hers would be swept from her hands. The chronometer, the result of a prize offered by the British government of $100,000 for any means by which the longitude of a vessel could be determined within ten miles, is an invention. Harrison worked at it for forty years, and in 1767 he won the prize of $100,000. It is recorded that he made one so perfect that it varied but one second and a quarter in ten years.

An unlimited number of inventions cannot be made by means of a limited amount of scientific knowledge; and in consequence of the lack of new knowledge, manufacturers and others continue to suffer losses which might be avoided. Improvements are wanted in processes, employers of steam engines want to obtain more power from the coals, iron puddlers want to economize heat; manufacturers in general want to utilize their waste products, and prevent their polluting the streams and atmosphere; and so on without end.

Inventors are continually trying to supply these demands. For instance, a machine for completely converting heat into mechanical force cannot be invented until more scientific knowledge is discovered. Yet generic inventions, like the Crompton loom and the machinery used in the manufacture of plain cotton sheetings, have produced enormous results. There has been no radical change in the process of manufacture of these goods since 1835; the gain has been by adding a little improvement here and there.

In one of those mills, 90 hands, working 60 hours a week, in 1878, turned out as much cloth as 231 hands, working 76½ hours per week, in 1838; and in another concern there were turned out 23,300 yards per year per operative, against 9,574 yards in 1835; while each Crompton loom in a certain mill turned out 12,191 yards last year against 7,766 yards in 1835, and the cost of labor has been reduced almost one half.

We might pursue this project in this line of thought almost indefinitely, but we think we have obtained enough of scientific discovery applied in a practical manner to demonstrate the national importance of the former and the utility of invention as applied in these latter days. As we intimated in the beginning of this article, some of the greatest practical realities of this age had their origin in search after pure truth instead of after utilities.—*Commerical Bulletin.*

Fast Speeds.

The St. Louis *Republican* of recent date says: "Mr. F.W. Hill, of this city, long a railroad man and late of the Hannibal & St. Joe road, contributes the most interesting figures yet applying to the mile-a-minute controversy. From the facts given it is shown that the speed of a mile a minute has frequently been exceeded by trains on American roads. In the year 1872, Mr. Hill states, Thomas McDonald, engineer of engine No. 36, a five-foot wheel freight engine on the Missouri, Kansas and Texas Railroad, ran from Parsons, Kan., to Sedalia, Mo., a distance of 156 miles, making more than a mile a minute over a greater part of the way. The occasion of this run was to get Phil Sheridan to Sedalia in time to catch the regular train on the Missouri Pacific Railroad in order that he might reach Chicago in time to keep an engagement. Col. R. S. Stevens, General Manager of the Missouri, Kansas and Texas Railway, was on the train with Sheridan. The most remarkable thing about this run was that the engineer did not know ten minutes before he started that a fast run was expected—in fact, he came in with a freight train late the night previous and expected to go out on freight the next day. At four o'clock A. M. he was called out of bed and not given time to oil his engine properly, as the train was waiting. All railroad men will understand what it means to take an engine off freight and make such a run. The same gentleman also furnishes the following account of fast time made in different years:

"In the year 185–, Albany to New York, Hudson River Railroad, 144 miles, 2 hours and 49 minutes.

"In 1855, New York Central Railroad, locomotive Hamilton Davis, with six cars, 14 miles in 11 minutes.

"In 1850, Paddington to Slough, England, 18 miles in 15 minutes.

"In 1862, Boston to New York, express train *via* Providence and New London, 230 miles in 5 hours and 27 minutes running time.

"In 1868, Indianapolis to Pittsburg, 381 miles in eight hours running time, 47⅝ miles per hour.

"In 1868, Janesville, Wis., to Chicago, 91 miles in 90 minutes. This was done by an engine built at the shops of the Chicago and Northwestern Railroad Company by George W. Cushing. I believe the engine pulled two cars, and side-tracked once to let a train pass they met."

Recent Progress in Soudan.

The financial failure of the late Khedive of Egypt has compelled the abandonment of his splendid projects for the opening up of Central Africa. The provinces of Bahr-el-Gazal and Darfur have already been given up, and the great work so far carried out by Gordon Pacha has been stopped. The importance of this work may be indicated by the following achievements: Since 1874 a tract of country larger than the Southern States of America has been mapped with tolerable accuracy. Over 3,000 miles of telegraph lines have been constructed and are now working efficiently. The slave trade has been suppressed, which alone has involved campaigns of months' duration and revolts of entire provinces. The postal service has been introduced, and a letter put in the New York post office with a five-cent stamp and addressed to the remotest station on the Bahr-el-Gazal or Darfur will reach its destination as surely as if addressed to Washington. The navigable rivers have been kept free from the "sud" or masses of vegetable matter which clog up all free passage, and which formerly stopped up the Nile nearly as far north as Berber. The natives have been taught the use of money, so that provisions and goods can be purchased where but a short time before raids had to be made to procure food. A system of military stations has been established, and by the aid of imported Indian elephants the native African elephants have, in several instances, been trained to serve as beasts of burden, thus greatly diminishing the cost of transportation. Telephones have also been introduced at all available points in the Soudan, and are of the most inconceivable service in quickly dispatching business.

Small Cotton Factories for the South.

The *Star*, of Wilmington, N. C., believes that on every creek of good size from Maryland to the Gulf it is perfectly practicable to set up a small cotton factory. In every county in North Carolina, especially in the cotton section, there ought to be ten or a dozen such factories at work. "They pay elsewhere—in South Carolina and Georgia, for instance. Why will they not pay in North Carolina? There is a factory in South Carolina that is a marvel in two respects—it costs but little, and it makes such a large percentage of profits. Let our people make an effort. Let every neighborhood or township organize for a small cotton factory. There is no doubt that they will pay if judiciously managed. As we have said, they have paid elsewhere, and they can be made to pay in our own State. It would be well if a practical man of business were sent into South Carolina to examine the little mill and get all the facts. We have the cotton, the water power, the labor, and even the capital, for it will require so little to start and keep running one of the mills referred to. The prosperity of a State depends no little upon the diversity of crops and the multiplicity of industries. New England has grown immensely rich by its manufactures. Let North Carolina awake to its true interests and try small cotton factories."

England's Domain again Invaded.

Another of our American products, it is said, is materially affecting a great industry of England. Celluloid, in its use as a substitute for ivory, has already exercised a world-wide effect upon the ivory industry, the falling off in the demand having been felt in the remotest regions of Africa.

This composition of tissue paper, camphor, and certain chemicals, is already used for billiard balls; combs, backs of brushes, hand mirrors, and other toilet articles; whip, cane, and umbrella handles; every kind of harness trimmings; foot rules; chessmen; handles of knives and forks; pencil cases; jewelry of all kinds; pocketbooks; mouth pieces for pipes; cigar holders; musical instruments, doll heads; porcelain imitations; hat bands; neckties; optical goods; shoe tips and insoles; thimbles; emery wheels; shirt cuffs, collars, and a great variety of other articles which England manufactures out of its ivory importations from her possessions in India and Africa.

The Asbestos Roofing (with white or gray fireproof coating), now in use in all parts of the world, is the only reliable substitute for tin. It is adapted for steep or flat roofs in all climates, costs only half as much as tin, and is easily applied by any one. Samples and descriptive price lists sent free by H. W. Johns' M'f'g Co., 87 Maiden Lane, New York.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

The most durable and economical protective coating in the world for tin roofs, exposed brick walls, etc., is the Asbestos Roof Paint. H. W. Johns' M'f'g Co., 87 Maiden Lane, New York, sole manufacturers.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

Special Tools for Railway Repair Shops. L. B. Flanders Machine Works, Philadelphia, Pa.

Wanted—The address of Mr. Good, or any manufacturer of Steam Generators inside the fire box or furnace of steam boilers. Address M. L. Slocum, Point Washington, Florida.

For Sale.—One large Corliss Engine, 23 x 48, with 16 8-12 ft. x 27 in. face wheel, right hand; now running in good order. The Arlington Cotton Mills, Wilmington, Del.

Books on Applied Science. Catalogue free. E. & F. N. Spon, 446 Broome St., New York.

A saving of 25 to 33 per cent of customary outlays can be effected by use of the Asbestos Liquid Paints, which are the purest, finest, richest, and most durable paints ever made for structural purposes. Samples of sixteen newest shades for dwellings sent free by mail. H. W. Johns' M'f'g Co., sole manufacturers, 87 Maiden Lane, New York.

Brass or Iron Gears; list free. G. B. Grant, Boston.

For a thorough practical education in the duties of steam and mechanical engineers and firemen, apply to the National Institute, Stamford, Conn. For pamphlet and particulars, address Hy. R. Foote, C.E., Director.

Tapping Water Main Pipes.—Machines for tapping pipes under pressure, for sale by Wm. Young, Easton, Pa.

Steam Traps; best and cheapest in use. No blowing through to start. T. Sault, New Haven Conn.

The Friction Clutch that is doing work in many places satisfactorily, that has never been done by any other, can be seen at Institute Fair, New York. D. Frisbie & Co., New Haven, Conn.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

The Secret Key to Health.—The Science of Life, or Self-Preservation, 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 206.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Band Saws a specialty. F. H. Clement, Rochester, N. Y.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Oak Tanned Leather Belting, Rubber Belting, Cotton Belting, Polishing Belts. Greene, Tweed & Co., N.York.

Automatic Machines for grinding quick and accurate. Planer, Paper, Leather, and other long knives. The best Solid Emery Wheels and Portable Chuck Jaws. Made by American Twist Drill Co., Woonsocket, R. I., U.S.A.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 222.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eclipse Portable Engine. See illustrated adv., p. 189.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

$250 Horizontal Engine, 20 horse power. See illustrated advertisement, page 189.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with small capital. Send stamp for 80 page illustrated catalogue. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Shafting, Pulleys, and Hangers. Nadig & Bro., Allentown, Pa.

Lathes, Planers, and Drills, with modern improvements. The Pratt & Whitney Co., Hartford, Conn.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Machines for cutting and threading wrought iron pipe a specialty. D. Saunders' Sons, Yonkers, N. Y.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 29.

Microscopes, Optical Instr'm's, etc. G. S. Woolman, 116 Fulton St., N. Y.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. R. M. asks for the best way to fill barometer tubes so as to exclude the air. The tubes are straight, about 34 inches long. I have never filled any, and am afraid I will fail without some instruction. A. Invert the tube, pour a little pure mercury into it. Boil the mercury to expel the air and moisture. Add more mercury, boil again, and so on until the tube is filled. As the vapor of mercury is very poisonous, you should not inhale it.

(2) J. J. D. asks (1) how screw heads are nicked. A. By means of a circular saw or cutter. A number of screws are held by a rotating holder, which carries their heads over the edge of the saw. 2. How can I make in malleable iron a groove 1-32 inch wide and 1/8 inch deep? A. By employing a circular saw. See article on rotary cutters, p. 340, vol. 40, of SCIENTIFIC AMERICAN.

(3) C. F. B. asks: 1. Can I make a telephone from the shop to the office, distance 800 feet, without a battery? A. Yes. 2. What would be best for a diaphragm? A. Use ferrotype plates or mica. 3. Would a fine copper wire be best for a conductor; if so, how should it be supported, and what gauge should it be? A. No. 24 copper wire will answer. Support it on elastic rubber bands or strings. 4. How large should the diaphragm be? A. 2 inches in diameter.

(4) W. A. asks whether mercury in a glass tube will rise more degrees at a certain heat when weighted than it will if not weighted. A. As mercury is practically incompressible, there can be little or no difference.

(5) W. H. B. asks (1) how to stain the white part of a black walnut board so as to have it the same color as the rest. A. Apply a thin asphaltum stain, (asphaltum dissolved in turpentine). 2. How to make shellac varnish? A. See p. 252, current volume. 3. Is it proper to apply it with a brush; if so, how can I make it so as to have a smooth surface? A. Apply it with a camel's hair brush. 4. To ebonize walnut wood? A. See vol. 40, p. 91 (18).

(6) W. S. H. asks: What is the Herreshoff coil boiler? A. For illustrated description of this boiler see p. 210, vol. 40, SCIENTIFIC AMERICAN.

(7) W. T. writes: We have a skylight in our store (dry goods) which is surrounded by high brick walls, and black goods shown under this skylight take on an unnatural color from the glare of the sun shining upon the red brick walls. Can you tell us of anything that we can do to remedy this and obtain a soft white light? The skylight is made of hammered glass. A. Your remedy will be to whitewash the brick walls.

(8) T. E. G. asks: 1. How many feet of copper wire of No. 16, 18, and 20 American gauge are equal to a resistance of one ohm? A. No. 16, 310 feet; No. 18, 200 feet; No. 20, 110 feet approximately. The resistance will vary with different specimens. 2. What is the average resistance of the gravity battery? A. 2 to 4 ohms. 3. What should be the resistance of electro-magnet so as to use the battery to the full? A. The resistance of the battery and electro-magnet should be the same.

(9) W. B. asks: What finally becomes of heat? Is it changed into some form of force, or is it scattered and wasted and resolved into nothing? The sun has been for countless ages pouring his store of heat upon the earth. If it receives nothing back, where is the accumulation? The coal beds account for part of it, but not for what has been received since their formation. As the earth and the materials of which it is composed are limited, it seems that the capacity for the storage of force must also be limited. Again, when those forces are liberated, the same amount of heat is evolved that was originally stored there. If there is no loss, the heat must accumulate somewhere. Then, a very small portion of the sun's heat falls upon any planet. What becomes of the rest? A. It is assumed that heat is simply the rapid vibration of an imponderable elastic ether which pervades all matter and infinite space. This hypothesis as to the nature of heat is now generally admitted. If it be correct, it is evident heat is not matter, but a state of matter, and can not therefore be stored.

(10) W. R. writes: To an acoustic telephone line, 1,500 feet long, No. 22 copper wire, with 10 cotton cord insulations, I propose to add at each end an ordinary electric call bell (size 2½ inch box pattern), and to use the above wire for the line. The ground connections will be a gas pipe at one end and an iron water pipe at the other. 1. Can I make the battery at one end answer for both? A. Yes, by using closed circuit bells. 2. How many cells of Calland battery are necessary? A. Probably six or seven will answer. 3. Of the wires from the battery, which is connected to the main line? A. Either. 4. How are the wires arranged to bell battery and ground connection respectively? A. From ground to one pole of the battery, from the other pole to the line, from the line to the ground. Place in your line the closed circuit bells and keys according to your convenience.

(11) A. S. P. asks how papier mache is made for fine, small work. A. Boil clippings of white or brown paper in water, beat them into a paste, add glue or gum, size and press into oiled moulds.

(12) O. A. asks: 1. Can I with a plane slide valve to steam engine cut off at 1-3 or ¼ the stroke with as good results and economy as I can with a cylinder valve; if not, why is it? A. Probably one style of common valve is as good as another, but it is impossible to cut off with such valves shorter than about 2-3 advantageously on account of the compression of the steam within the cylinder. 2. What are the objections (if any) to a slotted cross head. It is full as cheap to make, and the motion of piston and crank pin are alike, when with the ordinary connecting rod the motions are not the same. A. "Slotted" cross heads are frequently used in small engines and steam pumps, but the friction is too great and wear too rapid for larger engines.

(13) J. R. writes: I want to buy a work on engines, one containing steamship and stationary engines, also works on mechanical drawing. Which are the best in use on the subjects named? A. Probably "Roper on Land and Marine Engines" and "MacCord on Mechanical Drawing" will suit.

(14) W. R. writes: A is building a small turning lathe of cast iron 5 feet long; spindle is of cast steel, with a hole clear through, and is to run in a case-hardened iron box in the front, and behind is a plug fitted in, also of case-hardened iron, which is V-shaped on its extremity, and is to run in a center of hard cast steel; the spindle, where it runs in the box in front, also being hard and of conical shape. B claims the box should be of hardened steel instead of iron. Who is right, A or B? A. We do not think there can be any material difference, as a properly case-hardened iron surface is steel.

(15) N. P. R. asks: 1. Which is considered to be the best and most practical signal for railroad switches, those showing bars at different angles, or color signals? Which is most in use in this and in the old country? A. Semaphore signals are largely in use, and we believe increasingly so, for daylight signals, though colored signals are used on many of our principal railroads. We think for daylight signals the semaphore is generally preferred.

(16) B. E. & S. M. write: Having had a dispute with B about the travel of a valve, I contend that the true meaning of travel is the distance the valve moves in traveling from its middle position to the extremity of its stroke and back again to its middle position; but B says I am mistaken. Who is right? A. The travel of a valve is its whole movement between its two extreme positions, or, in case of a direct connection, twice the throw of the eccentric.

(17) L. G. writes: A planer in our factory has been giving us considerable trouble for a long time. The boxes heat, compelling us to re-Babbitt every week and sometimes oftener. I noticed an article in the SCIENTIFIC AMERICAN several months ago concerning the use of plumbago in such cases. I cannot find the paper now. Can you name a remedy, or rather a preventive, to the heating? A. You can try fine plumbago and oil, or fine soapstone and oil; but the probability is that your shafts and boxes are out of line, or the cylinder may be out of balance.

(18) H. C. H. asks: If two balls of the same size, and one twice as heavy as the other, be dropped from a great height, which will reach the ground first? Of course there will not be much difference, but will there be any? A. If falling in the atmosphere, the heavier ball would reach the ground first; if falling in a vacuum, there would be no difference.

(19) G. B. asks: What is the best composition for expansion metal? A. Brass is generally used for expansion tubes and bars.

(20) H. S. writes: You say in your answer to J. G. B., in SCIENTIFIC AMERICAN, September 27, 1879, that 150 revolutions = 300 feet per minute, and 150 revolutions = 500 feet per minute. This I do not understand—that is, whence you obtain the 300 feet and 500 feet in finding the horse power of an engine. It occurs on page 204 (29). A. 150 revolutions is 300 strokes of the piston, as it requires two strokes to one revolution. In the first case the stroke is 1 foot, hence the speed is 2x150=300 feet; and in the second case the stroke is 1 2-3 feet, two strokes = 3 1-3 feet; 3 1-3x150=500 feet.

(21) G. H. S. writes: In your issue of the 27th inst., I noticed an error in the figures given in answer to "Novice" (26). Diameter of wheel should be 19·77 inches; diameter or pinion should be 5·60 inches, without any regard to pitch or number of teeth.

(22) W. S. W. writes: 1. I have a condenser working with a pair of Corliss engines, 20 inch by 23 inch cylinders, adapted to use with either or both. It acts on the principle of an injector, and a column of water, with a head of 9 feet, flows through a nozzle (which has an adjustable nozzle that regulates the quantity of water passing in), and the steam from either or both engines meets this water at the combining nozzles and is condensed. After having condensed the steam, the column of water flows through an expanding tube and is discharged into a canal. The natural head gives this column a velocity of about 24 feet per second, and when there is a 27 inch vacuum, the velocity is increased to over 400 feet per second. Now with both engines on, we have run with a steady vacuum of 26 inches to 28 inches, but when running only the 20 inch engine, the vacuum would dance up and down from 27 inches to 15 inches, and the only way we could get it steady was to admit a small quantity of air into the exhaust pipe, when it would hold at 22 inches. Can you explain why this should act so, as we have always aimed to exclude every particle of air to hold a vacuum? A. It is difficult to say, without actual examination, precisely what is the cause of the peculiar action of your condenser; it may be due to an air leak, but we are inclined to think that it is the irregular action that we have heard attributed to this class of condensers. 2. The level of water behind our dam extends back some ten miles. Now, theoretically, would we gain more power in our water wheels, by keeping the water 3 inches below the level of the dam, so as to make the water flow more rapidly towards it; or by keeping it right up to the top of the dam and having the 3 inches more head? A. Keep your 3 inches additional head. 3. How is it that authorities like Cooper, Haswell, Buel, etc., state that rubber belts will drive 25 per cent and 30 per cent more than leather ones? I had a 12 inch leather belt, driving from a 30 inch to a 20 inch pulley, 10 feet apart, and keeping 16 roving frames up. On some days it would slip badly, so I put on a 12 inch, 4 ply, rubber belt, thinking there would be a gain of 25 per cent, and the result was it would not drive eight frames. I had to take it off and put on the old 12 inch leather one, with a six inch rider on the outside, and I have heard no complaints. A. We do not remember any experiments to test the relative adhesion of leather and rubber belts under the conditions of actual use. It is probable that in a damp atmosphere rubber would be superior.

(23) F. M. asks for a receipt to make a black ink for the copying press described in the SCIENTIFIC AMERICAN. A. Dissolve soluble nigrosine in about 5 parts of boiling water and strain through a fine cloth. When cool it is ready for use.

(24) W. R. H. writes: We want to use kerosene in a liniment, but the offensive odor is very objectionable. Can you tell me how to destroy it without taking from its virtue as a medicine? A. It cannot be completely deodorized without altering its character. The odor may be cloaked by the addition of various essential oils without materially affecting its properties.

(25) A. E. F. writes: I wish to make good red sealing wax in quantities of about 5 lb. I have hunted through several books of receipts and can find no receipt for my purpose. Will you kindly furnish formula? A. Yellow resin, 1 lb.; shellac, 5½ oz.; Venice turpentine, 5½ oz.; vermilion, 1 oz. Melt the shellac in a copper pan over a fire, add the resin, pour the turpentine slowly in, and soon afterwards add the vermilion, stirring continually.

(26) F. E. H. asks: What will make the darkest brown lacquer to put on copper bronze? A. 2½ oz. shellac, 2 quarts wine spirit, 2 oz. gum sandarac, ½ oz. gum elimi. Mix and keep warm until solution is effected, then strain and color with dragon's blood and aniline brown to suit.

(27) R. F. B. asks: 1. Can commercial zinc be made sufficiently pure for battery use by remelting? What is the dross left in the crucible? A. Your question was answered on p. 187 (4), current volume. Zinc cannot be purified by fusion, as you suggest. The dross is zinc oxide, formed by the action of atmospheric oxygen on the molten metal. 2. Can electroplating be done as economically with the gravity battery as with the Smee? How do they compare as to first cost? A. Yes, on a small scale; they are cheaper. The gravity form is the cheapest. 3. Please explain how stencil dies and solid burning brands are made. A. Stencil dies are made by driving red hot steel into suitable matrices, afterward filing them into shape. Burning brands are moulded in sand from a pattern and cast.

(28) J. H. K. writes: I wish to know how to make Pharaoh's serpents' eggs, as I have need of some in experiments I am about to make. A. To solution of ammonium sulphocyanide add mercuric nitrate solution; mercuric sulphocyanide is precipitated as a white powder. This washed, made while moist into little cones, and thoroughly dried, are the so-called serpents' eggs. They are very poisonous.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

S. G.—The sample contains lime phosphate, clay, quartz sand, iron oxide, lime carbonate and sulphate, of some value for fertilizing purposes. A full analysis would be advisable.—H. J. D.—A, B, D, and E are banded agates, of very little value in the rough state. C is a variety of jade and jasper. F is jasper, of little economic value. —A. E. F.—It is a lignite of good quality.

COMMUNICATIONS RECEIVED.

On Sea Sickness. By C. K. M.
On Wear of Shafts. By J. B.
On Explosion of the Alaska. By J. H. R.

[OFFICIAL.]

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FOR WHICH

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AND EACH BEARING THAT DATE.

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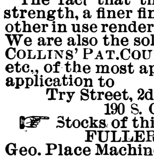

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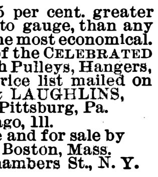

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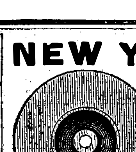

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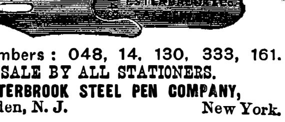

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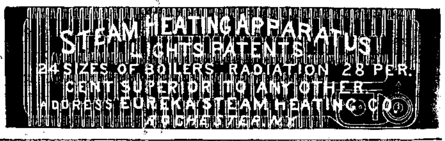

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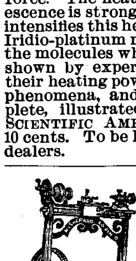

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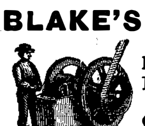

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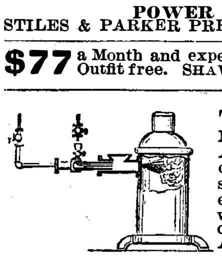

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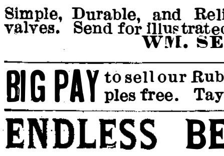

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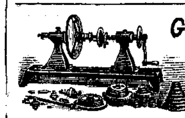

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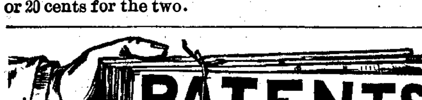

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