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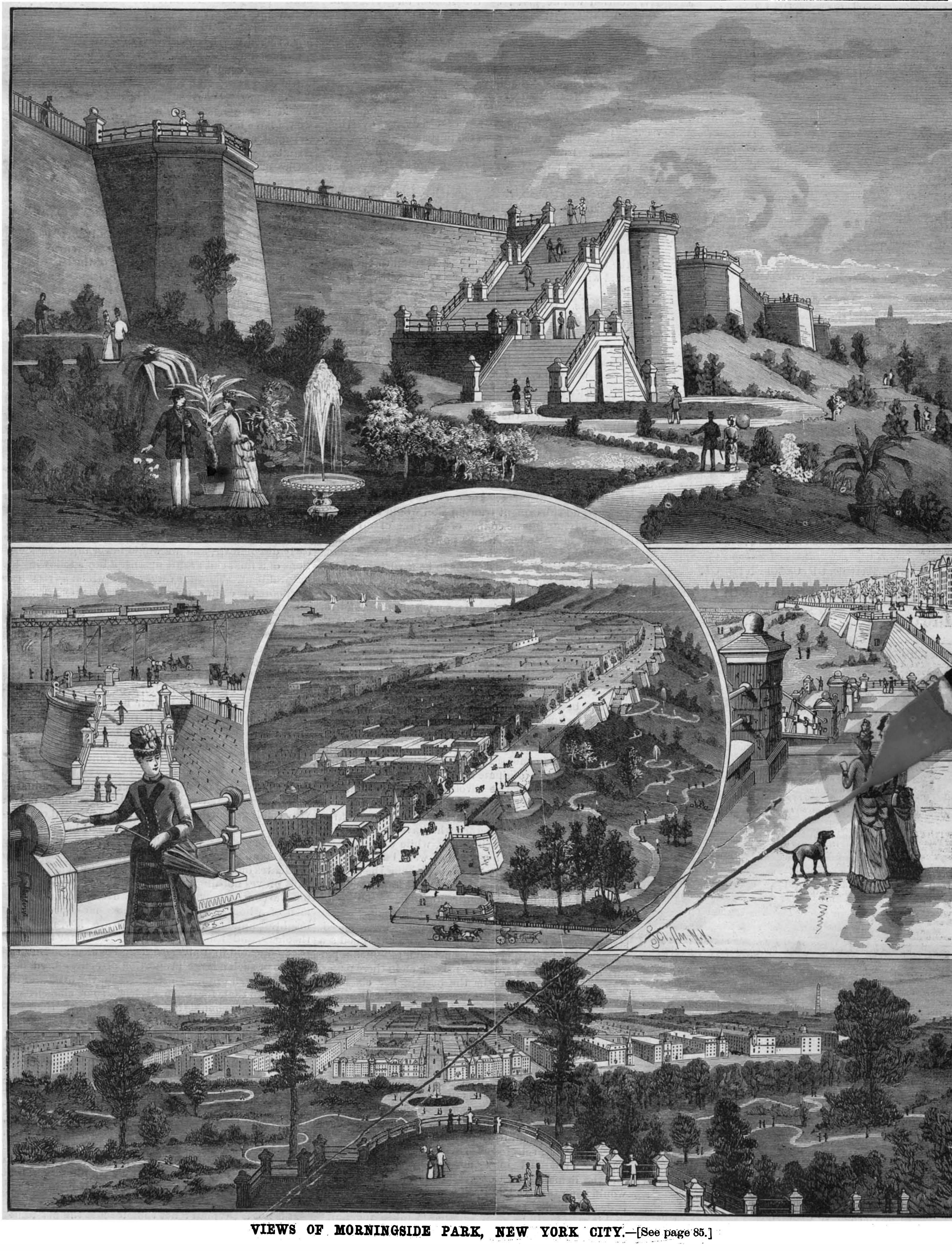

VIEWS OF MORNINGSIDE PARK, NEW YORK CITY.—[See page 85.]

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NEW YORK, SATURDAY, AUGUST 7, 1886.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 558.

For the Week Ending August 7, 1886.

Price 10 cents. For sale by all newsdealers.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The thirty-fifth meeting of the American Association for the Advancement of Science will be held at Buffalo, New York, from Wednesday morning, August 18, until Tuesday evening, August 24. This is the third time that the Association has accepted an invitation to hold a meeting in Buffalo, the previous occasions having been at intervals of ten years. The city offers such excellent facilities for a gathering of this kind, both in its spacious auditoriums and hotels and in its general accessibility from either the East or the West, that it has grown to be a favorite locality with the members, and a large assemblage has been assured. Special attention will be given by the section on geology and geography to the problems connected with Niagara Falls and its gorge. The retiring President, Prof. H. A. Newton, of New Haven, will deliver his address on the first evening of the meeting. The President-elect is Prof. E. S. Morse, of Salem, Mass.

TRANSMISSION OF POWER BY ELECTRICITY.

The carefully conducted experiments of M. Marcel Deprez, on the transmission of electricity over long distances, have finally resulted in success. After many trials and difficulties, the conductors established between Creil and La Chapelle Station, Paris, begin to work satisfactorily.

The power transmitted, and rendered available at the receiving station, was found by measure to be 50 horse power, an efficiency of 47 per cent. As the distance between Creil and Paris is almost 32 miles, this result is not unsatisfactory. The line consists of a copper cable, the total cross section of which is equal to that of a solid wire having a diameter of three-twentieths of an inch. The cable is aerial, and supported on porcelain insulators. When near frequented spots, it is incased in insulating material, but at other places it is exposed.

The success of these experiments suggests the advantageous introduction of the practice into this country. In many localities, and particularly where water power is available, it would be possible to produce electricity under such favorable economic conditions that a loss of even fifty per cent in its transmission would still make the arrangement a profitable one when compared with the direct generation of electricity on the spot where it is needed.

It frequently happens, too, that power is available in one place at certain periods of the day, and, from the nature of its origin, must be wasted unless transmitted to a distance. Its conversion into electric energy and subsequent transmission would then represent a saving in the course of the year of no inconsiderable magnitude. Water power has been utilized in several localities in the United States and Canada for the generation of a current to be used in the electric illumination of towns and works located at a distance of perhaps two or three miles; but the limit has not nearly been reached, and even within these shorter ranges there have been as yet but few attempts to utilize the power at hand. There is room here for considerable ingenuity in securing the services of an agent which is at once convenient and economical.

THE CHARACTER OF THE NEW CRUISERS.

It has been said that the best thing after knowing a thing is to know where to find it; and in selecting designs for the cruisers provided for by the act of March, 1885, the Naval Board has, apparently, acted on the suggestion. It could scarcely have been expected that the Board would originate a new system of marine architecture or otherwise revolutionize naval warfare. The most that could reasonably be hoped for was that it would intelligently examine the best models of the Old World naval constructors, who have had large and varied experience of recent years, while we have been standing still, and discover which were best suited to the purpose Congress had in view. Among the cruisers built by Sir William Armstrong for the Japanese, Chinese, and Chilian governments are to be found by far the most successful models of unarmored and partly armored fighting ships afloat. They have speed, strength, and stiffness, work quickly, and are good sea boats. The Chilian cruiser Esmeralda, of which a picture and description were recently given in these pages, may safely be said to be the best of her class now afloat. She has made 18·4 knots speed on the measured mile; and while she can readily run away from such ponderous and slovenly monsters as the Devastation, Invincible, Imperieuse, Dandolo, or Duilio, and attack the merchant fleets they are supposed to protect, she can fight too, upon occasion, choose her own target and firing point, and get out of the way when she has got enough. The Japanese cruiser Naniwa-Kan is another of this class—a staunch, speedy, fighting cruiser; and the Chinese Tchao-Yong is likened unto her.

These are the craft that the Naval Board have, wisely it seems, selected as criteria for the new Yankee cruisers, modified in some respects as necessity and the demands of Congress required. The Board would seem to have left itself a certain amount of latitude as to decks, spars, barbette towers, and the like, and it remains to be seen whether Yankee ingenuity retains its pristine promptitude in selecting the best and improving by combination and innovation.

It seems fortunate, now that Congress and the country are in the humor to do something for our long neglected navy, that the naval constructor and expert, on whom we must depend for models, have not shown a disposition to fit us out with floating forts, such as the great powers have been building for many a year—monsters whose lagging prows will not admit of their approach to hostile ships on the high seas near enough to do them injury, and which, when they make the shore, may be made the prey of a torpedo fleet, whose sum total of cost will scarcely make up that of one of their number, as a school of whales is scattered and beaten off by a few resolute though comparatively insignificant thrashers.

Whoever has read the naval history of our civil war must remember the effective work of the swift-running, unarmored corsairs Alabama, Georgia, and Florida—at a time, too, when we had the greatest fighting fleet the world ever saw. Had these Confederate cruisers been slow-going, steel-clad batteries, it is not likely they would have done a tithe of the injury. Their drums would have been beating " to quarters" from sunrise to sunset, and they would assuredly have got more fight than booty.

One of these ships could overhaul a merchantman with celerity, and lie in wait in the tracks of the various trading fleets with the precision of a cat which knows that within a given time a mouse will issue from the crevice near at hand.

Again, the modern marine gun has advanced so much in efficiency that it will pierce the heaviest armor that can be floated, until now, when some of the best authorities believe that heavy armor is a less defense than light armor, because it lets a hostile shot in on one side and will not let it out on the other, as light armor will do, and it is under such conditions that a lucky shot often does its maximum damage.

OUR BOYS.

In glancing over the possible openings for boys, one is forced to admit that unless a lad have genius, perseverance, and a good, physical consititution, he will find the beginning of a professional life almost insurmountably difficult, if he be obliged from the start to depend upon his profession for a living. So large is the competition, even in our own comparatively new country, and still [illegible]so in England and on the Continent, that the indu[illegible]nts to enter the so-called learned professions are financially very small. The satisfaction of ultimate success, and the intellectual pleasures which such a course makes possible, are regarded by any true student as more than compensations for the early discomforts, and we would never urge considerations of a financial nature against a boy's following his natural bent. That is a fatal policy which advises him to choose his calling simply for the money returns it promises, for he will learn sooner or later that money is but a small factor in true success. But we would very strongly urge such considerations in attempting to dissuade those who have no natural qualifications for a professional life from entering upon so unpromising a career. There are many whose scholarly abilities are too meager to permit the hope of successful competition when pitted against their more gifted brothers. It is certainly unfortunate, if not pitiable, that these young men should, through mistaken notions of what is respectable and what is praiseworthy, rush into a course which can bring them only failure and mortification.

Each year, thousands of young men are graduated from our universities and schools of learning, only a very small proportion of whom are ever heard of afterward in the real contests of life. And it has become a notable fact that an advertisement for a man to fill any but a manual position will bring a number of college graduates out of all proportion to the total applicants. This proves nothing against our schemes of education, for the contrary evidence is too overwhelming. The men of whom as a nation we are most proud, the brightest minds in science, literature, law, medicine, theology, and the fine arts, have been for the most part educated in universities and colleges. But the failure of such a large proportion of college-bred men to attain even ordinary usefulness in the events of life does prove that, for them at least, some element was lacking which should have contributed to their preparation for subsequent duties. Had they been blessed with the three qualifications already enumerated, success would have been possible in almost any direction. But unfortunately very few have genius; a smaller proportion than should, have good health; and of the three, perseverance only appears to be a cultivable quality, and even this is largely limited by physical endurance. A very successful man of affairs, quoted by an English contemporary, *Industries*, when asked for the secret of his success, replied, "I had the physical constitution to begin work at six o'clock in the morning, and keep on till eight, nine, or ten at night, and that for twenty years." One would say [illegible] was well deserved.

It is not a Utopian tenet that teaches the possibility of success for all normally constituted men. The essential condition is the right choice of a vocation. It is a serious question, what to do with our boys, for it is just here that so many fatal blunders are made. The parent or guardian, actuated by the best motives in the world, is very apt to lay out a plan of life framed entirely from his own point of view, and unmindful that what may prove eminently successful in one case may be equally disastrous in another. And very often the decision is rendered more difficult by the necessity laid upon the boy of earning his daily bread as he eats it. Then, too frequently, circumstance usurps the place of decision, and what should be the result of careful thought is left to mere accident. Though one be of optimists the most extreme, it is impossible to deny that the plan of life pursued by the majority of men does not lead to success. And since this plan, whether it be of design or the mischievous fatalistic drifting which is no plan, begins when the man is still a boy, it is in the boy that our hope for the future lies. How is he to be trained, and his skill and character developed?

We are accustomed to believe that demand and supply regulate themselves, but in this very problem of the future of our boys, we are brought face to face with a curious incongruity. We see on the one hand the overcrowded professions, and hosts of clerks who are ready to apply for any vacant position, however low the salary, while on the other hand we see a market for labor which is so far from being glutted that its supplies must be brought from foreign countries. But between these unequally balanced classes, little or no exchange is possible, for it is a characteristic of the latter class that its members must be able to use their hands and eyes, as well as the brain, and must have a manual dexterity sufficient to place them among the ranks of the great industrial army of producers.

What is wanted to-day in our own country is skilled labor. Education in its highest form is wanted, but it must be coupled with an ability to do something, if it is to gain for its possessor any position in life. It must find some mode of expression, or the world is none the richer. Americans are noted for their ingenuity, but in how few has a thorough technical education brought out its highest powers of expression! Here is a field which can be heartily recommended to any boy who has decided to take the reins of life in his own hands instead of leaving them to the caprice of circumstances. If he has a taste for the mechanic arts, he has a splendid opportunity for the exercise of his powers. The acquisition of manual dexterity is not difficult. It requires little beyond intelligent perseverance. But when this skill of hand is once acquired, it brings an independence which many a man in apparently easier circumstances of life might well envy. Nor is it the humble calling which the drawing room is apt to picture it. The possibilities open to the skilled worker are almost unlimited. Some new and more excellent creation is always possible, and from the workshop the directors of large undertakings are commonly chosen.

An Electrical Silo Cutter.

We have before had occasion to place on record the work done by means of electricity at Hatfield, both at the Marquis of Salisbury's house itself and on the estate. In addition to the various operations of lighting, pumping, pile driving, weed cutting in the river, and others, another application of the power has just been perfected by Mr. Shillito, the resident electrician of the estate, one which, as far as our experience goes, is quite novel. Ensilage is being stored on a large scale for the use of stock at one of the farms, where, for this purpose, some of the old farm buildings have been converted into silos. This year it has been decided to chaff the green food before placing in the silo, and this arrangement has necessitated the placing of the chaff cutter used in cutting up the rough grass some 20 feet above the ground. The electrical power is used not only for driving the cutting machine, but also for elevating the grass to the level of the cutter. Some four tons of rough grass are raised and cut per hour by this means. The generator, a 16 light Brush machine, driven by a water wheel, is situated a mile and a half distant, on the banks of the River Lea; the electrical power being transmitted to one of Siemens Brothers D 2 type, specially wound to work as a motor with the Brush machine. The same source of power is also brought into use in working the elevators at the various hayricks on the estate.

Calorimetry with Compressed Oxygen.

With regard to the calorimetric testing of combustibles by burning them in apparatus like that of Mr. Lewis Thompson, MM. Berthelot and Vieille observe, in a communication to the *Comptes Rendus*, that the only really exact process consists in burning the substances in a great excess of compressed oxygen, in the authors' calorimetric bomb. The exactitude of this method proceeds from the fact that the process of combustion is total and instantaneous. Besides this, the experiment in question requires but one weighing. The authors declare that combustion under ordinary pressure is seldom, if ever, complete, and leaves some thousandths, or possibly more, of carbon monoxide and of hydrogen more or less carbureted. They claim that their method is especially applicable to solid bodies and such as are not volatile, which can scarcely be burnt satisfactorily by the old methods, even with free oxygen.

It also dispenses with the complicated connections necessitated by the use of chlorate of potash. MM. Berthelot and Vieille have made a great number of determinations by their method, operating with oxygen compressed to 24 atmospheres in a calorimeter containing 1·800 kilos. of water, and with a quantity of material capable of raising the temperature about 2° C. The material is compressed into the form of small pastilles, and placed upon a piece of dished platinum foil, with a spiral of iron wire weighing 0·018 gramme suspended above it. The oxygen is not previously dried. When the arrangement is complete, the iron wire is rendered incandescent by a momentary electric connection, and at once takes fire and ignites the material to be tested. The latter burns instantaneously, without a trace of smoke, carbonic oxide, or hydrocarbon gases.

NIGHT SKY—JULY AND AUGUST.

BY RICHARD A. PROCTOR.

The Great Bear, *Ursa Major*, is now in the northwest, his paws near the horizon. The Pointers, α and β, direct us to the Pole Star, α of the Little Bear, *Ursa Minor*. A line from the Pole Star to the Guardians of the Pole is in the position of the minute hand of a clock about seven minutes before an hour. Below the Little Bear we see the Camelopard, a little to the east of due north. The Dragon, *Draco*, curves round from between the Pointers and the Pole, above the Little Bear toward the east, then upward to near the point overhead, its head, with the bright stars β and γ, being highest. Low down in the west we see Berenice's Hair, *Coma Berenices*, and one star of the Hunting Dogs, *Canes Venatici*, is seen in the chart between Coma and the Great Bear. The Herdsman, *Bootes*, occupies the midheaven in the west, the Crown, *Corona Borealis*, higher up, and due west, Hercules, between the Crown and the point overhead.

Low down, extending from the west to near the southwest, we find the Virgin, *Virgo*, the bright Spica near its setting place. In the southwest are the Scales, *Libra*, and father to the left, extending from the Scales to low down near the south we find the Scorpion, *Scorpio*, one of the finest of the constellations, Antares, the rival of Mars (as the name means), marking its heart. Above the Scorpion and the Scales are the Serpent Bearer, *Serpentarius* or *Ophiuchus*, and the Serpent, *Serpens*, extending right across him to near the Crown, after which the Serpent seems reaching.

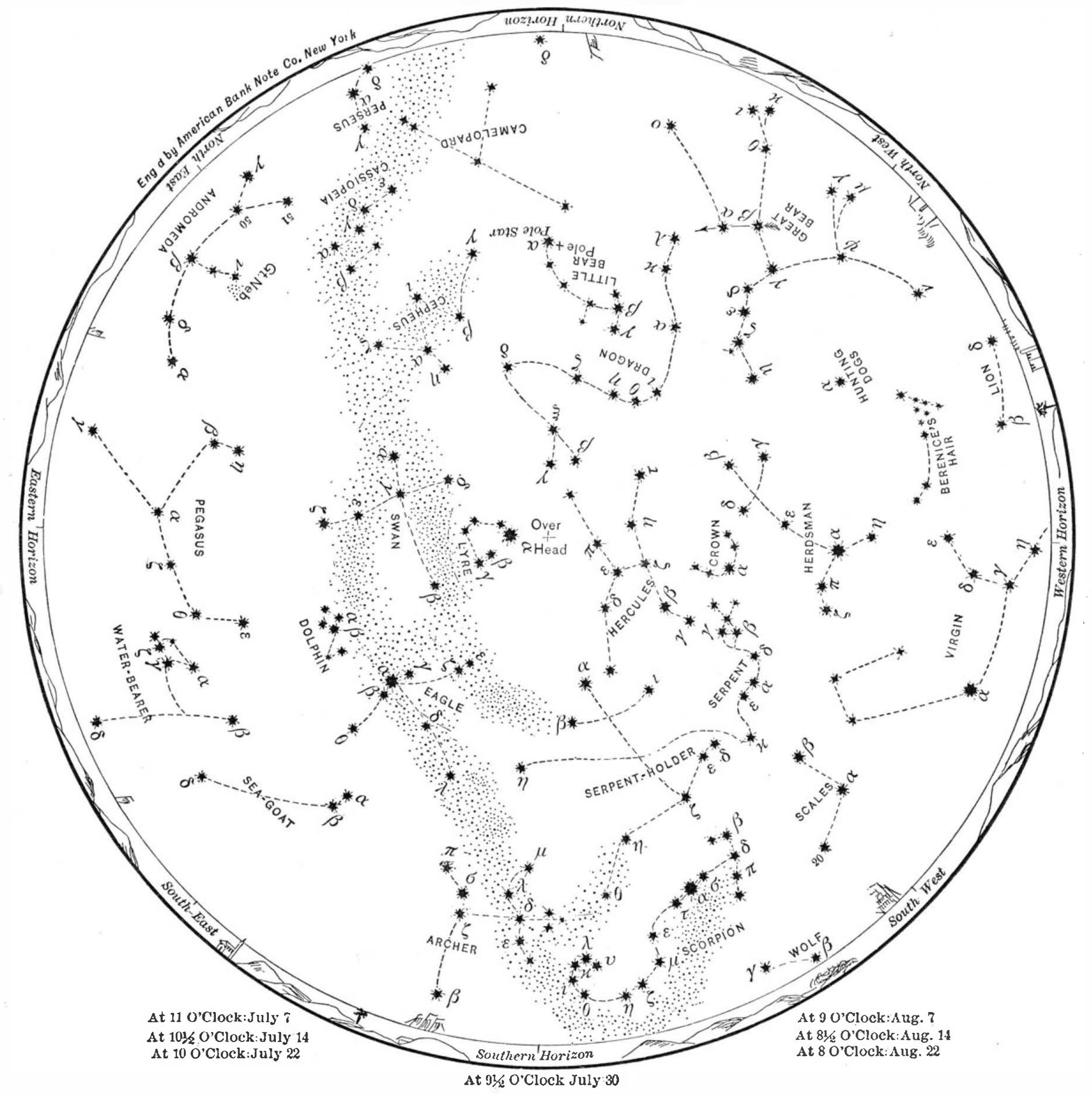
A little east of due south, low down, we find the Archer, *Sagittarius;* in the southeast, low down, the Sea Goat, *Capricornus;* and farther east, and lower down, the Water Bearer, *Aquarius*. Above the Sea Goat is the Eagle, *Aquila*, with the bright bluish-white star Altair; on its left the pretty little Dolphin, *Delphinus*, and above the Dolphin, nearly overhead, the Lyre, *Lyra*, with the bluish-white star Vega (even brighter than Altair) nearly overhead.

Below the Lyre we see the Swan, *Cygnus*, due east; and below the Swan the winged horse, *Pegasus*, upside down, as usual.

In the northeast, *Andromeda* the Chained Lady, is rising, her head marked by the star α (which was also called δ of Pegasus. (The "Square of Pegasus" is formed by α of Andromeda and α, β, and γ of Pegasus.)

Between the north and northeast is *Cassiopeia*, the Seated Lady, and above her, her husband, King Cepheus. And lastly, Perseus is just rising, between the north and northeast.

NIGHT SKY: JULY & AUGUST



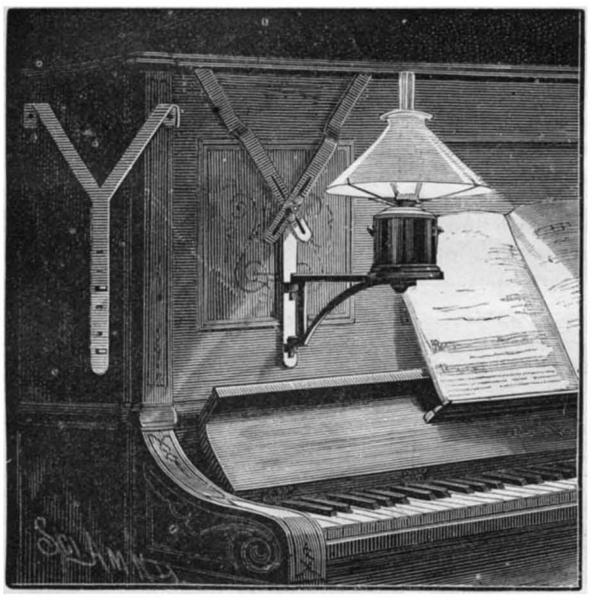
In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

The Telephone of 1664.

And as glasses have highly promoted our seeing, so 'tis not improbable, but that there may be found many mechanical inventors to improve our other senses, of hearing, smelling, tasting, touching. 'Tis not impossible to hear a whisper a furlong's distance, it having been already done; and perhaps the nature of the thing would not make it more impossible, though that furlong should be ten times multiplied. And though some famous authors have affirmed it impossible to hear through the thinnest plate of Muscovy glass, yet I know a way by which it is easy enough to hear one speak through a wall a yard thick. It has not yet been thoroughly examined how far Otocousticons may be improved, nor what other ways there may be of quickening our hearing, or conveying sound through other bodies than the air; for that is not the only medium. I can assure the reader that I have, by the help of a distended wire, propagated the sound to a very considerable distance in an instant, or with as seemingly quick a motion as that of light, at least, incomparably swifter than that, which at the same time was propagated through the air; and this not only in a straight line, or direct, but in one bended in many angles.—*From works of Robert Hooke, published in 1664.*

LAMP BRACKET.

The bar forming the body of the bracket is provided with apertured ears to receive the pintles of the lamp-supporting bracket. Two bars, each formed with a hook at the upper end to pass over the upper edge of the front board of an upright piano, are slotted at their lower ends for the passage of a bolt, by which they are held to the main bar. The hooked ends are separated to form a wide bearing, and each hook has a thumb-screw, by means of which it is clamped securely on the back of the piano front. The free end of the bracket holds a lamp in the usual way, and the height of the



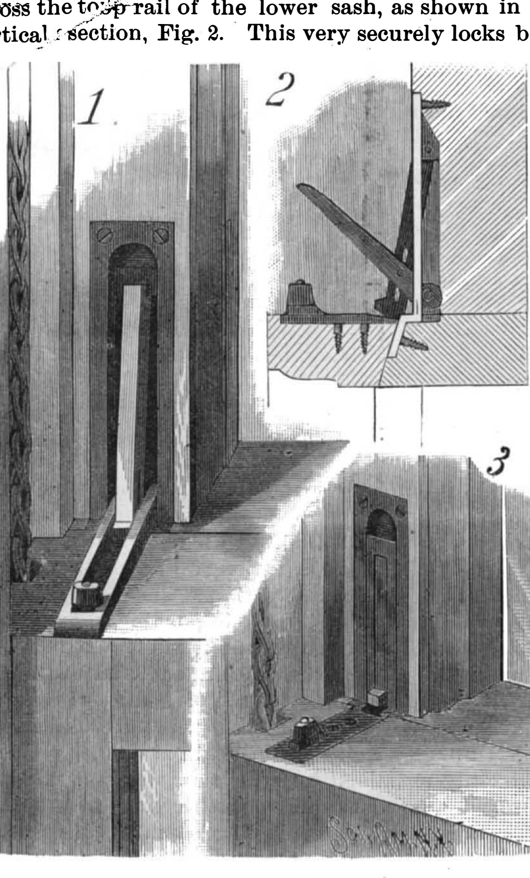
BARNEY'S LAMP BRACKET.

lamp may be adjusted by shifting the position of the bolt in the slots in the bars; it may be still further adjusted by separating the free ends of the bars or bringing them together. The lamp may be supported at any desired position along the piano front, and the rattling of the bracket is prevented by the clamping screws and by a soft button upon the inner surface of the lower end of the vertical bar. The bars may be made in one piece, as shown in the left of the engraving.

This invention has been patented by Mr. James W. Barney, of Junction City, Kan.

IMPROVED SASH FASTENER.

The engraving shows a fastener which may be used either singly, and occupy a central position when the window has a mullion through the center, or in duplicate on either side of it, when the window is a wide one and without a mullion. Secured within the stile or the mullion of the upper sash is a metal frame having a vertical slot and a recess in its face terminating in a finger notch. Pivoted by its upper end in the slot is a locking bar of such length, as when swung slightly outward its lower end will bear on a plate extending across the top rail of the lower sash, as shown in the vertical section, Fig. 2. This very securely locks both



CARY'S IMPROVED SASH FASTENER.

the upper and lower sash, which can only be released by forcing the bar back into the frame piece. The lower end of a finger piece is pivoted within the frame in such manner as to admit of its being shut closely within the recess, as represented in Fig. 3. This lever has a longitudinal slot in it, to allow the locking bar to work through it. The lever and bar are connected by a pin passing through a slot in the bar. To lock the window, Fig. 1, the lever is pressed downward, its free end passing over a nose formed on the end of the plate on the lower sash, and thereby binding the sashes together laterally. This movement of the lever brings the locking bar forward, and locks the window. Pushing the lever back into its recess releases the sashes. A turn button on the nose prevents the lever from being raised. This fastener presents but little or no opportunity to tamper with it from the outside, and, unlike the ordinary fastener, it cannot be pushed one side by a knife blade inserted between the sashes.

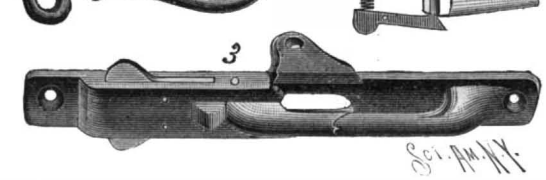
This invention has been patented by Mr. Alanson Cary, of 234 W. 29th St., New York city.

IMPROVED SNAP HOOK.

This snap hook has a rigid tongue, held in place by spring-acted latches, and which does not depend upon the spring to retain it in a closed position. The shank of the hook, Fig. 1, has a chamber, in which is pivoted a tongue beveled at its free end to fit the beveled end of the hook. The inner end of the tongue is widened and formed with transverse slots for receiving the ends of pivoted latches, which are pressed into engagement with the tongue by a spiral spring, as shown in Fig. 2. The inner ends of the latches extend beyond the sides of the shank, so that these ends may be pressed together to release the tongue.

When the tongue is open, the ends of the latches rest upon the sides of the tongue, with the spring compressed, so that the latches are in condition to drop into the slots as the tongue is moved into a closed position.

The form of snap hook shown in Fig. 3 is carried by an angle plate, which fits over the thill, upon either the inside or outside, for receiving the trace loops. In this case the shank of the hook is the plate, and the hook and tongue when closed are axially in line with each other, forming a straight bar, upon which the trace hook is carried. The snap hook is like that above described.



STAHL'S IMPROVED SNAP HOOK.

This invention has been patented by Mr. S. S. Stahl, of Connellsville, Pa.

Treatment of Erysipelas with Creosote.

Dr. H. J. Fox, writing in the *St. Louis Med. Jour.*, May, 1886, claims that creosote may be regarded almost as a specific in the treatment of erysipelas. His manner of application is to keep the parts constantly covered with cloths wet with a solution of 6 to 20 drops to the ounce of water. In ulcers or wounds it may be used in the form of a poultice by stirring ground elm into the solution, the strength to be regulated according to the virulence of the attack. Ordinarily, 10 drops to the ounce is strong enough for the cutaneous form of the disease, and in dressings for wounds or recent injuries. If the inflammation threatens to spread rapidly, it should be increased to 20 or more drops to the ounce of water.

The antiseptic properties of this remedy render it of additional value, as it will certainly destroy the tendency to unhealthy suppuration, and thus prevent septicæmia.

In the treatment of hundreds of cases of erysipelas, according to Dr. Fox, but a single fatal case has occurred, and that one in an old and depraved system. In the less violent attacks no other remedy was used, but where constitutional treatment was indicated, the usual appropriate tonics were prescribed.

Fire from Steam Pipes.

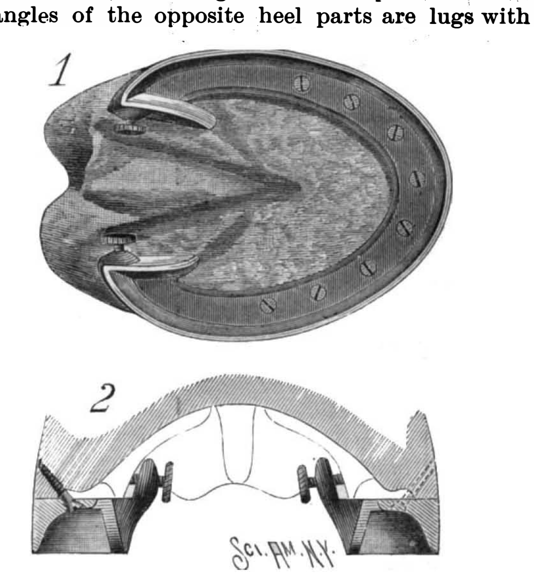
Glaser's Annalen says: After wood has remained a long time in contact with steam, hot water, or hot air pipes, the surface becomes carbonized. During the warm season, the charcoal absorbs moisture. When again heated, the moisture is driven off, leaving a vacuum, into which the fresh air current circulating around the p[illegible] rapidly penetrates, and imparts its oxygen to the charcoal, causing a gradual heating and eventually combustion.

The rusting of the pipes contributes also to this result, inasmuch as the rust formed during the hot season may be reduced by the heat of the pipes to a condition in which it will absorb oxygen to the point of red heat.

The same article also notices that a building was set on fire by pitch distilled out of a pine plank placed nearly three inches above a steam pipe, which dropped on the pipe and took fire.

A HORSESHOE TO FIT THE NATURAL FOOT OF A HORSE.

In the invention herewith illustrated it will be seen, from the cross sectional view shown in Fig. 2, that the shoe has a flat top part, which fits upon the lower edge of the wall or shell of the hoof from its heel portions clear around the front of the shoe, while the lower edge is sharp all around. At the heel the side parts or extremities are bent forward abruptly to form lips, tapering downward to form an edge on a level with the sharp lower edge of the shoe, and thus forming heel calks, their broad upper faces giving support to the bars or braces of the animal's hoof, which are not to be cut away, but preserved to give proper support to the heel of the foot, according to Nature's provision. At the angles of the opposite heel parts are lugs with



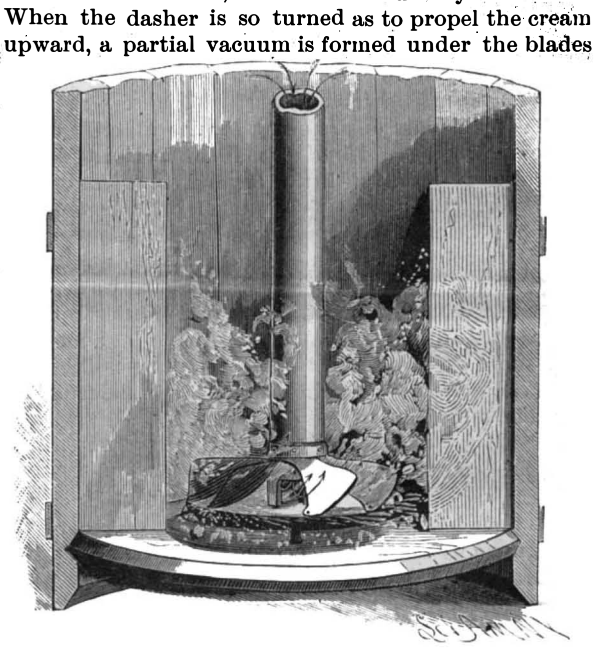
MONROE'S IMPROVED HORSESHOE.

threaded screws, whose ends may be forced against the inner sides of the outer walls of the hoof to prevent or cure contraction of the hoof. The shoe is attached to the hoof by screws passed diagonally outward and upward into the wall or shell of the hoof, as shown in Fig. 2, from which it will be seen that the shoe can be readily put on by an amateur after being properly fitted by an expert, it being the intention to make the shoe of cast malleable iron or cast steel, and fit it to the foot when cold, the shoes to be cast from patterns in graduated [illegible]rom impressions taken from horse's feet that ar[illegible]rmal condition. This shoe is designed to readily clear itself of mud and snow, etc., and to give an excellent foothold to the horse on either pavements, soil, or turf.

This invention has been patented by Mr. Edwin A. Monroe, of No. 370 Broadway, Saratoga Springs, N. Y.

IMPROVED CHURN.

The churn herewith illustrated is the invention of Mr. C. A. Madsen, of Gunnison, Utah. The screw is formed of sheet metal or other suitable material, and is provided with blades, as clearly shown. Both the screw and hollow shaft to which it is attached are secured to a disk. Between the screw and disk is a chamber having outlets between the blades, and in the hollow shaft are openings, thus forming communication between the shaft and chamber. From the center of the under surface of the disk projects a pivot having a bearing in the bottom of the churn. The shaft is rotated by suitable means. To retard the rotation of the cream, there are two vertical ribs extending from the bottom of the churn, about two-thirds way of the side. When the dasher is so turned as to propel the cream upward, a partial vacuum is formed under the blades



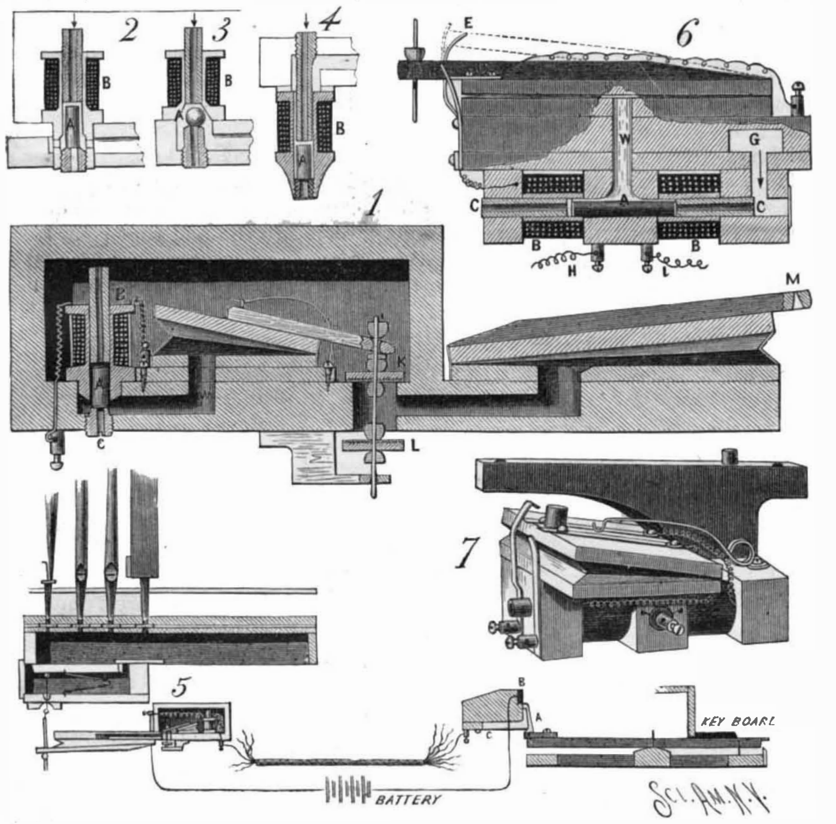
MADSEN'S IMPROVED CHURN.

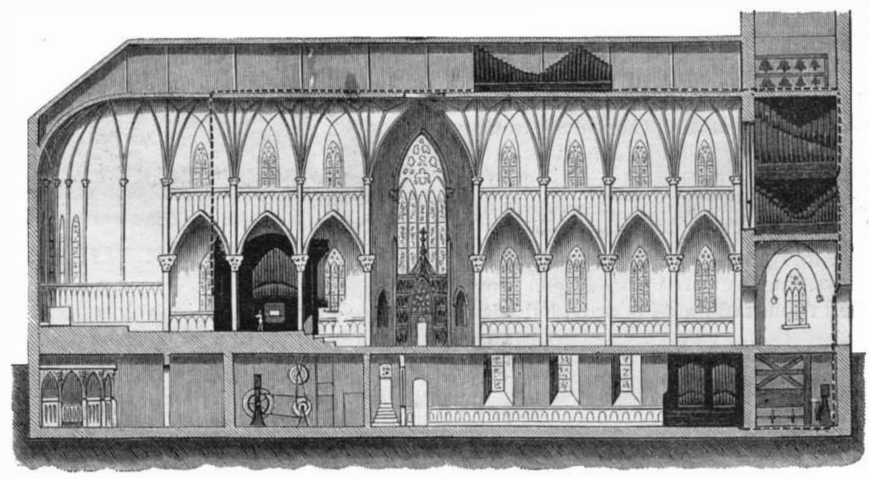
in the chamber, into which air is drawn through the shaft. This air mingles with the cream, and in its upward passage assists in agitating the cream, thereby hastening the separation of the butter. In actual practice, this churn has been found to produce a great saving both in time and labor.

A Great Steel Forging.

The steel forging for the fighting tower of the Italian armorclad Lepanto is 10 feet in outside diameter, 7 feet 11 inches inside diameter, 12⅛ inches thick, and 4 feet 9 inches high, and is intended to protect the captain of the ship in battle.

The weight of this huge block of steel is 30 tons, and the rough ingot from which it was forged was 65 tons. It was produced by the firm of Schneider & Cie., of Le Creusot, France. The ingot was worked to a diameter of about 6½ feet, then bored, and then worked by forging on a mandrel to the dimensions given above. It is the first fighting tower that has ever been made in one single piece.





WACKER'S IMPROVEMENTS IN ELECTRIC ORGANS AS APPLIED IN THE CATHEDRAL, GARDEN CITY.

CURIOUS ACCRETION OF EMERY WHEEL DUST.

The particles of material removed from solid bodies by the abrasive action of dry emery wheels are always more or less heated. Dust from metals is often fused, and sometimes dissipated altogether. Fused globules of metal are frequently found in emery wheel dust, but the stalagmitic formation consisting of particles welded together, as shown in our engraving, is not common.

These curious growths are formed almost hourly by a wheel 14 inches in diameter, revolving at the rate of 900 revolutions per minute, employed in shaping some of the steel parts of a sewing machine. The position of the stalagmite relative to the work and the wheel is shown in Fig. 1. Under the microscope the particles do not appear to have been entirely fused, but only sufficiently softened to cause them to stick together.

The mass of the aggregation is quite solid and strong. Except in color, it more nearly resembles a spire of coral than anything else.

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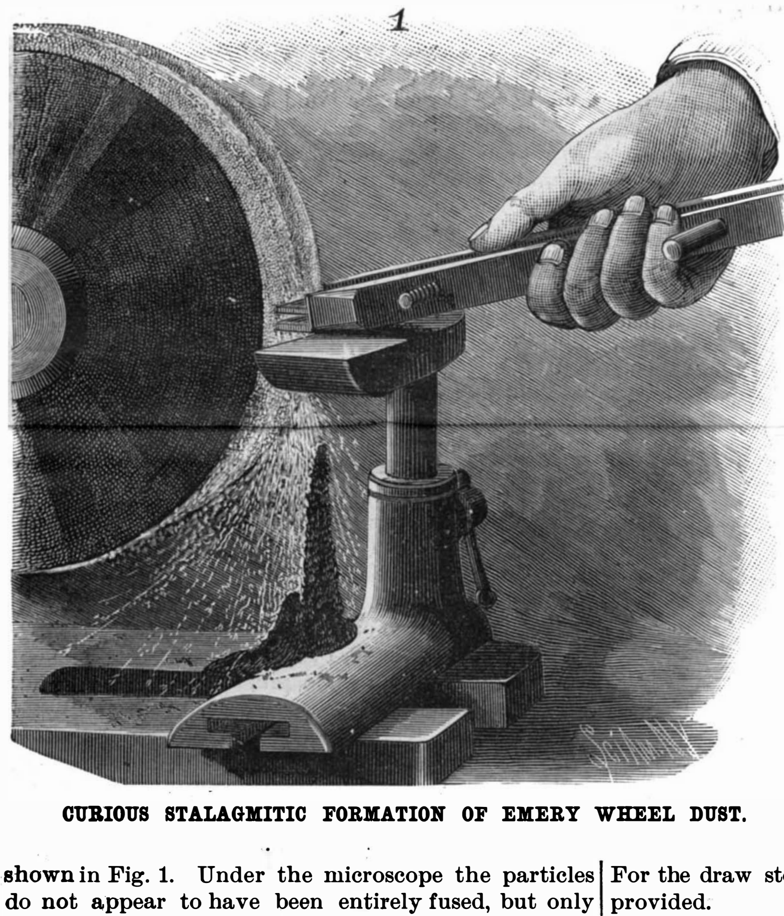
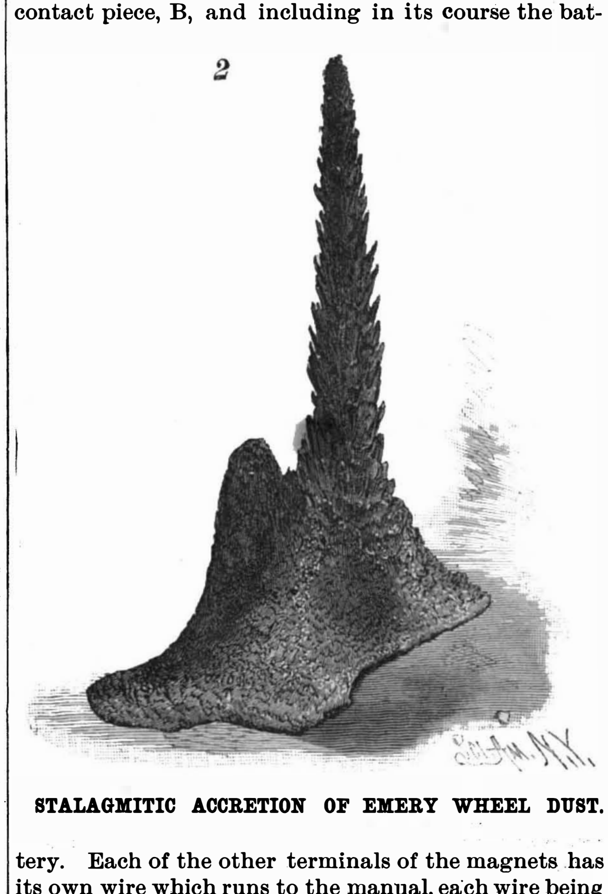


CURIOUS STALAGMITIC FORMATION OF EMERY WHEEL DUST.

2



STALAGMITIC ACCRETION OF EMERY WHEEL DUST.

NEW ELECTRIC ORGAN MOVEMENT.

The introduction of the pneumatic movement for organs was one of the great steps in the development of this instrument. By it the strain of directly opening the pipe valves was removed from the fingers of the performer, and a light acting manual, as easily played upon as a piano keyboard, was placed at his command. In the illustrations accompanying this article we show another improvement, that is as distinct a step in advance as the one just mentioned. By it electricity is called into play, and the pneumatic movement is controlled by the electric current.

In Fig. 1 a section of the mechanism is shown. The details of the pneumatic movement will be at once recognized by those familiar with it. It is controlled by the electric attachment, that forms the subject of this article. Within a wind chest a hollow cored electro-magnet, indicated by B, is mounted in a vertical position. A cylindrical armature, A, plays up and down below it. The armature and core are made of soft iron. The armature fits loosely in a cylindrical chamber directly below the magnet. Its top and bottom are covered with disks of leather.

Below the armature a nozzle communicates with the open air. Thus, when the armature rises, the opening in the magnet core is closed. When it falls, it closes the opening of the nozzle, C. The wind chest is in constant communication with the organ bellows, so that the air within it is maintained at a pressure above that of the atmosphere. Within it is a bellows that is held open normally by a spring. It will be seen that when the armature has fallen the bellows is filled with air from the wind chest. The pressure is carried down through the hollow core and space surrounding the armature and through the passage, W. The bellows, under the circumstances, remains distended and closes the valve, K, and keeps the valve, L, open. This leaves the outer bellows free to remain open or shut. The tracker attached to the arm at M, acted on by the pipe valve, pulls it shut, and no air is admitted to the pipe.

When it is desired to sound the pipe a current of electricity is passed through the wire. This draws up the armature, and closes the opening in the magnetic core, and at the same time opens the nozzle, C. The bellows in the wind chest, having its interior put in communication with the outer air, at once closes under the effect of the air pressure within the box. This opens the valve, K, and closes the valve, L, so that the outer bellows is forced open by the pressure from the wind chest. The tracker is caused thereby to open the pipe valve, and the pipe begins to speak. In Figs. 2, 3, and 4 different modifications of the magnets and armatures are shown.

All this is done so quickly that a sensitive pipe can be made to speak six hundred times a minute.

These are the pipe movements, and one such magnet and attachments are supplied for each key in the manual and for each pedal key. For the draw stops a somewhat different apparatus is provided.

It is clear that what has been described would answer for them, but with the attendant disadvantage that electricity would have to be supplied as long as the stop was kept open. In Figs. 6 and 7 a section and elevation of the draw stop mechanism are given, by which arrangement this difficulty is avoided completely. Referring to the section, two magnets, BB, wound in the same way are shown arranged horizontally, and supplied with a horizontal cylindrical armature, which is permanently magnetized. It is attracted to one or the other of the magnets, according to the one the current is caused to pass through. Air pressure from the organ bellows comes through the passage, G. When the armature, A, is attracted toward the left, as a current passes through the left hand magnet, this air pressure raises the bellows and opens the stop. As the bellows rises, the spring, F, breaks contact with the piece, D. This cuts off the left hand magnet from the line, but the polarization or magnetization of the armature causes it to retain its place. Hence the bellows stays open. But in rising by means of the spring, E, and another contact piece corresponding to it, it throws the right hand magnet into its own circuit. Then, when another pulse of electricity is sent by the opposite movement of the stop handle, it passes through the other magnet, and draws the armature to the right. The bellows under the influence of the spring shown in Fig. 7 collapses, closes the draw stop, and at the same time cuts off the current of electricity. A separate wire is provided for each magnet going from the draw stop handle, but a single return wire acts for both. The horizontal position of the magnets in conjunction with the polarized armature are the distinguishing features of this mechanism. The bellows acts by a tracker directly on the stop valve.

One of these movements is supplied for each stop, and thus the whole range is controlled by electricity. Very little current is required, as the draw stops are worked by a current of a second's duration. The manual consumes but little.

To give some idea of the connection between manual and soundboard, the section shown in Fig. 5 has been given. To the right is a key in its normal position. When depressed by the finger, it makes an electrical connection between the oscillating piece, A, and the contact piece, B. All the magnets connect at one terminal with a single wire, running from them to the contact piece, B, and including in its course the battery. Each of the other terminals of the magnets has its own wire which runs to the manual, each wire being connected by the binding screw and spring, C, to its own key. Hence, when a key is depressed it actuates the magnet connected with it, and makes the corresponding pipe give its note. On the left of the drawing will be recognized in section the electric valve movement just described. A variation is here introduced by placing the outer bellows below, instead of above, the supporting board. The cable containing the individual wires, insulated from each other, is shown between the keyboard and movement, while above the movement is shown the soundboard, a pipe valve, and a row of pipes.

This arrangement leaves the manual perfectly free from strain. The keys, by being weighted, or by the use of springs, are made to work as easily or stiffly as desired.

What this invention effects is to render possible the playing of any number of organs from the one manual and by one organist, whatever be the distance of the soundboards from the performer. It is the invention of Mr. George Wacker, of 168th Street and Franklin Avenue, New York city, an organ builder of long experience, and, as this invention shows, a competent electrician. The complications and difficulties that beset the simple organ movement have to be allowed for, and here the skill of the organ builder is necessary. An electrician would not be able to cope with these difficulties any more than a mere organist could solve the electrical problems. A combination of the two was required in the solution of the problem.

The Stewart Memorial Cathedral, in Garden City, on Long Island, furnishes a good illustration of the practical application of this invention to the second largest organ in the world. There an organ with two hundred and forty keys in the manual, thirty pedal keys, one hundred and fifteen stops, and seven thousand pipes, is provided with this instrument. A sectional view of the cathedral accompanies this article.

The organ is divided into five parts. The main organ is in the chancel, immediately back of the manual. In the crypt under the front entrance is what is known as the "chapel organ." High up in the tower are the "tower" and "solo" organs, the latter unprovided as yet with its pipes. Then over the stone ceiling, between it and the roof beams, is the "echo organ." The bellows for the chancel organ are driven by a steam engine under it. A second engine and bellows supply the other four divisions. A small magneto-electric machine, run by a sewing machine belt, generates the electric current. At will the organist plays on one or the other of these organs, producing the most beautiful distance and echo effects.

In the processional hymn with which the service commences, the system is brought into play most effectively. The choir forms in the chapel, and is accompanied by the chapel organ. As they come up into the body of the church, the tower organ is brought into action. Then, as they approach or reach the chancel, the current being shifted from the tower, the chancel organ may take up the strain.

Each of the different divisions has its own manual for the convenience of the tuner. When the chapel organ is played from the chancel manual, the keys of its independent keyboard, the church's length from the organist, move up and down as the notes are sounded, producing a most peculiar effect, as if some invisible performer were seated in front of it, and moving the keys.

In the entire organ there are about four hundred of these magnets. Having no springs and no adjustments, when once in place, they are set forever. The great wind valves, sometimes of fourteen inches area, open and close with absolute certainty. The most beautiful effects of this great organ are due to and depend upon electricity, and it never yet has failed.

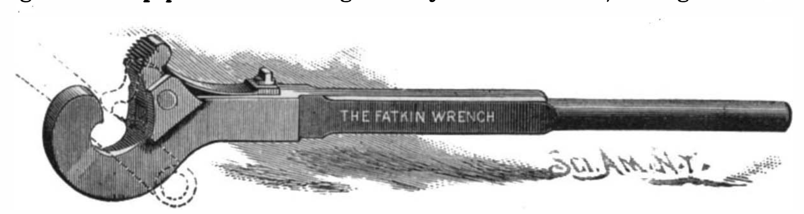
As an illustration of the size and range of the organ, it is of interest to note the largest and smallest pipes. The largest is 19 in. by 23 in. in area and 32 ft. long, giving 16½ vibrations per second (sub-contra C or C_2); the smallest, rather less than half an inch long, gives 16,896 per second, corresponding to the upper C (C^7)—a range of ten octaves, and practically covering the musical capacity of the human ear, though Preyer has claimed that from 16 to 41,[illegible] vibrations per second, or an octave and a fraction higher, can be heard by some ears.

Tetanus Treated by Rest.

Dr. De Renzi states, in the *Rivista Clinica*, that by treating patients with traumatic tetanus by means of perfect rest, he has been able to restore four out of five to health ; whereas, when treated in other ways, these patients usually die in two or three days. He places the case in a special room, where absolute silence reigns. Even in the passages leading to it and in the neighboring wards care is taken to lay down carpets, so that no sound shall penetrate the tetanus ward. The door of the latter is of course well oiled, so as to open and shut noiselessly, and the patient's ears are stuffed with cotton wool, he himself being strictly enjoined not to make the slightest noise. He must, of course, be fed. This has generally been considered impossible, the teeth being clinched and the spasmodic contraction being increased by attempts to masticate. The obstacle may, however, be easily overcome by parting the jaws and introducing liquid food through a curved sound ; swallowing is accomplished without difficulty. This method of treating traumatic tetanus has been tried with success by several Italian practitioners—Drs. Pisani, Maragliano, Ria, etc. The only disadvantage is that the affection is sometimes prolonged for two months. It seems to increase in duration as it diminishes in force.

IMPROVED PIPE WRENCH.

This wrench is strong, durable, and very simple in construction, and not liable to get out of order. It is preferably made of cast steel, the serrated block being made of the best tool steel. For its gripping power it does not rely upon the spring, which is applied to hold the block in place when working the wrench in an inverted or overhead position. The gripping power is obtained by placing the serrated block eccentrically in relation to the hook-shaped jaw. To operate the wrench the block is simply closed on the pipe, and to remove it the handle is pushed backward, when the peculiar curve in the jaw will allow the wrench to easily leave the pipe. When using an adjustable wrench, fitting pipes of various sizes, the pipe is liable to be crushed; but with a wrench such as this, three-fourths of the circumference of the pipe is covered, and that danger is obviated. It is claimed that the several sizes of this wrench can be furnished for the same amount that is now paid for one adjustable wrench.



THE FATKIN PIPE WRENCH.

Further particulars regarding this wrench, which has been patented, can be obtained from Mr. T. O. M. Davis, of Winifrede, W. Va.

Corundum and Its Uses.

Corundum in its pure state is composed of the oxide of aluminum, having the formula Al_2O_3, *i. e.*, it contains two atoms of oxygen in each molecule. It is an exceedingly tough, compact mineral, occurring in a great variety of colors—blue, red, yellow, to nearly white. The pure crystals are translucent, and used as gems. It is one of the hardest known minerals, being placed in the scale of hardness next to the diamond. This quality is the source of its greatest value in the arts. The species is divided into three varieties—sapphire, corundum, and emery.

Sapphire includes the purer kinds of fine colors, transparent or translucent. These stones are used as gems, and are known by names indicating their color. The following well known jewels are forms of this mineral : Ruby, sapphire, oriental emerald, oriental topaz, and oriental amethyst. These gems are found chiefly in the beds of rivers in Ceylon, though some rubies are brought from Syria. The value of these stones was well known to the ancients, who used them under various names now obsolete. The stone called sapphire by Pliny is now known to lapidarists as lapis lazuli.

The oriental emerald is perhaps the rarest gem known. A few specimens have been found among the gold sands of the Missouri River near Benton. But few of these jewels are in existence, and these are in the great collections of Europe.

Corundum generally means the dull, untransparent occurrences of the mineral. They vary in color—blue, gray, or brown—but are never clear or capable of being cut ; it usually occurs in large, rough crystals, or in massive cleavages.

Emery is granular corundum. It is black or grayish-black in color, and mixed with grains of magnetite. Emery has very much the appearance of fine-grained iron ore, and for a long time was considered to be such. The texture is variable, some specimens being composed of almost impalpable grains, while others are made up of large, rough fragments of crystals.

Until recently the only source of emery was the far East, the island of Naxos, in the Grecian Archipelago, containing the chief mines. The emery was shipped from the port of Smyrna, and was known to commerce as Smyrna emery. Between the years 1835 and 1846 the entire business was in the hands of an English capitalist, who had a monopoly obtained from the Greek Government. In 1847 Dr. J. Lawrence Smith, an eminent American scientist employed by the Turkish Government to explore the dominion for valuable mineral deposits, discovered two large deposits of emery, one at Smyrna and the other on the site of ancient Ephesus in Asia Minor. These deposits have since then been worked by companies paying a royalty to Turkey.

Emery and corundum are chiefly used in the arts as abrading and polishing materials. The mineral is ground, and separated by passing through sieves into classes of various dimensions, which are then further prepared in different ways adapted to the purposes for which they are to be used. For the use of jewelers and opticians, the fine emery is poured into water containing gum, and the coarser particles allowed to settle ; the fine, impalpable dust remaining suspended in the liquid is then collected and used in polishing fine lenses, spectacles, and similar articles. The largest amount of emery is used by the manufacturers of plate glass, though great quantities come upon the market prepared in a great many different shapes to suit special purposes. One of the largest of these industries is the manufacture of emery wheels ; these are prepared by mixing the powder with glue or cement, and subjecting the paste to great pressure. Mixed with paper pulp and rolled into sheets, it is sold in the form of patent razor strops and knife sharpeners. Spread out on paper and cloth, it forms an excellent substitute for sand paper. Recently it has been discovered that crystallized corundum, when ground, forms a better abrading material than emery, owing to the fact that it breaks into sharp edged fragments, while emery has rather a rounded form. This discovery was followed by the discovery of large deposits of corundum and emery in Massachusetts, North Carolina, and Georgia. All of these localities are being actively worked, and large quantities of American material are being put on the market.

In the near future it is probable that corundum will assume a far more prominent place among the useful minerals as the source of the metal aluminum. The cheap production of this metal has long been the object of experiment to metallurgists ; and corundum, furnishing the purest source from which it can be obtained, will probably be the most valuable ore. Even at present a good deposit of corundum is as valuable a "find" as one could desire to have on his property, there being a steady and regular demand for it. Corundum is generally found associated with crystalline rocks, such as granular limestone, gneiss, granite, or slate. The emery of Asia Minor is associated with granular limestone. The characteristic by which it is most readily distinguished by the prospector is its extreme hardness. A fragment of corundum will scratch any of the constituents of the rocks in which it is found.—*The Milling World.*

A Shying Horse.

To the inquiry, Why does a horse shy ? the *National Live Stock Journal* replies : Because he sees something which he does not understand, and is filled with a greater or less degree of fear, something as the boy feels when he shies at the burying ground, and goes around to keep clear of it. It may be some new or unusual object that the horse sees, or it may be an imperfect view of it. Even a familiar object, if it comes to view suddenly and unexpectedly, will cause a horse to shy or jump, just as an unexpected object or sound causes a nervous person to start. When a person is so startled, how much would it improve the matter to be scolded at or given a cut with a whip ? Just as much as the same treatment would in the case of the horse. Harshness only aggravates the matter.

The more the horse is scolded and whipped, the more nervous he gets ; and every time he passes the place where the fright and whipping occurred, he will recollect the unpleasant affair, and he will begin to prick up his ears and fidget, ready for another jump. Give him the lines, and he will go by in a hurry. The proper way is never to strike or scold a horse that is startled or frightened. Speak to him coolly, calmly, and kindly ; give him time to see and collect his scattered senses, and make him feel that you are his friend and protector. When he sees that all is right, there is an end to all further trouble. We have seen a horse refuse to cross an unsafe-looking bridge ; but when the driver took him by the bits and walked ahead, the horse cautiously followed. Next time he required no coaxing or urging to cross the bridge. He might have been whipped into it at first, but was not the milder course, although a little trouble, the better one ? The horse showed his confidence in the driver ever afterward.

Photometry.

A neat method of indicating the precise rate of consumption of candles, used in photometrical work, has been carried out in Germany. The candle holder is hung in an unequal arm balance, the beam of which has a long pointer hanging down from the fulcrum, for marking the position of the balance on a vernier scale. At the two opposite ends of the scale there are two metallic pins, while a movable pin, in electrical connection with a battery and a bell, is arranged in the middle of the scale. The candles are lighted and weighed until the pointer just swings clear of one stud of the vernier, when a certain weight is placed in a pan provided for the purpose underneath the candles, a clock being started at the same moment. When, owing to the consumption of the candles, the weight placed in the pan is lifted by the weight in the opposite pan, the pointer swings back and touches the pin, which completes the circuit and so rings the bell. By noting the time the candles were burning, the precise rate of consumption of the candles can be easily determined.

MORNINGSIDE PARK, NEW YORK CITY.

Naturally, one of the most picturesque and attractive portions of New York city is that bordering the Hudson River for a considerable distance south of the Harlem. Along the water front at Riverside Park—made famous as the final resting place of Grant—is a high bluff, beyond and to the east of which is a rolling, elevated country, plentifully covered with large trees. The high land abruptly terminates at Morningside Avenue, where a comparatively low and flat section commences. This level portion has been selected by the city to form Morningside Park, which will be, when the present plans of the Park Department shall have been fully carried out, a most pleasing pleasure ground.

The park is bounded by 123d Street on the north, by New and Ninth Avenues on the east, on the south is 110th Street, and on the west Morningside Avenue. Separating the park from the more elevated country is the wall that forms the subject of our frontispiece. Our artist, while faithfully depicting the general characteristics of the wall itself, has availed himself of that license for which artists, as well as poets, are cheerfully forgiven, and has slightly drawn upon his imagination for the pleasing features seen in the adjoining landscape.

The massive retaining wall was built by the Department of Public Works. Beginning at 110th Street, the wall is straight to a point near the northern extremity, where it curves, as shown in the center view, closely following the contour of the land to 123d Street. The wall is built of gneiss rock, obtained from the excavations. It has a batter of 1 in 12, and the face is broken ashlar. In some places it is over 20 feet thick at the bottom, and at the highest point, at 116th Street, it is 40 feet from the surface of the ground to the top, the foundation extending some distance below. The entire face of this wall will ultimately be covered with clinging plants.

Four bays and two entrances, which may be said to comprise the strictly ornamental branch of the work, combined, of course, with the useful, have been erected by the Department of Public Parks, whose jurisdiction may be said to begin at the face of the wall. There are two approaches to the main entrance or steps at 116th Street, shown in the upper view. The stairways measure 24½ ft. from out to out; the first platform is 22 ft. long by 7 ft. wide, and the other two are 15 ft. in length. The extreme width of the top, illustrated in the lower view, is 62 ft., and the front is broken by a large semicircular bay. The steps, coping, and caps of the columns are of granite, all the rest of the work being of gneiss. On top of the wall there will be placed stone columns and bronze railings.

The steps at 110th Street present similar features, as will be seen from the middle left hand view, and there will be like ones at 123d Street.

Located at 111th, 113th, 115th, and 117th Streets are four bays, semi-octagonal in form, and built in a style in keeping with the entrances. At the intervening streets it is expected to erect additional steps. The bays are designed to serve as outlooks and resting places from which the park may be viewed.

The tops of the bays are formed of iron channel beams resting upon the outer and inner walls, transverse partitions being erected in the larger entrances to support the ends of the beams. Between the beams are thrown brick arches, covered with asphalt. The chambers thus formed are entered through doors in the outer wall, and will be used for keeping tools, etc.

In this entire work no attempt has been made at profuse ornamentation; the whole is quiet, rich, and massive, and will be in harmony with the park upon one side and residences upon the other, and will form an appropriate division mark between the two.

The cost of the walls of the bays and entrances was $53,500; the steps, platforms, balustrades, and coping of the bays and entrances cost $75,000, making the total cost of the improvement as far as carried out ~~about $250,000.~~

Improved Fire Extinguishing Apparatus.

A novel system of fire extinguishing has just been introduced in London by Mr. William Glenister, chief of the Volunteer Fire Brigade, Hastings, and Mr. J. C. Merryweather, of London. The apparatus forms the subject of a patent. The new fire and life saving machine consists of a tricycle with which are embodied the following: 1. A hose reel carrying a large quantity of specially constructed hose for winding in a small compass, with all the attachments for working on to a fire from the street hydrants. 2. A light double-pump fire engine in collapsible cistern, capable of throwing 25 gallons per minute, to be worked by two pumpers. 3. A simple fire escape, with descending ropes and bag. 4. Jumping seats formed from the riders' seats. The machine is run at full bicycle speed by two men, and if desired the treadles can be so disposed as to work the fire pump, but for this a special gearing is required. For country districts and suburban towns, this improved machine will doubtless be appreciated.

Correspondence.

The Island of Malta.

To the Editor of the Scientific American:

In the May number of your Export Edition is a short article, in which it is stated that the island of Barbados, with an area of 166 square miles, contains a population of over 175,000 souls, that is to say, an average of 1,054 people to the square mile, and that therefore the Barbados is the most densely populated part of the earth.

Permit me to present the claims of this historic island of Malta for the peculiar honor of being even more densely populated than Barbados. The total extent of the land (or, more properly, rock), surface of Malta is about 95 square miles, and the proportion of the population (exclusive of the British war forces and of the visitors or non-residents) is, as near as can be estimated at this date, 1,500 to the square mile.

The city of Valetta contains the greatest plethora of population—its area being 0·318 of one square mile and its population 24,854, a proportion of 78,157 persons to the square mile. There is one specially populous quarter of Valetta known as the *Manderaggio*, whose area is 0·004 of a square mile, or 2·56 acres, wherein dwell 2,544 persons—a proportion of 636,000 souls to the square mile.

Excluding the one-third of the island which is unsuitable for cultivation, and the area occupied by buildings, and the population of Malta reaches the biggish number of 2,000 persons per square mile.

The island raises enough to support about one-third of its inhabitants. Nevertheless, the people are contented and fairly prosperous. There are no direct taxes levied of any kind, nor any insurance, for the buildings are absolutely fireproof; there is no fire department to support. The buildings are of the soft Malta stone, and the builder scarcely needs any other tools than a hatchet and a square, for the material is worked almost as easily as cheese. The island has no debt; *per contra*, it has upward of £250,000 invested in English funds. Honesty and economy distinguish the administration of this model little government. It is a so-called free port, but its custom house receipts are upward of £140,000 annually, and £50,000 or £60,000 of that total is derived from the import duties on wheat, and £40,000 from the duties on wines and spirits. The laboring clases pay these duties, but they don't seem to know it!

Malta is one of the busiest and most important ports in the Mediterranean, and in one year I have known 6,675 vessels to arrive in the harbor.

The following countries are represented in Malta by Consuls or Consuls-General: United States, Austria, Belgium, Brazil, Denmark, France, Germany, Greece, Italy, Morocco, Netherlands, Persia, Portugal, Roumania, Russia, Spain, Sweden and Norway, Turkey, and Tunis.

The real property of the island is, as near as possible, thus owned: One-third by the Church and her priests, one-third by the wealthier inhabitants, and one-third by the British government, the latter succeeding to the property formerly owned by the Knights of Malta.

The franchise has lately been extended, so that now about 10,000 of the inhabitants are privileged to vote for members of council. The franchise is based on a money qualification, not on the intelligence of the voter. For instance, my Maltese cook, who pays not less than £6 per year for his house, but who cannot read or write, is a voter, whereas my intelligent friend Mr. Giovanni Vella, who is a gentleman and scholar, cannot vote because he lives with his father and pays no rent.

Education is, however, on the increase, for in 1842 there were but 3,833 scholars in the schools, and 12,390 in 1881. This year the scholars number upward of 15,000. About £20,000 is expended annually ~~by the educational~~ department. In 1881 the percentage on the native population of those able to speak, read, and write their own language was 16·50, leaving 83·50 illiterate or only able to speak their own tongue.

The Maltese is a most peculiar language. It is of Oriental origin, Arabic in its chief characteristics, but sprinkled all through with Italian incorporations. It has no grammar. It is phonetic and idiomatic. I will give you a sample. It is from a Maltese love song:

Tridu tafu shbeiba sh taghmel,
Min fil ghodu sa fil ghashia,
Taghmel il bokli f' rasa,
U tokghodlok fil gallaria.

The translation of which is:

Would you know what a maiden does
From morning until evening?
She adorns her head with curls,
And seats herself in the balcony.

JOHN WORTHINGTON, U. S. Consul.

U. S. Consulate, Valetta, Malta, July 10, 1886.

THERE are in Germany 620 paper mills, 437 wood pulp mills, 42 straw pulp mills, and 39 mills making chemical fiber.

PHOTOGRAPHIC NOTES.

Reducing Over-intense Negatives.—Farmer's well-known method of using a fresh 5 per cent solution of hyposulphite of soda in which is dissolved a few grains of red prussiate of potash (ferridcyanide of potassium), for reducing intense negatives, needs no further description here, since it is now generally used by both amateur and professional photographers.

Quite recently, Mr. Edward Leaming, a member of the New York Amateur Society, experimented with this process, using a 5 per cent solution of hypo and a 10 per cent solution of ferridcyanide of potassium; and noticed that while the reduction took place very uniformly, yet, when the operation was finished, a yellow tinge was left on the negative, which in a measure counteracted the effect of the reduction, as it slowed the printing on silvered albumenized paper.

His remedy was to change the color of the negative, which was accomplished by putting it into a saturated solution of common alum. In a short time it was changed from yellow to a bluish color, making it well adapted for quick printing.

The reason of the change is due to the fact that commercial potassium alum contains iron as an impurity, and when it comes in contact with a mixture of a ferrous salt and the ferridcyanide of potassium, a bluish precipitate of ferrous-ferridcyanide results. This precipitate is known under the name of Turnbull's blue.

Sulphurous Acid for Developers.—In experimenting with this acid, we have found that the samples to be purchased from leading manufacturing chemists are not as powerful as they should be, and we lately were led to prepare a fresh solution by the simple method described in SUPPLEMENT, No. 460. We were much surprised to note the better keeping qualities of this freshly prepared solution. The pyro solution in which it was employed retained its full strength and kept perfectly clear, being very nearly colorless. As the sulphurous acid may be very easily and quickly prepared, we believe using it fresh is of much utility in preserving the pyro solution intact.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court.—Northern District of Illinois.

DRUMMOND *et al. vs.* VENABLE *et al.*

PLUG TOBACCO.

Blodgett, J.:

A claim reading "As a new article of manufacture a plug of tobacco one or both faces of which are marked off by indented lines, which serve to secure the wrapper to the filling, and also as guides for cutting up the plug into small pieces of definite size and weight," is void for want of novelty, in view of the fact that it was common prior to the date of the alleged invention to mark cakes, candies, chocolate, etc., with indented lines to indicate measured quantities.

A feature of utility which is merely incidental to the main purpose of the invention is not of itself sufficient to sustain a claim where it is shown that the main purpose has been accomplished prior to the date of the alleged invention.

Patent No. 200,133, of February 12, 1878, to James Drummond, for an improvement in marking plug tobacco, is void for want of novelty.

U S. Circuit Court.—District of New Hampshire.

JENCKS *vs.* THE LANGDON MILLS *et al.*

Colt, J.:

This bill in equity is brought for infringement of Letters Patent No. 168,644, granted the complainant for improvement in spindle bolsters. The suit is between citizens of New Hampshire, and the first question to be determined is whether there is a subsisting license between the plaintiff and the defendant corporation covering the patented bolster in controversy.

The plaintiff was in the employ of the defendant corporation as overseer or superintendent from June, 1861, to 1877. During this time he made several improvements in the machinery used in the mills. His patented adjustable rings were put into the mills in 1866 and 1870, and his patented traveler cleaner in 1868 and 1870. The patented bolster, upon which suit is now brought, was put in between 1875 and 1877. The date of the patent is October 11, 1875. The defendants contend that Jencks agreed to give the company the free use of his inventions as an advantage to him in introducing them elsewhere; that he was to make no charge for royalty, and that no royalty was ever paid; that he took the time which belonged to the company to devise and experiment with his improvements, used the tools, workmen, and materials of the company in making the improvements, and tested them in the machinery which was run by the company.

Held, When complainant was an employe of defendant company, and used the time it paid for, and its tools, workmen, and materials in experiment and perfection of the invention, and put it, when completed, in use in defendants' mill, and made no contract as to compensation or royalty, the law will infer a license to the defendant to use the invention in the particular mill without royalty during the term of complainant's patent.

SIX CYLINDER QUADRUPLE EXPANSION ENGINES.

We give engravings of a very interesting set of engines lately constructed by Rankin & Blackmore, of Greenock, for the steel screw yacht Rionnag-na-Mara, built for Mr. A. G. Pirie, of London, by John Reid & Co., Port Glasgow. For the illustrations and following particulars we are indebted to *Engineering*. Her dimensions are 170 ft. long over all, 21 ft. beam, and 13 ft. 6 in. depth (moulded), tonnage (Thames yacht measurement) 311 tons, while the speed specified was 11½ knots, but on trial 12 knots was easily maintained.

The engines are of the six cylinder "disconnective" quadruple expansion type recently patented by John F. & Matthew Rankin, of the makers' firm. The three high pressure cylinders are placed tandem fashion over the first and second intermediate and low pressure cylinders; the respective diameters being 7 in., 7 in., 7 in., 16 in., 22 in., and 34 in., and the stroke of pistons 24 in. The reason why six cylinders were adopted in this case instead of the four cylinder arrangement which the makers at first proposed to the owner, was that Mr. Pirie particularly desired to have an engine which would run so slowly (say not more than 15 revolutions, as against 30 in his former yacht) that he might be able to fish direct from the vessel, and thus save the trouble of pulling about in a small boat, as is customary. Another motive for distributing the power equally over three cranks was to make as sweet working a job as possible, this being a matter of the first importance in a yacht. Again, by admitting steam to the three high pressure cylinders simultaneously, prompt handling is insured and starting valves are dispensed with, as the three cranks are set at angles of 120 deg. apart.

Further, this combination of cylinders enables the so-called "disconnective" arrangement to be applied in a singularly efficient way, as each high pressure cylinder forms a natural starting point for the three principal subdivisions of the engine when working single tandem, for which purpose auxiliary exhaust pipes have been provided. The high pressure cylinders are also utilized for heating up the lower cylinders in a very simple manner, by allowing the hot water and steam to drain into them instead of into the bilges as usual. The chief objection to this type of engine, as compared with the ordinary triple expansion working on three cranks, is the increased friction of the additional cylinders; but there is not so much in this as might be supposed at first, as, owing to the number of stages, the great advantage of superior economy. This idea has also been applied to all the other modifications embodied in Messrs. Rankin's plans, on account of the great security it affords against a complete breakdown or in the event of any part requiring to be overhauled; say, for example, if the white metal often employed for crank pin bushes should give out, it would only be the work of a few minutes to uncouple the connecting rod and set the remaining two-thirds (or one-third if need be) of the engine to work, thus allowing ample time for refilling the bushes at leisure. This might be the means of saving a vessel in the case of a breakdown off a stormy lee shore. It may be of interest to describe in detail the various modes of working this engine as a whole and in parts. They are as follows: 1. *As a Six Cylinder Quadruple Expansion Engine working on Three Cranks.*—The high pressure pistons (which with their rods form admirable guides for the larger pistons in a heavy seaway), and, indeed, the others also, can be made so easy a fit that no oil need be used unless just before stopping the engines, as the steam itself will do all the necessary lubrication, and any portion which may escape will be worked up in the next stage.

The idea of the "disconnective" gear (thus named to distinguish it from the patent "disconnecting" engines of the same makers for paddles and twin screws) originated with an arrangement of four cylinder quadruple expansion engines in the attempt to make the two divisions as independent of each other as is the case in the ordinary four cylinder tandem compound engines, such as are used in the White Star and other liners, the result being quite as simple a machine with steam is admitted to the three high pressure cylinders through the small pipe shown in the front view on our engraving, and is exhausted through the horizontal curved pipe shown in the back view, this pipe gradually enlarging until it joins the vertical portion leading to the first intermediate cylinder. Thence the steam passes into the second intermediate cylinder by means of the large horizontal pipe shown on the front view, then through an exhaust passage into the low pressure cylinder, which finally exhausts the steam into the condenser.

2. *As a Five Cylinder Quadruple Expansion Engine working on Three Cranks.*—This is a modification of No. 1, with one of the high pressure cylinders shut off (or with just enough steam to lubricate the piston), thus practically taking the place of an expansion valve.

3. *As a Four Cylinder Quadruple Expansion working on Three Cranks.*—This is a still further modification of No. 1, two of the high pressure cylinders being cut off; this mode of working might prove useful if the vessel should run short of fuel.

4. *As a Four Cylinder Triple Expansion (Non-condensing) working on Two Cranks.*—In this case steam is supplied to the two forward high pressure cylinders, which exhaust into the first intermediate cylinder, thence into the second intermediate, which in turn exhausts into the atmosphere.

5. *As a Four Cylinder Triple Expansion (Condensing) working on Two Cranks.*—Steam is let into the two after high pressure cylinders, which exhaust into the second intermediate, and thence into the low pressure cylinder and condenser.

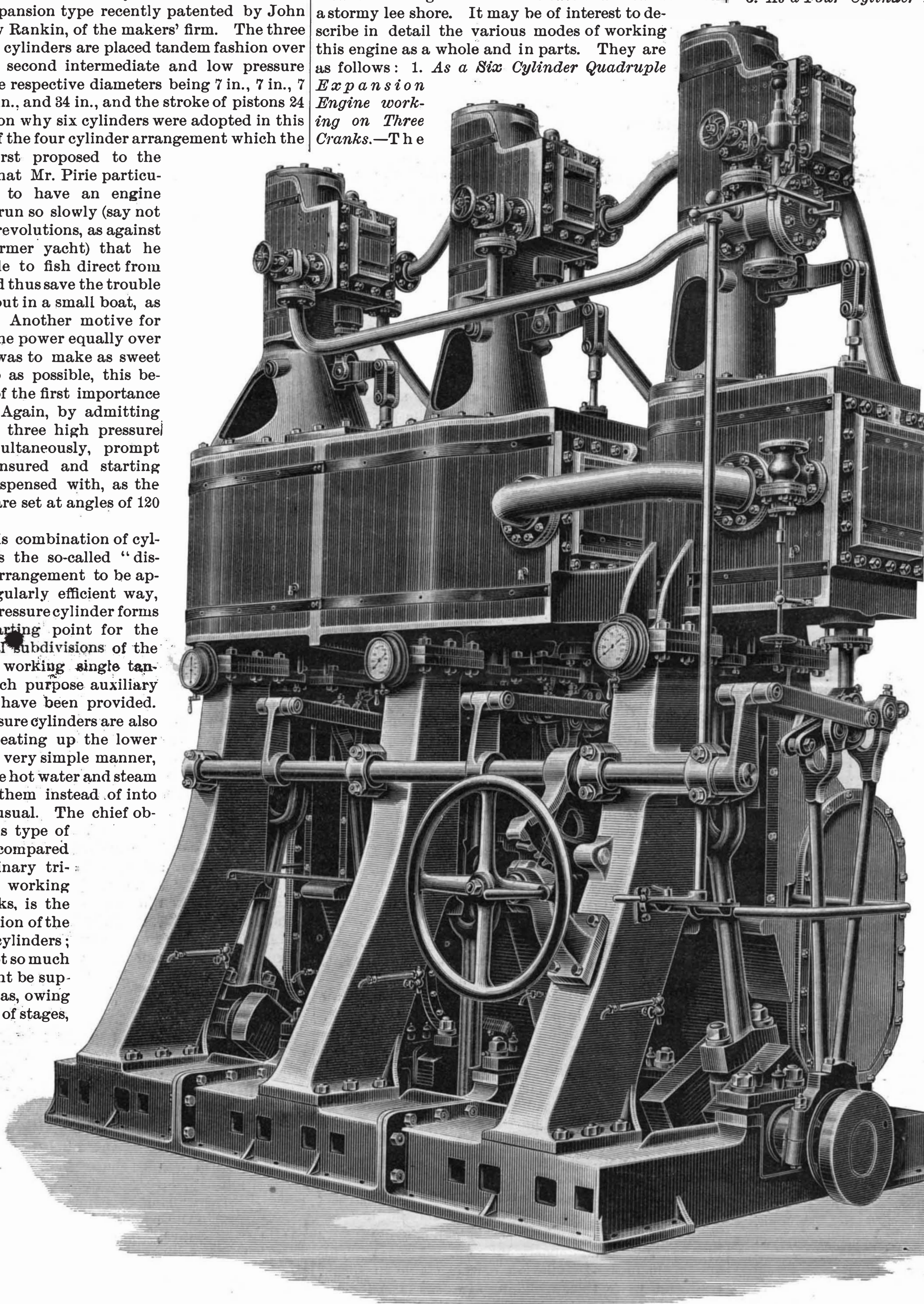
6. *As a Three Cylinder Triple Expansion (Condensing) working on Three Cranks.*—In this case the three high pressure cylinders are merely used as guides for the upper portions of the piston rods, and steam is admitted direct from the boiler through a special valve (suggested by the owner) into the first intermediate cylinder, then into the two succeeding cylinders, thus forming the usual type of triple expansion engines.

7. *As a Two Cylinder Tandem (Non-condensing).*—In this modification the two after divisions are supposed to be useless, and the steam is exhausted from the forward high pressure cylinder through the special auxiliary valve and pipe into the cylinder beneath and thence into the atmosphere.

8. *As a Two Cylinder Tandem Compound (Non-condensing).*—This is practically a repeat of No. 7, with the central high pressure cylinder sending its steam into the second intermediate, which exhausts into the atmosphere.

9. *As a Two Cylinder Tandem Compound (Condensing).*—The after high pressure cylinder works in conjunction with the low pressure cylinder, forming the ordinary single tandem type, so well known in connection with Holt's steamers.

The valve gear is of the ordinary link motion type, with all the working parts made very large and easily adjustable; the valves themselves being all of the common locomotive description.



SIX CYLINDER QUADRUPLE EXPANSION STEAM ENGINE.

The air, circulating, feed, and bilge pumps are worked from the after division of the engine by levers, in accordance with the makers' usual practice with single screw engines.

The propeller is of solid cast steel with four blades thrown well aft, and the absence of vibration on trial was very marked, owing to this and the extremely uniform working of the engines.

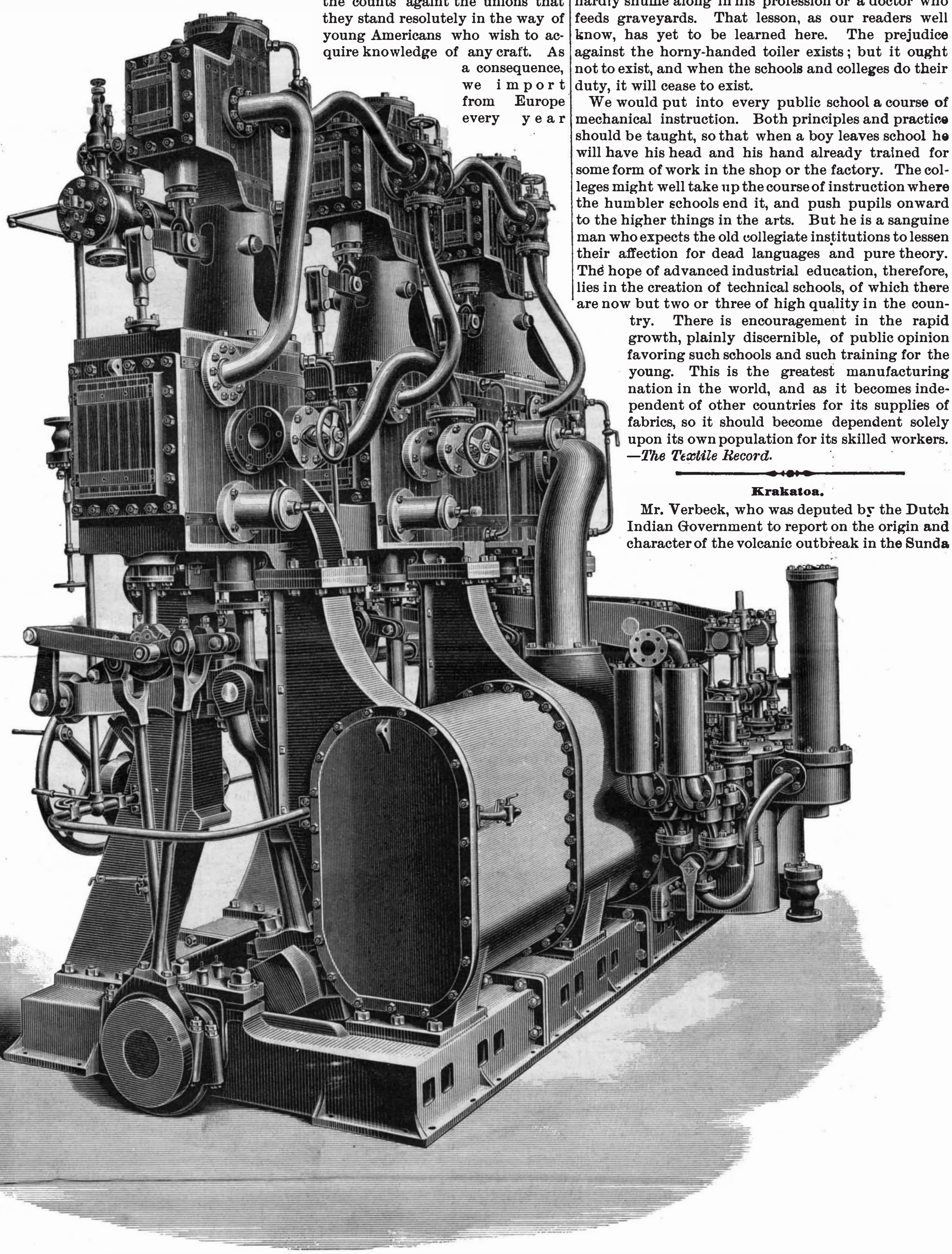
Forced draught has been provided for, but merely for occasional use.

Recently the boat was subjected to running progressive trials for the purpose of testing her consumption of coal, and the results were highly satisfactory.

For three hours the consumption was 1,391 lb. of coal, or a mean per hour of 463·6 lb. The mean revolutions were 102·2, the mean steam pressure 170 lb., expanding thirteen times, and the mean indicated horse power 412. This gives the extraordinary result of 1·125 lb. consumption per indicated horse power.

No lubricant whatever was used in any of the cylinders during the whole day's steaming; but notwithstanding this, the engine was run as low as ten revolutions, or a piston speed of 40 ft. per minute. The feed water was kept about 115 deg. at the pump, and the vacuum about 25 in. Respecting the conclusions to be deduced from these results, Messrs. Rankin & Blackmore write as follows:

"Reasoning from the present types of engines, we think it may be safely said that large engines constructed on the quadruple expansion principle will be got to work at a consumption of 1 lb. per indicated horse power, a figure which has lured on engineers for years, and is now fairly within their grasp. But it may be asked, When is this diminishing consumption to cease? In our opinion, the answer is easily given. In the first place, the saving on 1 lb. of coal per indicated horse power (even allowing two or three per cent could be gained) would be small indeed; and in the second place, the present type of boiler has reached the limit of pressure at from 180 lb. to 200 lb., owing to the great thickness of plate required. And as no other fancy description can approach the present type, which has been evolved through the law of the survival of the fittest, we can look for nothing more in this direction; so that if any further saving is to be effected, recourse must be had to some other agent, if that is possible—which is doubtful indeed. From the above facts, it is unnecessary to say that the triple expansion engine must be as rapidly displaced as it itself has displaced the compound engine."



SIX CYLINDER QUADRUPLE EXPANSION STEAM ENGINE.

Teaching for Hands as well as for Heads.

During the last thirty days all the colleges, high schools, and other advanced institutions of learning have held their commencements, and thrust their graduates out upon the world. The number of these young persons probably reaches tens of thousands, but of them all, perhaps not two per cent have learned how to *do* anything. The education has been of the head alone, and not at all of the hand. They have been taught to know a great many things of greater or less importance, but of the practical work of the world, by means of which men and women earn their bread and butter, they are absolutely ignorant. Much of what the schools impart is certainly useful, and the least important of it may have some value; but it is fairly a subject of complaint against the system of education in use in this country that it is too completely theoretical.

The injurious consequences of this fault appear in several forms. As the country grows industrially, the demand for skilled workmen increases. In the presence of this demand we have, first, the fact that the old and excellent apprentice system has fallen completely into disuse, and, second, the further fact that the modern trades unions are hostile to apprenticeship in any comprehensive form, new or old. It is not the least of the counts against the unions that they stand resolutely in the way of young Americans who wish to acquire knowledge of any craft. As a consequence, we import from Europe every year thousands of skilled workmen, while our own young people are driven into poorly paid clerkships or persuaded to attempt success in the overcrowded professions. It is extremely discreditable to the practical common sense of the American people that they should permit this state of things so long to continue. It is a reflection upon the good judgment of the nation that it should expend millions every year upon instruction which only half fits the young for the actual duties of life.

Another and very serious consequence of this neglect of mechanical training is that it fosters the impression, already too widely prevalent, that mechanical labor should involve social and other discredit. Not only is this theory undemocratic, and in a political sense dangerous, but it is directly opposed to the best material interests of individuals and of the whole community. In a republican and industrial country like ours, it ought to be that the most expert handicraftsman is the man most honored. This is not a land for loafers. It is, in an exceptional and unique sense, the country of workers; and there can be no duty more truly patriotic than to instill into the minds of American young men that a man who works at a mechanical trade with a strong arm and a hard fist, and works dexterously, should have more respect than a lawyer who can hardly shuffle along in his profession or a doctor who feeds graveyards. That lesson, as our readers well know, has yet to be learned here. The prejudice against the horny-handed toiler exists; but it ought not to exist, and when the schools and colleges do their duty, it will cease to exist.

We would put into every public school a course of mechanical instruction. Both principles and practice should be taught, so that when a boy leaves school he will have his head and his hand already trained for some form of work in the shop or the factory. The colleges might well take up the course of instruction where the humbler schools end it, and push pupils onward to the higher things in the arts. But he is a sanguine man who expects the old collegiate institutions to lessen their affection for dead languages and pure theory. The hope of advanced industrial education, therefore, lies in the creation of technical schools, of which there are now but two or three of high quality in the country. There is encouragement in the rapid growth, plainly discernible, of public opinion favoring such schools and such training for the young. This is the greatest manufacturing nation in the world, and as it becomes independent of other countries for its supplies of fabrics, so it should become dependent solely upon its own population for its skilled workers.—*The Textile Record.*

Krakatoa.

Mr. Verbeck, who was deputed by the Dutch Indian Government to report on the origin and character of the volcanic outbreak in the Sunda Straits in August, 1883, has published his report. He calculates that the amount of ejected matter from Krakatoa must have been at least 10 cubic miles. This would be enough to make a respectable range of hills about 1,000 feet higher than the surrounding plain. The velocity of ejection was considerably greater than that of the heaviest rifled ordnance, and the ejected material must have reached a height of 30 miles, or six times the height of the highest mountain in the world. The noise of the explosions was heard over one-fourteenth of the earth's surface, and a great atmospheric wave, starting from Krakatoa as its center, spread itself round the world, describing the whole circumference in some thirty-six hours. The mass of floating pumice found after the outburst on the surface of the sea has been drifting in the direction of America.

A NEW SUBMARINE TORPEDO BOAT.

For some time past Lieutenant Zalinski has been experimenting at Fort Hamilton, in the Narrows, with a novel submarine torpedo boat, the invention of Mr. John P. Holland, of this city. The boat can be sunk to any desired depth below the surface of the water, propelled in any direction, and brought to the surface at any time. The boat has a wooden hull, is cigar shaped, and measures 50 feet in length by 8 feet in diameter at the largest part. The floating surface, under ordinary conditions, is 30 feet long.

All the various operations of the boat are controlled by one man in the turret, which is a small chamber placed about in the center and provided with a dome-like cap, in the sides of which are glass bulls' eyes, spaced the same distance apart as a man's eyes. Through these glasses observations can be made.

The propeller is driven by a petroleum engine. The vertical and horizontal rudders are operated from the turret. The two horizontal rudders are placed one at each side of the stern, as plainly shown in the large engraving, and are used to raise or depress the stern, as may be required. When the weight of the boat is but little more than that of the water displaced, these rudders can be used to depress the bow and compel the boat to pass below the surface. But the sinking and raising of the vessel is usually accomplished by admitting or forcing out water from certain chambers, compressed air accumulated by a compressor serving to expel the water.

When fitted for actual service, the bow of the vessel will be provided with one of Lieut. Zalinski's compressed air guns for throwing cartridges charged with nitro-glycerine. Just before firing the gun, the muzzle will be raised a little above the surface by forcing water out of one of the compartments in the bow, when the vessel will rest at an inclination, as shown in Fig. 2. The recoil will serve to completely submerge the boat. To permit of properly guiding the boat without bringing it above the surface, there will be a tube extending six or eight feet above the top of the turret. The top of the tube will be provided with an inclined mirror, and at the bottom will be a camera lucida prism, by means of which the surroundings may be conveniently viewed by the individual in the turret, which may be kept at a safe distance beneath the surface. A cartridge could be thus thrown at a vessel from a distance of one or two miles, while the only indication of the torpedo's presence during its approach would be the small portion of the tube reaching above water.

Another method of attack would be to run beneath the vessel, detach buoyant cartridges to be exploded by electricity when the torpedo boat had reached a safe distance. Still another plan would be to fire a steel pointed cartridge into the bottom of a vessel, and discharge it in the above manner. It is apparent that with a perfect submarine boat, a vessel could in many ways be destroyed without exposing the torpedo to excessive danger. Provision is made for allowing a man in a diving suit to leave the torpedo when the latter is submerged, and there is also means provided for the crew leaving the boat should it be unable from any cause to rise to the surface. As an additional safeguard, there are several different methods of accomplishing each of the various operations of the boat, such as raising or sinking, and working the propeller and rudders.

The torpedo now at Fort Hamilton was designed as an experimental boat to test the plans of the inventor. It has attained a speed of nine miles an hour, and has been successfully sunk to the bottom and raised. It is expected shortly to more thoroughly and severely test the capabilities of the boat by more extended journeys beneath the surface.

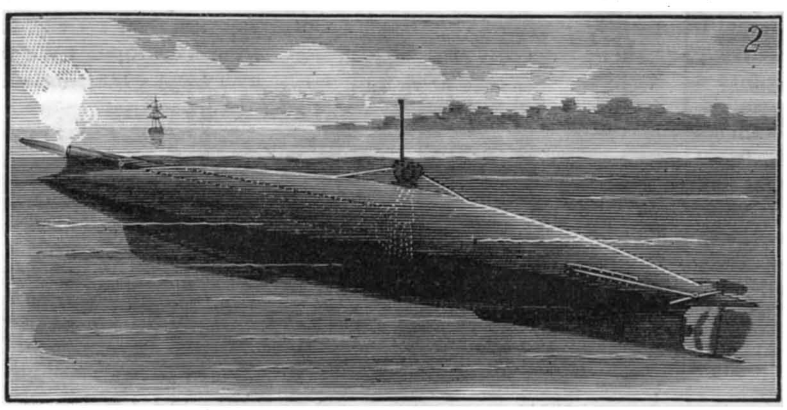


Fig. 2.—TORPEDO BOAT IN POSITION FOR FIRING.

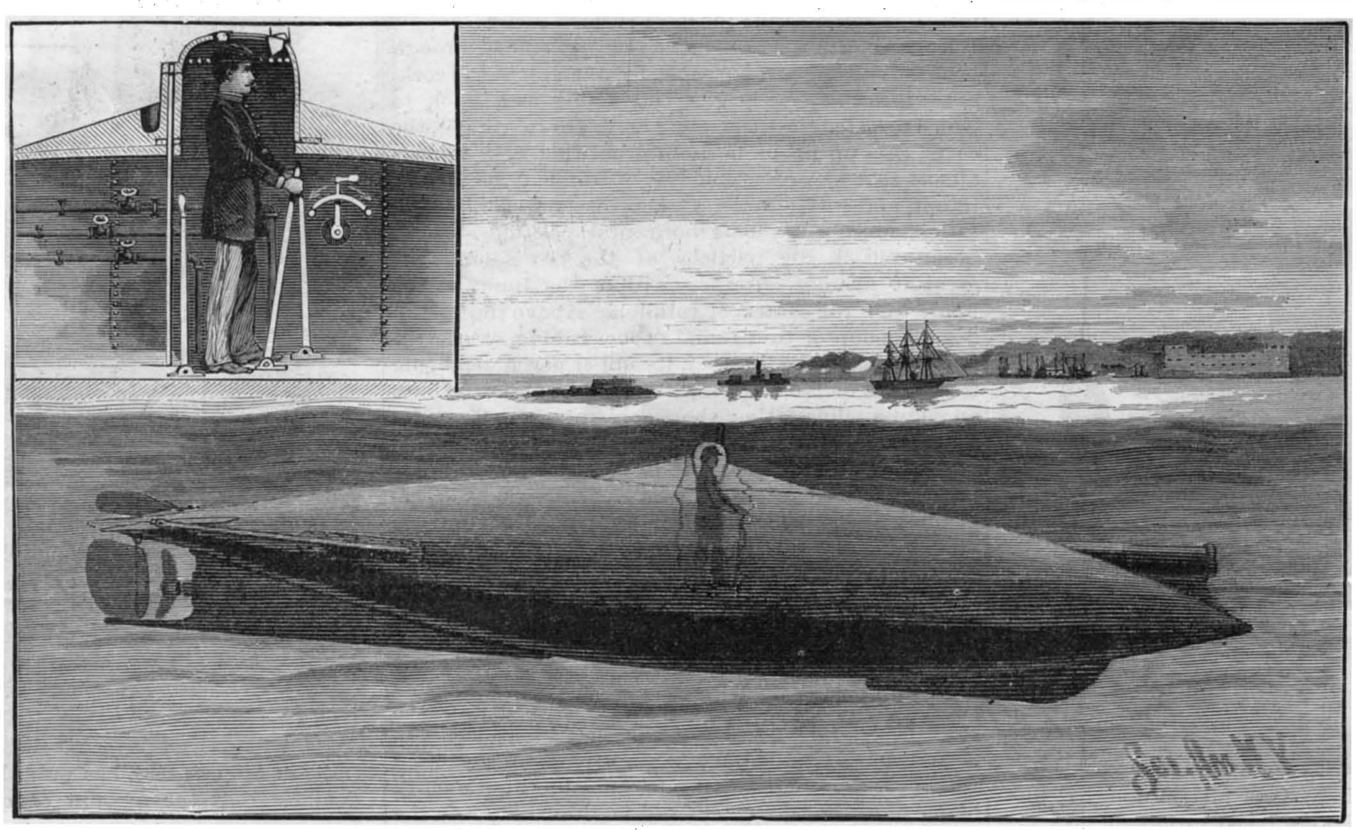


Fig. 1.—HOLLAND'S NEW SUBMARINE TORPEDO BOAT.

Legal Hints for Travelers.

A railway company is not an insurer of its passengers, according to the law in England, but is responsible for their injuries, according as it or its servants have or have not been guilty of negligence.—13 Pet. 181.

But the fact that any part of the car breaks raises the presumption of negligence.—2 Camp. 79.

And, indeed, if any of the means of transportation, whether connected with the engine or train, or with the roadway, gives way, and you are injured, it is presumptive evidence that the company has been negligent.—18 N. Y. 534.

But the fact that an accident has happened does not always raise a presumption of negligence, for the accident may be imputable to a trespasser, for whose conduct the company is not liable.—18 N. Y. 534.

Out of regard for the value of human life, and in view of the danger that besets a railway traveler, the law makes it the carrier's duty to convey the passengers safely, so far as human care, skill, and foresight can do it.—14 How. (U. S.) 468.

As fast as new and improved means and methods are perfected and found practicable and more safe than the old things and old ways, they must be adopted.—64 Pa. St. 225.

It is a first principle that a railway company must employ competent inspectors to make proper examinations of its rolling stock. For instance, it has been laid down that every test known to science and recognized by experts must be applied to boilers of locomotives, to ascertain their condition. But if there are defects which such tests would not bring to light, and which experts could not discover, and by reason of such defects an explosion occurs, the company is not liable.—20 Blatch. (M. S.) 338.

The mere fact that an explosion takes place where such tests have not been applied raises a presumption of negligence.—Id.

And likewise, car wheels and other parts of the cars must be frequently inspected. It is no excuse that the cars were bought ready made of a reliable car builder, and that the defect which caused the accident was a defect in manufacture which could not be discovered after the car was completed, provided the defect could have been known during the process of manufacture. —13 N. Y. 9.

When an accident is caused by a broken rail, the company can only relieve itself from responsibility by showing that the rail was sufficient in size, free from defects, and properly laid down and spiked on sufficient cross ties.—74 Ind. 462.

If a bridge gives way, it is presumed that the company has been negligent in constructing or locating it. —2 Col. 442.

But if the bridge gives way and the train plunges into the water because of an unusual and extraordinary flood—something unknown to common experience in that region, and which could not have been reasonably anticipated by skillful engineers—the accident may be attributed to "act of God," for which the company is not liable.—53 Texas 46.

And so if the track is undermined and weakened by an extraordinary freshet. But the engineer is in a position to notice such an extraordinary condition of things, and take precautions. If the water is so high as to afford suspicion that the track or bridge may be out of condition, he must stop and test it, or he will make the company liable for the consequences of an accident.—76 Mo. 518.

Allusion is made to the acts of a trespasser for which the company is not responsible. Thus, if a shot is fired into the car and you are wounded, the railway is not bound to pay the bill.—27 L. J. 155.

Nor is it liable if an obstruction is suddenly thrown across the track, or a switch maliciously opened, and your train rushes into destruction before the employes have time to right things.—Id.

And if the train is derailed by a tornado of unforeseen violence, that, too, would be considered an accident caused by "act of God," relieving the company from liability.—3 Neb. 44.

It is not always that a company escapes liability for the consequences of an accident caused by a misplaced switch, though. If not suddenly thrown open by a trespasser, in front of a moving train, the company must show that by no human skill or foresight could the accident have been averted.—6 Am. & Eng. Ry. Cas. 139.—*Myron T. Bly, in Pathfinder Railway Guide.*

A New Joint Material.

Portland cement mixed with a solution of calcium chloride rapidly acquires considerable hardness. Setting begins in three or four minutes, and is attended with an elevation of temperature that may attain to 70° C. A slight expansion is also produced in the course of setting. Cement mixed with calcium chloride softens if it is plunged immediately into water; but after having been air dried for eight or ten days, it may be so immersed without inconvenience or detriment to its cohesion and hardness. Ordinarily damp air has no influence upon the mixture. The fact that, according to the *Journal du Ceramiste*, the runners of cement mills are repaired with this chloride cement mixture is a sufficient indication of the great strength which the compound is capable of acquiring. The stones are put to work within an hour of repairing; and the cement is perfectly resistant, and wears less than lead, which is commonly employed for the same purpose. All joints can be made with great facility, and acquire in a short time extreme solidity with this chloride cement mixture. The slight swelling during setting is very useful in filling all hollows and making good adhesion. The cheapness of calcium chloride permits of the use of the mixture for numerous purposes. When great hardness and quick setting are desired, the cement may be gauged pure; but in general, an equal mixture of sharp sand or gravel will be found to answer every purpose.

MOST metals and alloys shrink or contract on cooling. But an alloy which will expand on cooling may be made of lead nine parts, antimony two parts, bismuth one part. This alloy can be advantageously used to fill small holes and defects in iron castings.

CENTRIFUGAL FORCE.

T. O'CONOR SLOANE, PH.D.

The tendency of modern physicists is to drop the term centrifugal force, that has for so many years done service in the text books. The true force developed by a body moving in a curve is due to tangential velocity, and one of the components of this velocity represents centrifugal force. But the convenience of the expression and the popular acceptance of the term justify its use, and it may be adhered to, as carbonic oxide is called carbonic acid and carbonous oxide is still termed carbonic oxide by the chemist. The inconvenience and confusion caused by changing old terms often causes the use of such as are incorrect, or rather correct by convention only.

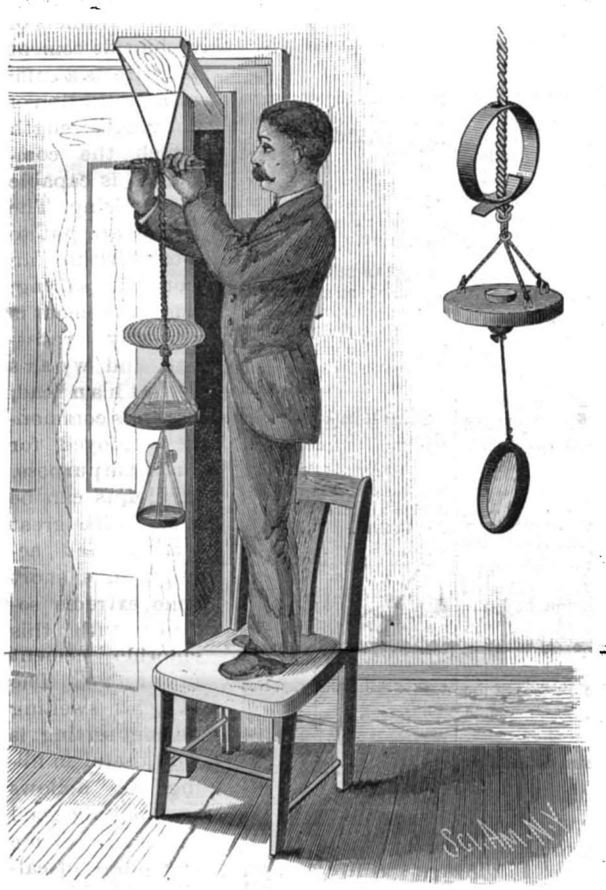
If a body is rotated, it tends by virtue of this force to fly away from the center of rotation. Every particle of the body tends to place itself as far as permitted from this point. By the use of fluids, granular solids, and bodies of different shapes very characteristic effects can be produced. The phenomena produced can all be accounted for by known laws, and exactly what will take place under any given conditions can be foretold. The variety of the experiments and the familiar objects that can be used in them make them most interesting. If proper apparatus is obtainable for rotating different articles, the number of variations that can be produced is endless.

The usual machines for inducing rapid rotation, such as the twirling table, are quite expensive. By utilizing a twisted cord as motor in the way to be here described, the experiments can be executed perfectly well at home with the most primitive appliances.

A piece of strong cord, about two yards long, is doubled and its ends are tied together, and the object to be rotated is tied to it.

One hand is passed through the doubled string, allowing the object to hang down, and the string is twisted a number of times. Then, by drawing a pencil or other smooth rounded body down against the twisted portion, an exceedingly rapid rotation can be started. The rotation lasts in one direction until the cord is unwound and rewound, the body comes for an instant to rest, to resume its rotation, but in the opposite direction. The pencil is again to be inserted to accelerate the speed, and the process may be kept up indefinitely. Smooth, round, and hard cord should be employed, and the part of the pencil coming against the cord may with advantage be lubricated with a little soap.

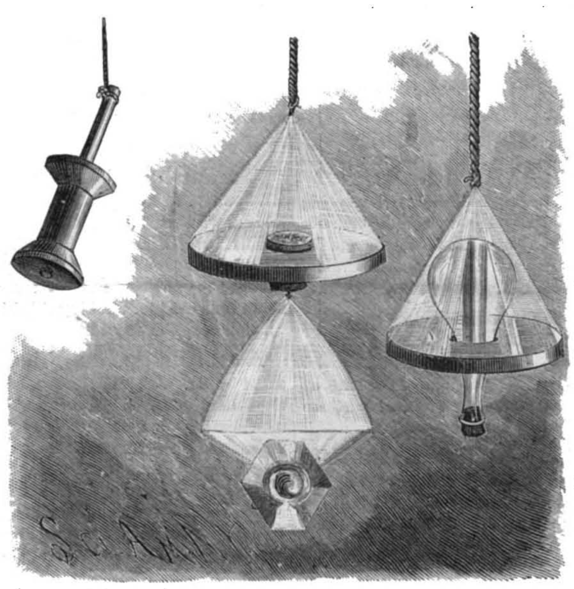
As an object to begin with, a glass containing a little water, suspended as shown, may be used. As it gains speed, the water, under the effect of centrifugal force, forms a cup, sinking in the middle and rising around the walls of the glass. The outline of this cup is a parabola. The appearance of the water just as the



HOOP AND DISK EXPERIMENT.

rotation is changing its direction is interesting, while the perfect glassy cup formed by the fluid in rapid motion is not less so. Great care must be taken that the glass revolves steadily and not too fast, or it will tip on one side and throw water in all directions. A goldfish globe, about four inches in diameter, is better, as it does not tend to shower its contents about to the same extent. In the drawing such a globe is shown rotating, and containing either sand and water or shot and water. All alike are forced outward against its walls, but the heavier substance goes to the greatest distance and forms a central zone, with similar areas of water above and below, while if a proper quantity of water is used, the bottom of the globe will be entirely exposed and free from water.

A lot of keys, the contents of a paper of tacks, or a watch chain, may be placed in the globe, and the water may be colored with a little ink. Taking into account



SPOOL AND FLASK EXPERIMENTS.

the probability of some water being thrown out, it is perhaps as well not to color it.

A solid symmetrical body may be rotated in the same way, but it is better to secure some more steady arrangement. This can be done by employing a disk of wood, about six or eight inches in diameter, and an inch thick. It is suspended from three points near its periphery, staples being used to fasten the string to. In its center a hole is bored, and a cork is supplied fitting this aperture. By suspending it by the rotating cord from some fixed point, so as to leave both hands free, a very high velocity can be given to it. As, moreover, it is often undesirable to have the direction of rotation change so frequently, a well oiled swivel may be placed above the twisted string immediately under the general point of suspension. When once started under these conditions, the disk will rotate for some time in the same direction, and come gradually to rest. Otherwise it will wind the cord up very tightly, rising most curiously as the twist tightens, with attendant danger of breaking the cord. The disk, in virtue of the tendency of rotating bodies to remain in their plane of rotation, gives a steady basis for the attachment of different objects. Before fastening anything to it, it may be set into strong motion, and moving like a pendulum, when, under the effects of gyroscopic forces, it will describe the most curious curves.

A cover of a tin box has a hole punched through it near its edge, and is suspended thereby to the cork, a pin bent at the headed end acting as a hook to which to fasten the suspending cord. On rotating it, the cover rises up into a horizontal position, and appears almost as if it were motionless. A coin may be thrown into it, and will lie quietly there as long as rapid rotation continues. This horizontal position is taken because in it the particles of the box assume the greatest average distance within the limits of the figure from the center of rotation. Above the disk a flexible hoop of thin India rubber tubing, or of writing paper, may be fastened, its upper perimeter being free to rise or fall. On rotation, this will flatten into an ellipse, illustrating the cause of the ellipsoidal shape of the earth. As shown in the other cut, a spool may be suspended and rotated, a stick or piece of pencil being forced into its central aperture and the suspending string being fastened to that. Obeying the same principle, this will approximate to a horizontal position in rapid rotation and will present a most curious appearance, that of a central globe surrounded by hazily outlined figures of two crossing spools.

The object of the cork as a point of attachment is clear. It will be found a great convenience as adapted to so many objects. A bunch of keys, a loop of heavy cord, of chain, or a skein of silk, may be attached to it, and the effect observed. If properly managed, they will open into ellipses. A turnip, hung by the extremity of one of its long diameters, will be thrown up into the horizontal position, as was the box cover. A moistened sponge or piece of blotting paper will shower water in all directions if pinned to the cork and rotated, even when comparatively dry. This is a good illustration of the methods used in large laundries for drying clothes, and in sugar houses for separating sugar from the sirup from which it has been crystallized.

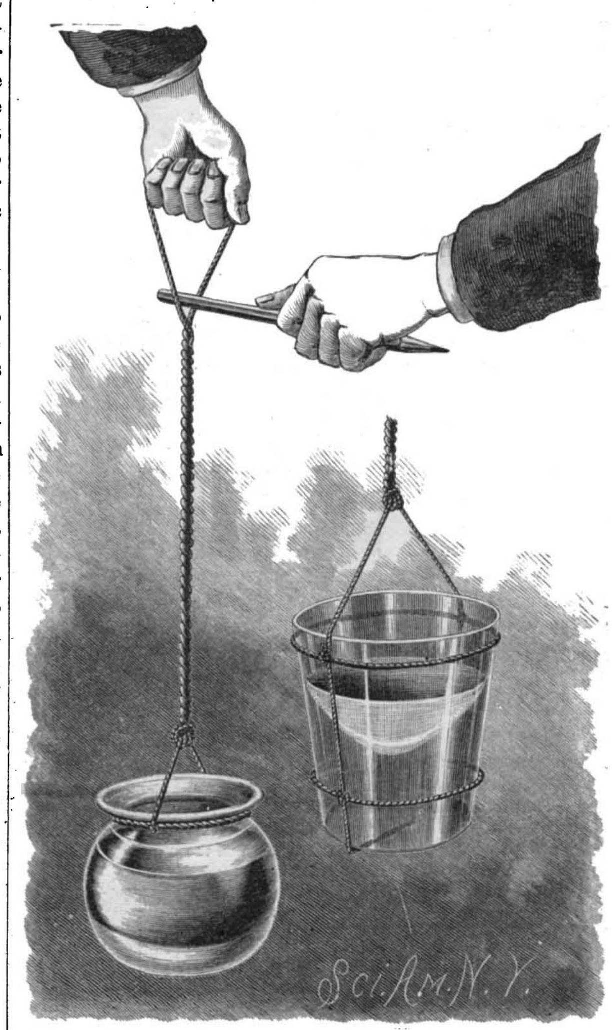
A small flask nearly filled with water is corked and inverted in the hole in the disk, and secured by tying or otherwise. On rotation the water is driven outward, and the air draws down into a cylindrical shape. If very little air is contained, and the rotation is extremely rapid, it will descend and form a spherical bubble in the center of the flask. It is well-nigh impossible to obtain sufficient velocity for this last.

Enough has been shown to illustrate the fact that this very simple apparatus will perform nearly all the ordinary experiments in centrifugal force. A light weight may be made to lift a heavy one; a model of the steam governor may be mounted on it, and numberless experiments tried. It is really a substitute for a piece of apparatus that costs as many dollars as this costs cents.

Departing from the line of centrifugal force, it is adapted for another class of experiments—those in which rotation alone is in question. Thus, all color disk comparisons, such as described in Prof. Rood's article in this journal (vol. liv., No. 23), may be executed with it. Wires bent into various shapes may be rotated with excellent effect, producing images of vases and the like.

Foundations.

The modern architect has at his command means and appliances of the greatest utility, which were unknown to men in former times. Steam can be brought to aid in driving timber piles, and simple applications of water or air will sink hollow iron piles with comparative ease. The old Eastern plan of forming deep wells and then filling them up with concrete has been too much neglected. Modern well sinkers will go down in any strata almost to any depth—certainly to any depth required in practice; and a secure foundation may thus be made for the loftiest structure in the most difficult ground. Masses of concrete or of brick or stonework placed on a compressible substratum, however cramped and bound, may prove unsafe. Solidity from a considerable depth can alone be relied on. Enlarging the area of a base or foundation by footings can be resorted to; but mere enlargement of area may not in itself be sufficient. A lofty structure which is to stand secure must have solidity sufficient to maintain each part in the position in which it is first placed. Foundations are too frequently slighted, or labor and material are wrongly applied. The compressibility of oolitic and tertiary clays can only be overcome by piling, deep sinking, heavy ramming, or heavy weighting. The point of bearing must be carried below any possibility of upward reaction. A heavy embankment or heavy pile of building frequently disturbs the surface ground at a distance of many yards, the subsidence causing a corresponding rise around or on either side, as the



EXPERIMENT WITH FLUIDS.

case may be. A tall chimney or tower of like proportions, built on such a foundation, if not made safe to a sufficient depth, would most likely become a "leaning tower," if not actually a falling tower. Probably the depth of a foundation in compressible ground ought not to be less than one-fourth the intended height above ground; that is, for a shaft of 200 feet the foundation should be made secure to a depth of 50 feet. This could easily be done by piling, or by well sinking and concrete.—*Sir R. Rawlinson in the Architect.*

ENGINEERING INVENTIONS.

A signal has been patented by Mr. Jacob F. Riethmayer, of Lansdale, Pa. It is made with a bar carrying a flag or light and normally held within a casing by a spring catch, but so arranged as to be moved forward by the action of a weight when the catch is withdrawn by a tripping mechanism actuated by the train.

A railroad ditching machine has been patented by Mr. Alonzo H. McGrew, of Hurley, Dakota Ter. This invention covers an improvement on a former patented invention of the same inventor, the object being to facilitate and make more easy and certain the dumping of the contents of the scoop than was possible with the prior construction.

A railroad gate has been patented by Mr. Nathan Harris, of Wabash, Ind. It is pivotally supported to form a barrier across the track, and has a crank arm connected to a cylinder by a flexible pipe, a piston fitting the cylinder to compress air therein, and the device being automatically operated by a passing train to open the gate and adjust it to a normal raised or closed position after the train has passed.

AGRICULTURAL INVENTIONS.

A potato digger has been patented by Mr. James Van Siclen, of Jamaica, N. Y. It has a plow plate set at such inclination as to pass between the potatoes and raise them with the soil to the surface of the ground, when a separator with fingers operates to clear the potatoes from the soil and vines and leave them ready to be gathered.

A plow has been patented by Mr. Artemus Rolow, of Cherokee, Iowa. The invention is an improvement for plows with hinged mouldboards to spread or narrow the plow, where a lever and rack are employed, whereby the rack is arranged at a suitable height and relation to the mouldboard, and is at the same time braced firmly from the handles.

A field weeder has been patented by Mr. James P. Johnson, of Willmar, Minn. It has an elevated cylinder carrying teeth or combs, in connection with spring-retracted strips arranged to move in contact with the teeth and acted upon by a cam, the machine being so constructed as to pull or comb out wild mustard without injury to wheat or other grain in which it may be growing.

MISCELLANEOUS INVENTIONS.

A gutter for buildings has been patented by Mr. Joseph Gray, of Amelia, O. It is a metal gutter suspended in a suitable eaves box, with a stationary cap which overlaps the edges of the gutter, the construction being such as to allow any amount of expansion or contraction, to prevent breaking of joints and leakage.

A sash cord fastener has been patented by Mr. Edward T. Bradbury, of Mahanoy City, Pa. This invention consists of an attachment to receive the end of the cord and wedge itself fast upon it, and also adapted to engage with or embed itself in a shoulder formed in the sash, whereby the sash cord can be easily detached from or reattached to the sash.

A heating apparatus has been patented by Mr. Henry C. Berry, of Wauseon, O. This invention covers a peculiar construction and arrangement of the firepot in connection with the casing of a stove, whereby the ashes and other accumulations are easily removed, and clinkers can be easily taken out, the parts being made of cast iron or other suitable material.

A naphthol black color compound has been patented by Messrs. Meinhard Hoffmann and Arthur Weinberg, of Mainkur, near Frankfort-on-the-Main, Germany. This invention relates to a new method of manufacturing blue to violet coloring matters belonging to the azo group, the product being delivered to the trade as a black paste or in solid form.

A channeling machine has been patented by Mr. Charles S. Ames, of Bishop, Ill. It consists of a pair of adjustably mounted channeling blades so arranged that they may be mounted in front of the formers of a leather rolling machine, or with rollers which bite upon a strap and carry it forward, or so the strap might be pulled through by hand.

A letter file has been patented by Mr. Lloyd Nottingham, of Norfolk, Va. This invention relates to that form of letter file in which an adjustable wire loop is connected to a base plate, the file being one which can be adjusted to stand upon a desk or hung against a wall, the invention providing a more secure attachment and a greater variety of adjustments.

A suspender or other buckle has been patented by Mr. Charles R. Harris, of Jersey Shore, Pa. It has a hook within a hook, a tubular hinged construction of the opening and closing portion of the buckle adapted to receive the ends of the wires of which the two main portions of the buckle are composed, with other novel features.

A gig saddle has been patented by Mr. Godfrey R. Lips, of Louisville, Ky. The saddle tree is of metal, formed with loops for holding a casting formed with a plate to support the jockey and give it a curved finish, giving a full and rounded support and preventing it from sagging, with other novel features, making a saddle which is light, cheap, and durable.

A cane stool has been patented by Mr. Eric O. Leermo, of Gold Hill, Nev. It consists of a casting forming the body of the stool, with legs and arms jointed to the body, with arms connected to a central head, in such way that it may be readily folded to form a staff or cane, or unfolded to form a convenient seat.

An animal poke has been patented by Mr. Timothy D. Reaves, of Farmington, Ky. It is a novel and inexpensive device to attach to the heads of horses, cattle, and other live stock, to prevent their jumping over or demolishing fences, while not being oppressive to the animals, and allowing them to graze more naturally and comfortably than heretofore.

A wire binder for boxes has been patented by Mr. James A. Griffiths, of Winter Park, Fla. It consists of wire fasteners bent to form prongs and eyes in such way as to hold the binding wires on the box and also assist in holding the top, bottom, ends, and cover of the box together, in boxes used for shipping oranges, etc.

A writing teacher's cabinet has been patented by Mr. John W. Lefevre, of Mooney, Ind. It has ink bottle ledges, pen rack, compartments for copybooks, blotting paper, etc., and with hook or other device for pen wipers, all conveniently arranged for writing teachers having to distribute such articles to the pupils in a schoolroom.

A bell crank has been patented by Mr. Nelson Magee, of Hoboken, N. J. Its construction is such that the strength of the spring action maybe easily adjusted, and increased or diminished, and the spring is readily detached from the gudgeon when the crank is turned in the wrong direction, so there is no danger of injuring the spring, and the crank is cheap and durable.

A flexible button fastening for corsets or other garments has been patented by Mr. Sherwood B. Ferris, of Lakewood, N. J. The buttons are carried by tapes or a flexible strip passed forward and backward successively through the center portions of the buttons and secured to the garment at their terminal portions under cover and inclosure by a seamed portion.

A lifting jack has been patented by Mr. William Dwiggins, of Westfield, Ind. The lifting bar passes through keepers attached to the standard, its upper end being bent to form a rest, and by swinging down the operating lever the lifting bar is raised by connecting rods and locked in place at such height as desired, the device being simple, strong, and durable.

A folding table has been patented by Mr. John E. Cotton, of Fairfield, Me. It has hinged legs, carrying braces having pins on which are friction springs, in combination with slotted plates on the under surface of the top in which the pins move, locking pawls being pivoted to the plates to engage with the pins, the table being closed by turning upside down.

A hop drier has been patented by Mr. William S. Plummer, of Leavenworth, Kan. It is an attachment for a kiln, and the invention relates particularly to novel and easily adjusted devices for creating a vacuum, to make a suction above the material to be treated, and thus draw air up through it and quickly dry the mass.

A violin has been patented by Mr. Gustav A. Skugrud, of Genesee, Idaho Ter. Combined with the violin is a reed instrument, and tube and mouthpiece connected therewith, with valves and a lever in the neck of the violin for operating the valves, whereby the violinist may play the bass tones for the melody he is playing on the violin.

An automatic brake for vehicles has been patented by Mr. George McInroy, of Charleston, Pa. Its mechanism is operated by the holdback of the horses on the tongue, and there is also an arrangement of the running gear with the brake mechanism, whereby the brakes may be operated irrespective of the relative positions of the front and rear sections of the running gear.

A straw cutter has been patented by Mr. Horatio E. Collins, of Detroit, Mich. This machine is designed to cut a thicker layer of straw or hay and do more work than ordinary machines; it has vertically moving reciprocating knives, and relatively adjustable upper and lower feed rollers, whereby the material will be fed to the knives when separated, and the feed will cease when the knives meet.

A whiffletree hook has been patented by Mr. George R. B. Swanton, of Okawa, Hawk's Bay, New Zealand. It has an internally threaded socket, with axially bored head, having transverse grooves in its inner surface, the trace holder being provided with a transverse pin, and a spring resting on a flange pressing the trace holder outward, the device being simple and easily manipulated.

A fire extinguisher for chimneys has been patented by Mr. Desire Putzeys, of Brussels, Belgium. It consists of a plate with funnel-shaped opening secured inside the masonry of the chimney, above which is suspended a sphere by bands which will be severed by undue flame or heat in the chimney, when the sphere will drop into the funnel-shaped plate and close the chimney.

A jack carrier has been patented by Mr. Charles H. Driver, of Towns, Ga. It is for transporting lifting jacks horizontally, after they have been applied to and raised a building or other load, and consists of a laterally movable jack platform with an adjustable gear platform bearing operating gears, with a horizontal screw rod, designed to move such loads with safety and with greater economy than now customary.

A permutation padlock has been patented by Mr. Charles A. Volke, of Stapleton, N. Y. This invention consists in certain novel features of construction of the lock mechanism, covering the combination with the case and its bow or shackle of a plate, locking dog, pins, slotted posts, and a manipulating device consisting of a key and thumbpiece, with other special elements.

A smoke and cinder conductor has been patented by Mr. James H. Meacham, of Petersburg, Va. The body of the conductor extends over the tender and over the top of each car, and between the cars it has a jointed and detachable coupling, which is the main feature of the invention, and which allows movement in any direction without permitting the escape of smoke or cinders at the joints.

A mechanical movement has been patented by Messrs. James E. and John W. Adams, of Glassborough, N. J. This is a device involving novel features of construction, and intended to give considerable speed and power with a small expenditure of force, being especially applicable for the running of small machinery, such as sewing machines, churns, jig saws, fans, etc.

A cream separator has been patented by Mr. Merritt C. Barden, of West Pawlet, Vt. It is a milk receiver with a conical bottom, and with a floating stopper of such specific gravity that it will stop at rest between the cream and the milk, so that when the milk is drawn off from an opening in the center of the conical bottom, this floating stopper will automatically close the opening and thus separate the cream from the milk.

A paper making machine has been patented by Mr. Edwin Wilmont, of Laona, N. Y. This invention provides means, either by a roller or vibrating bar with perforating points, for continually perforating the endless felt apron used in pressing the water from the pulp on a paper machine, so that the apron will not have to be taken from the machine for washing and to have its fibers reopened.

A ground marker has been patented by Mr. John V. B. Rapp, of New York city. It has parallel bars with shafts, and marking teeth clamped to the parallel bars, there being shoes for regulating the depth of the marks and a gauge for regulating the distance between the series, the device making an easily adjustable implement for marking tilled land in parallel rows for the reception of seed.

A coal mining machine has been patented by Mr. Walter S. Gordon, of Atlanta, Ga. It has revolving toothed cutters or saws mounted on a common shaft, and a smaller intermediate rotary cutter working in the same plane between the two larger cutters, to remove the coal between the direct cuts of the larger cutters, and all geared to be run by power transmitted from a frame mounted on a carriage or truck forming the rear end of the machine.

A brake for baby carriages has been patented by Mr. William H. Tier, of Astoria, N. Y. A metallic brake strap passes around the inner end of the hub of the wheel, and is connected by a lever with the handle bar in such way that the movement of the wheel can thereby be readily checked, stopped, or prevented, or the brake can be permanently set so that the carriage when standing upon inclined ground will not be liable to start accidentally.

A coffee and spice mill has been patented by Mr. James W. Miller, of Butler, Pa. The shell in which the grinding cone of the mill works is largest in diameter at the bottom, the coffee or other substance to be ground being fed downward by gravity from a hopper between the serrated outer face of the cone and the inner toothed face of the shell, the fineness of grinding being regulated by adjustment of a nut, and the device being such as will make a neat appearance.

A scrubbing brush holder has been patented by Mr. John T. Gramer, of Bowmansville, Pa. It consists of a yoke having downwardly projecting arms with spurs extending inward toward the center of the yoke, and adapted to engage the edges of the scrubbing brushes, a cam being journaled in the yoke to press the scrubbing brushes in opposite directions against the spurs, whereby the brushes may be readily clamped in position for use or removed from the holder.

A vibrating churn has been patented by Mr. Charles J. Fellrath, of Gatesville, Texas. The invention relates particularly to a motive power or driving mechanism for churns, freezers, etc., and has a sliding frame bearing a fly wheel and crank on one side of the supporting standard and toothed segment being arranged on the other side, the fly wheel and toothed segment being arranged in vertical planes, and the frame being vertically adjustable on the standard.

A blind nailing plane has been patented by Mr. William G. Stranahan, of Minneapolis, Minn. It has a shuttle operated by a hand lever and carrying a narrow knife made to project slightly through a longitudinal groove in the body of the plane, to strike against and cut beneath the surface of the wood in such way that the shaving will not be crumpled or narrowed, and will entirely fill up the cut when put on again over the driven nail.

An atomizer has been patented by Mr. Ferdinand A. Reichardt, of New York city. It has an outer and an inner tube of soft rubber, in connection with a narrow strip of copper inclosed within the outer tube, by which the tubes may be held at any desired curve, the outer ends of the tubes are detachably connected with a tip having a central passage for the liquid and side passage for a jet of air, and the atomizer as a whole may be cheaply made, and its parts sold as separate articles.

A process of transferring a precipitated or reduced metal has been patented by Messrs. Theophilus and James Millot, of New York city. It consists in precipitating the metal upon a hard surface, then applying a coat of viscid substance to such deposit, flowing the plate, placing the material to which the transfer is to be made upon the treated surface of the plate, expelling the excess of solvent, washing the whole, and stripping the material and the deposit from the surface of the plate, thus readily bringing out metallic-faced patterns on textile and other flexible fabrics.

NEW BOOKS AND PUBLICATIONS.

ARCHITECTURAL STUDIES. Vol. I. F. A. Wright, Architect. New York: William T. Comstock.

This volume contains sixty plates, giving views in perspective, elevations, plans, and sketches of leading details, for low cost, houses, store fronts, and interior details, stables, seaside and southern homes, and outbuildings. It is a work that can hardly fail to be of great value to any young architect, and of material assistance to the more advanced and busy members of the profession.

SHOPPELL'S MODERN HOUSES.

The July number of this quarterly, published by the Co-operative Building Plan Association, has the usual variety of designs for many different styles of residences with partial plans and estimates of cost, and is gotten up in handsome form. An attractive feature of this number is a sheet of colored drawings for constructing a paper model house.

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.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. J. M.—The angle at the circumference of a windmill varies much for the power and velocity required. For high speed and light work the extreme angle may be from 7° to 10° with the plane of the mill. Where high winds prevail, 10° to 20° may be desirable. The angle should increase toward the center; at half distance between periphery and center the angle should be double the peripheral angle. For a full and illustrated description of mills and their power, see a work on "The Windmill as a Prime Mover," by Wolff, which we can furnish for $3. A six foot mill will run a churn or grindstone.

(2) D. L. T. asks the number of pounds required to lift bodily from ordinary soil a green oak stump 12 inches diameter, also pine stump 12 inches diameter and 24 inches diameter. A. From 4 to 8 tons, according to kind and condition of soil.

(3) J. G. asks: 1. What is the freezing and boiling point of hydric cyanide? A. Boils at 80° Fah. Freezes at —0·4° Fah. 2. Are ferric disulphide and sulphide of iron the same? A. Both are identical.

(4) J. K. B. asks: What material is used in the manufacture of binder twine, such as used on harvesting machines? Does it require expensive machinery? A. Jute, Sisal hemp, and waste products of flax mills. Machinery for that purpose alone is not very expensive. Could be home made if you are familiar with the manufacture.

(5) "Louisville."—The footprints in the limestone found in Washington Co., Ohio, were probably made during the Carboniferous or coal-producing period. It is impossible to state the amount of denudation that this indicates. Where the geological sequence is complete, the Carboniferous is overlain by the Mesozoic, Tertiary, and Quaternary formations, but we do not know whether the series was complete at this point. It is probable that many thousand feet of sediment have been removed in order to expose this formation. Having no measure of the thickness of these more recent formations, the time required for their deposition and subsequent removal is similarly unknown.

(6) J. C. M. asks a recipe for sticky fly paper. A. Melt together one pound of resin and add two fluid drachms of linseed oil. While the mixture is warm, dip a spatula into it, and spread what adheres to the blade on foolscap paper. Different samples of resin require varying proportions of oil to make the composition spread properly.

(7) T. McM. asks: 1. What is the process of preparing salmon for canning? A. See "Canned Food," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 499. 2. Would the mullet make a good canning fish under same process as the salmon? A. Such samples of canned mullet as have been put in the market have not been well received. 3. A cheap receipt for deodorizing kerosene oil. A. Mix it with chloride of lime in the proportion of three ounces to each gallon of liquid to be purified. The mixture is then introduced into a cask, some muriatic acid is added, and the whole well agitated. It is then passed into another vessel, containing slaked lime, which absorbs the free chlorine and leaves the oil sufficiently deodorized.

(8) C. L. asks: Can air after having been pumped out of a glass vessel be kept out? A. An exhausted glass vessel may be sealed so as to preserve a vacuum indefinitely by fusing the glass tube connecting the vessel with the air pump.

(9) L. H. H. asks: 1. Are there any mica mines now worked in Virginia, and what is the quality of the product? A. There are mica mines in Amherst, Bedford, Hanover, and Amelia Counties, which have yielded an excellent product, but are little worked now on account of the superior deposits in North Carolina. The southern portion of the State is believed to offer a promising field for prospecting. 2. Where are the largest and best deposits of mica found, to what extent are they worked, and what rank do the mines of North or South Carolina hold? A. The best deposits of mica so far discovered have been in Western North Carolina and in Custer and Pennington Counties, Dakota. The annual product of the latter locality amounts to $70,000. The total product of the United States amounts to about $370,000. The mica regions of South Carolina have not as yet been thoroughly explored. 3. What books would you recommend on mica mining, mineralogy, and geology? A. "Elements of Geology," by Joseph Le Conte (price $4.00), and "Manual of Geology," by J. D. Dana (price $5.00), are both excellent. "Descriptive Mineralogy," by J. D. Dana (price $10.00), is the standard work on the subject, but his smaller book, "A Manual of Mineralogy and Lithology" (price $2.00), would probably serve your purpose. We will send these books postpaid on receipt of price. For information concerning mica mining we would recommend "Mineral Resources of the U. S.," published by the Government, and the North Carolina Geological Reports.

(10) H. M. P. asks: 1. How do scientific men observe the process of development of man from the fructifying of the egg to the birth of the child, or the process of ontogeny? A. By direct examination of the embryo or fœtus during the several stages of development. The recent remarkable progress in embryology is largely due to the perfection of the mechanical means for making these examinations, and to the chemical reagents used to prepare the subject for extended study. By hardening, clearing, and tinting the fœtus with chromic acid, and then making the finest possible microscopic sections, it is practicable to represent the entire process of development; and by providing for the suitable preservation of the specimens, to secure the opportunity of similar study to other investigators. 2. Has the supposed organism *Bathybius Haeckelii*, discovered by Huxley, been confirmed? A. It is doubtful. Several scientists believe that the evidences of organic life which Huxley discovered were due to the alcohol in which the specimens were preserved. Recently, however, the Arctic navigator Bessels has reported the discovery of a free homogeneous protoplasm in Smith Sound, to which he gave the name protobathybius. 3. Has spontaneous generation been produced artificially? A. No.

(11) S. W. S. asks: Will you please inform me whether there is any coating that can be applied to the inside of a water lime-plastered cistern which will prevent the water from becoming "hard"? If there is such an article, please state what it is and how to apply it. A. Our best recommendation is to wash it over several times with a wash of hydraulic lime and water. Asphalt would stop it, but would tend to give the water a taste, and would require an absolutely dry surface for application.

(12) J. F. writes: Will you please give me a process for magnetizing knitting needles? A. Prepare a coil of wire, No. 15 to 20, as long as the needle and of five to ten layers. Place the needles within it, and pass a strong current through it. Or by rubbing with a strong permanent magnet from pole to pole, always in the same direction, you can do it. Or simply place the ends against the field pieces of a strong dynamo while running.

(13) H. E. S. asks: Can you let me know of a cement that can be used on a tin roof that is old and leaky, that will stand heat and cold weather? A. Old paint skins, such as may be procured from painters, are much used.

(14) W. W. S. writes: Reading your articles on films, as represented by the sieve and the floating needle, why is it that the needle floated on water in a basin will point north and south? Is it through the influence of the magnetic current? A. If it points north and south, it is because it possesses enough magnetism to be affected by the polarity of the earth. 2. If a ball rolling on a double inclined plane is operated at each end of its track by a spring of sufficient power to overcome the influence of gravitation and friction when the ball is put in motion, would it not continue to move from spring to spring until either the springs become weakened or the wearing of some parts increased the friction sufficiently to bring the ball to a rest? A. The springs would have to be worked by some other power than the impulse of the ball. 3. Such an instrument could not be termed perpetual motion, could it? A. It would not constitute perpetual motion.

(15) O. S. P. writes: I made a magic lantern, but cannot get satisfactory results from it. In my lantern I use 2 plano-convex condensing lenses 4¼ inches diameter for a condenser (the focal distance from the lamps is 4½ inches, and the two lenses are placed 2½ inches apart in the condenser). For an object glass I use a Darlot photographic lens 3 inches diameter. This lantern, when placed about 8 feet from the screen, only gives a picture of 2 feet diameter (with a 60 candle power oil lamp). Where do you think the fault lies? A. Your Darlot objective is of too long focus. You can only remedy the trouble by placing your lantern far back from the screen. Why do you not place your condenser lenses closer together, and shorten up the whole apparatus?

(16) W. S. W. asks: 1. Will sal ammoniac cells work an electric lamp? If so, how many Leclanche Gonda cells will be required for a 4 candle power incandescent lamp? A. Leclanche cells are quite unadapted for steady work. 2. What are the relative proportions of zincs and carbons, and sizes required, to retain a 19 platinum wire at white heat constantly for ¼ hour; the exciting fluid to be sul. acid and bichromate potash? A. It depends on the length of wire. Anywhere from eight cells upward.

(17) D. S. S. asks: 1. How many cells of Disque Leclanché battery will it take to operate a telephone line 1 mile in length of No. 16 galvanized wire, insulated at pole with glass, and ground connection? A. Two to four cells. 2. Would connection to iron pump pipe in well 70 to 90 feet deep answer for ground connection? A. Such connection would be excellent, as long as the well contained water enough to cover end of pipe. 3. Would additional cells be necessary if magneto bell be used? A. Four cells should do everything. 4. Would it be necessary to insulate wire through side of building with rubber tubing, or would silk-covered office wire answer? A. Insulate by rubber tubing. 5. Would a horse shoe magnet telephone, as described in SUPPLEMENT, No. 142, make a good serviceable instrument for every day use, and how long would it remain so, using six inch magnets? A. It would be perfectly serviceable, and would last for many years.

(18) E. B. R. asks: 1. What resistance would a straight electro magnet have to be to repel a 5 inch horseshoe permanent magnet to work as a motor situated between its poles, when provided with suitable commutator? A. Very slight resistance would be required. The electro magnet should have a thick core—½ inch round iron. 2. How can a permanent magnet be spread apart so that the top is as wide as the bottom, without damaging it? A. You could not spread apart the limbs of a horseshoe magnet without heating and consequently demagnetizing it.

(19) S. F. M. writes: I built a cherry sideboard. It was first gone over with Wheeler wood filler, sandpapered, and then shellac varnish rubbed in. It has a smooth, hard finish, but is dead in appearance. How should I treat it now to give it a bright, polished look? A. Make a mixture of rather thick alcoholic shellac varnish and boiled linseed oil, equal parts. Shake it well before using. Apply in small quantities with a cotton cloth, rubbing the work briskly until the desired polish is secured.

(20) J. W. asks: 1. How many cells of the Bennett battery, of the size indicated in SCIENTIFIC AMERICAN, April 11, 1885, will it take to charge the field magnet of a dynamo constructed after the model and proportions of the dynamo in SUPPLEMENT, No. 161? A. About six such cells would be enough. 2. Would well seasoned hard wood answer for a commutator if well coated with shellac and the set screw is bedded in the wood, so that the head can be thickly covered with shellac? A. It would answer, though ebonite is far preferable.

(21) F. S. D. desires a practical recipe for making a first class quick rising dry yeast. A. We would recommend you to strain brewer's yeast until a moist mass is obtained. Place this in hair bags, and press out till the mass is nearly dry. Then sew up in linen bags, and it is ready for transportation. It will keep for a long time, and is much used by bakers in the manufacture of the so-called Vienna bread.

(22) A. S. asks: 1. What volume of air is necessary for the complete combustion of a given volume of ordinary illuminating gas? A. From 7 to 10 vols. 2. Is there any flavoring added to pear phosphates, or is it the natural taste? A. It is made as follows: Take Bartlett or other good pears, cut or chop very fine, press, allow to settle; pour off supernatant liquid; mix one pint of this pear juice with one pint acid phosphate and one pound of sugar, or enough to sweeten.

(23) A. P. and H. A. M.—The first regular passenger railroad in America worked by steam locomotives was the Charleston and Hamburg, of South Carolina, chartered in 1827. On a part of this road the locomotive "Best Friend" was operated in the latter part of 1830. The first trial of a locomotive in America was in 1829, on a road built by the Delaware and Hudson Canal Company, to connect their mines at Carbondale with the town of Honesdale.

(24) J. L. P. asks: 1. The largest craft afloat? A. The Great Eastern. 2. The weight of the heaviest gun? A. 110 tons. 3. How many cubic feet of air are required for the practical combustion or consumption of one pound coal? A. 140 to 152 cubic feet for perfect combustion, according to the percentage of combustible in the coal. 4. By what rule do we determine the proper area or dimensions of chimney or smoke stack, to be in proportion with grate surface? A. A common practice is to make the chimney equal to two-tenths the area of the grate. The proper formula is:

$$\frac{15c}{\sqrt{h}} = \text{area},$$

c being lb. of coal burned per hour, h height of chimney. 5. A good work on the last question, and price? A. Nystrom's Mechanics (revised edition) is good on this and all subjects appertaining to steam engineering and mechanical subjects. We can mail it you for $3.50.

(25) A. S. writes: For home made ginger pop: Add about one gallon of boiling water to two ounces of best ground ginger. Stir in whites of one or two eggs and let settle over night. In the morning pour off as much clear liquor as possible, add enough water to make two gallons, and stir in three pounds granulated sugar. Now add 1 ounce cream tartar, the strained juice of three lemons, and two tablespoonfuls of home made yeast. It should be perfectly clear. Stir well and bottle. It will take about two days to ripen in a warm place, as a mantel piece over the kitchen range, or a week in a cool place, as the cellar. It should never be kept more than two weeks, or you may lose the bottles. The bottles should be laid on their sides, to keep the corks wet and tight.

(26) W. K. B. desires (1) simple method of removing strawberry stains from white marble—will ammonia? A. Mix up a quantity of the strongest soap-lees with quicklime, to the consistency of milk, and lay it on the stone for twenty-four hours; clean it afterward, and it will appear as new. 2. Best method of restoring nickel bicycle which has become slightly rusty? A. If the plating has not been worn off, the rust can be removed by polishing with rouge.

(27) J. L. H. asks: 1. What causes the leaves of the sensitive plant to fold up when touched? A. Because the petiole, which unites the limb or blade of the leaf to the stem, has an articulation, or a construction with a tendency to disunion, shown in a swelling formed of cellular tissue, irritation of the cells of which induces a depression of the whole bipinnate leaf; a similar property exists in the struma at the base of the leaflets which fold upward. 2. What is the most suitable material for foundation of a heavy engine? How much lower should the back end of a 14 foot return tubular boiler be set than the front end? How thick should the brick walls for boilers of this size be, also distance of bridge wall from bottom of boiler, to burn wood? A. For engine foundations, stone or hard brick laid in Portland cement, with or without dressed capstone, to suit style of bed plate or engine bearings. For a 14 foot boiler, 1½ inches inclination in its length to rear end. Walls 12 inches with 1 inch air space, and 4 inch wall outside tied in with headers enough to stay it, and solid at places opposite back stays. Bridge wall to be 8 inches clear from boiler shell.

(28) I. D. F., of Mass.—To etch your name on steel tools, proceed as follows: Clean thoroughly of grease, and then spread a thin coat of beeswax or paraffine on it at the place where the name is to be. This must be as thin as possible. Then, with a sharp needle point, write through the wax to the steel. Paint this over with a mixture of nitric and muriatic acid, in the proportion of six to one respectively, and when bubbles cease to rise, the work is done. Wash in strong soda water.

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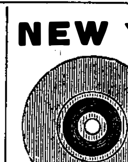

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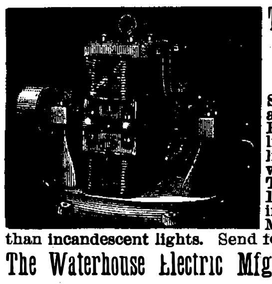

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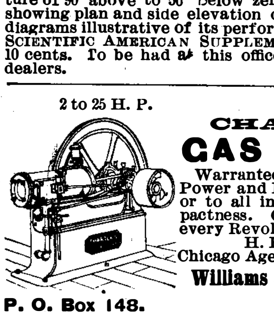

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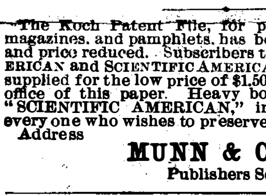

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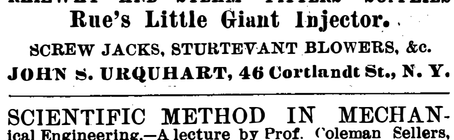

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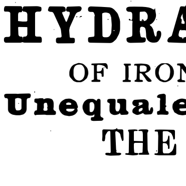

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