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THE MARENT GULCH TRESTLE.

The accompanying engraving represents the trestle on the Northern Pacific Railroad that crosses Marent Gulch, ten miles west of Missoula, Montana. The trestle is for a single track, is 226 feet high, and is supported upon eight piers built upon the Howe truss principle, the spaces between the end piers and the summits of the hills being spanned by trestles.

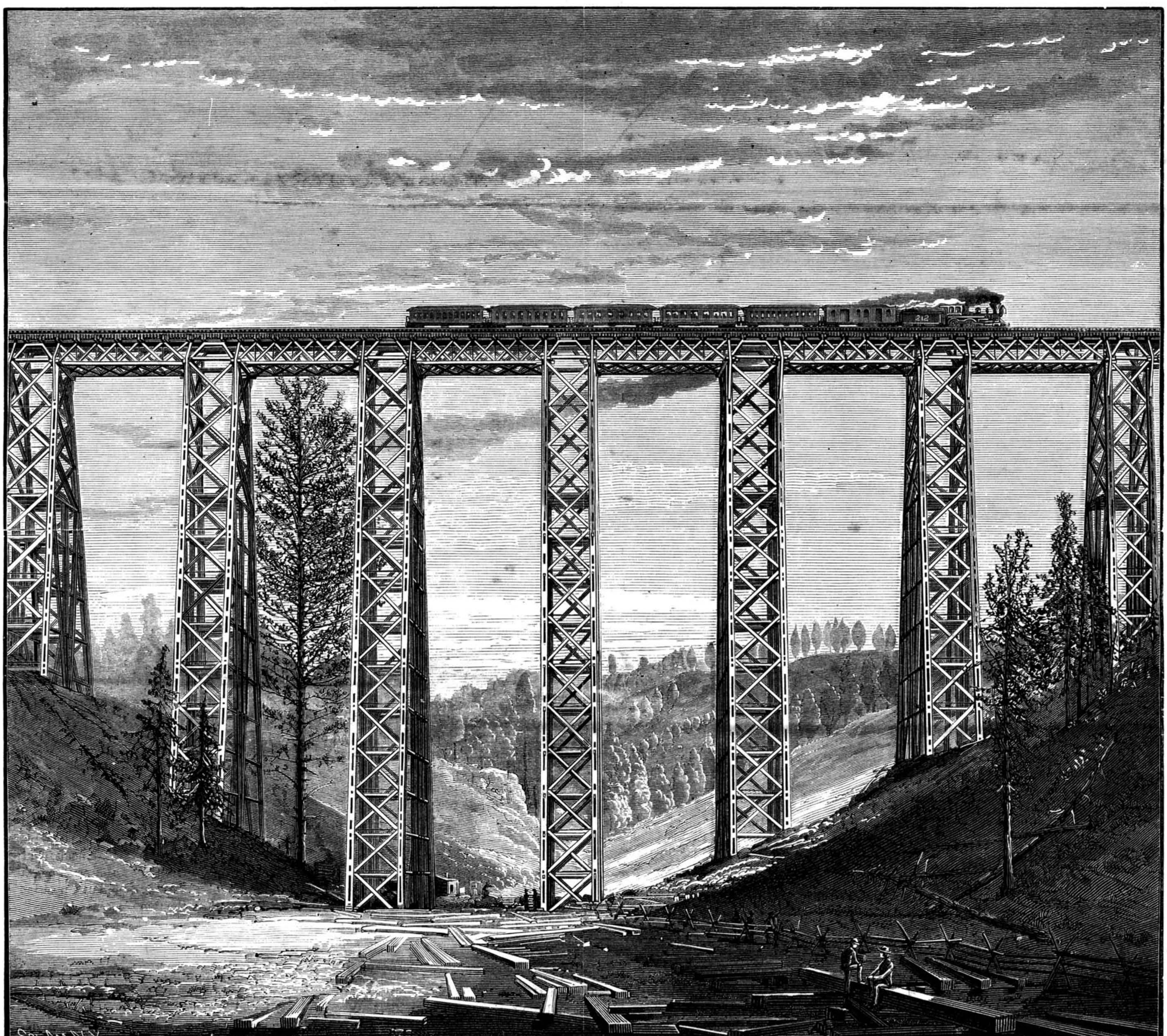
It is built entirely of wood cut from forests in the immediate vicinity, and a good idea can be formed of the magnificent proportions of some of these trees and their special adaptability to the needs of the builders of the trestle by the fine specimen shown in the picture, standing nearly in the center of the gulch, and whose top reached above the rails. The structure was designed to meet the requirements of travel only for the time being, the combustible nature of the material of which it is built prohibiting its permanent use. It was, therefore, so planned that at any future time it could be replaced by one of iron without in any way interfering with the traffic of the road.

No difficulty was experienced in obtaining a foundation for the piers, since one hill was composed of loose and solid rock, and the other of slate rock. The piers are placed 70 feet apart between centers, the distance between the parallel sides, center to center, being 20 feet, and the centers of the tops of the corner posts being 10 feet apart between the sloping sides, which have a batter of 1 in 6, thereby increasing the width of the foundation to about 80 feet, and insuring the stability of the structure. The piers consist principally of four corner posts, each of which is built up of two 10 x 12 inch timbers, placed in a plane parallel with the line of the track and bolted together.

The sloping sides are divided into panels 16 feet in height, the diagonals of which are 6 x 10 inch timbers, tied with iron rods 1½ inches in diameter.

The parallel sides are divided into panels of the same height, but the bracing is more complex. From the bottom of the pier to bottom of the tenth panel extends a center post composed of two 8 x 12 inch timbers bolted together, and from each side of the bottom of this post to each corner of the same panel is a brace of the same size. Parallel with these braces and extending from the foundation to the bottom corners of the seventh panel are others of like dimensions. From the bottom corner of the pier to a point on the last mentioned braces just within the second panel, is a diagonal of two 8 x 10 inch timbers. The panels are formed of 8 x 12 inch pieces whose ends overlap and are bolted to the center post. The three top panels of the parallel sides of the pier are made up of diagonals of two 7 x 7 inch pieces, tied with rods 1¼ inches in diameter, with the exception of the top and next to the top rods, which are 1½ and 1⅜ inches, respectively. Horizontally the bottom of the sixth panel is divided into two panels by two sets of 8 x 10 inch timbers connecting the center posts, the diagonals being 8 x 8.

The tops of the piers are connected by truss 10 feet in height and the same in width, the diagonals of which are wood and the tie rods iron. Between the bottom chords and the tops of the piers are transverse beams extending beyond the sides of the piers. The ends of these beams are braced from the sides of the piers, and braces from the ends to the top chords stiffen the truss. The floor beams rest immediately upon the top chords, upon which rest the stringers and above them the ties to which the rails for the single track are spiked. The ends of all the diagonals in the trestle abut against angle blocks. The piers for the iron or permanent trestle will occupy every alternate space between the piers of the present structure. The trestle was designed by C. C. Schneider, C.E., of 35 Wall Street, this city, who also designed the great cantilever bridge at Niagara Falls, which was recently described in this paper, to whose courtesy we are indebted for the loan of drawings from which we obtained the foregoing description.



THE MARENT GULCH TRESTLE ON THE NORTHERN PACIFIC RAILROAD

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NEW YORK, SATURDAY, DECEMBER 29, 1883.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 417,

For the Week ending December 29, 1883.

Price 10 cents. For sale by all newsdealers.

PINK EYE.

Horse scarlet fever, or the so-called "pink eye," forms the subject of an interesting paper by Dr. John C. Peters in the New York *Medical Journal*, of December 15. The conclusion is that various diseases of animals, communicable to man and *vice versa*, had frequently prevailed in our great car stables and in stables along the river fronts, among such diseases being diphtheria, scarlatina, and true measles, or a hybrid of measles and scarlet fever. Inoculations with the blood, tears, and usual mucus have produced the disease, the so-called "pink eye" having thus been conveyed from a partly blooded horse to a cart horse, from that to Guinea pigs, and from them to a pony. Young horses take the disease more frequently than older animals, although the latter are not always exempt. On the seventh day improvement generally commences, but the disorder seems most contagious at that time. The trouble is self-limited ordinarily, so that palliative treatment is all that is required.

LIGHT IRON CASTINGS.

Many years ago articles of cast iron of a light, fragile, and ornamental character, known as "Berlin [German] jewelry," were quite fashionable. It seemed, then, almost impossible that these should be simply castings of iron, and it is within a comparatively recent period that the possibility has been proved by the production of similar articles in this country. When of an ornamental design, as shoe buckles, belt buckles, shawl clasps, and hair pins, iron frequently has the market name of steel, and such "steel" ornaments are very common and in general use. But they are made of iron cast in sand moulds exactly as massive lathe beds, planer beds, and anvils for drop hammers, weighing several tons each, are cast.

The brilliant polish on the ornamental articles is produced by means of emery wheels, rag, rotten stone wheels, and rouge wheels, prefaced by the action of the tumbling barrel.

Of course, only the easiest flowing iron is fit for such fine work. This is charcoal produced iron, that from the Salisbury mines in western Connecticut being admirably adapted to these purposes. There is an establishment in Connecticut that melts, for the purposes of minute castings, about ten tons of soft charcoal iron a day, casting scissor and shear blanks, clock bells, clock keys, drawer keys, door keys, piano tuning keys, rings, harness buckles, ornamental buckles, horsemen's spurs, and a hundred other articles, not one of which will weigh twelve ounces, and many of which weigh less than an ounce. Some of these articles require in their finished state more than one hundred to the pound in weight. So minute are these castings, mainly moulded from plate patterns, that the used sand of the moulds must be sifted to discover all the results of the day's casting.

TOOTHING A NICKING SAW.

The nicking or cutting-off saw in the machine shop is a necessary tool for many purposes, but, unlike knurling tools, it is not to be found in assortment in the supply stores. The usual method of producing a saw is to chisel it out of a piece of sheet cast steel of the required thickness, or to forge it from a bar, drill the center for an arbor, file or turn the periphery, and after truing it, file the teeth.

A better way to form the teeth is to make and keep on hand one hob of eight threads to the inch or of six threads to the inch—hobs made like those for producing thread chasers. But for forming the saws the hobs should be cut to a single angle tooth, a tooth having an acute angle on one side—the thread being a right handed thread—the other angle being right angled to the axis of the hob. A good idea of the section of the tooth is got from that of the ordinary milling tool or the circular saw for wood.

With such a hob suspended between the centers of a lathe, a steel disk can be cut or toothed by a very simple method. The drilled and turned saw blank is mounted horizontally on a bar set in the ordinary tool post, the bar having a stud on which the blank is secured by means of a nut and washer, but so that it may revolve freely in a horizontal plane. Being advanced to the rotating hob, the merest touch will show if an entire revolution of the blank will bring out the teeth, even without overreaching, and any error can be rectified by turning down the blank slightly.

By means of ordinary lathe appliances a nicking saw can be cut with little trouble, ranging from three inches to one and a half inches diameter, much more rapidly and perfectly than can be done by hand filing. The slight "slash" of the screw-threaded hob will not affect the direct action of the saw, even if the hob should be of so coarse a grade as four threads to the inch.

THE BOTTLERS' EXHIBITION.

The second annual convention and international exhibition of the United States Bottlers' Protective Association was held in the American Institute building, this city, from December 11 to 14 inclusive. The exhibition comprised bottlers' supplies, machinery, appliances, materials, beverages, etc., the main building being filled with novel and interesting articles. There were several exhibits of carbonated beverage apparatus, showing each step in the process from the barrel of pure marble dust and the carboy of acid with its siphon attachment, by which any surplus in the measure could be run back into the carboy, to the charged fountain and filled bottle.

Bottles of every kind used in the trade were shown fitted with stoppers adapted to every description of beverage; stoppers made of different materials and by which all or only a little of the contents of a bottle could be taken out without destroying the "head." One bottle washer consisted of a U-shaped spring, the arms of which were joined by a thick rubber band and which was secured to a spindle revolving at high speed. It was impossible to so quickly push a bottle on this device, that every portion of the interior would not be rubbed by the band. By changing the band the device could be adapted to bottles of different sizes and shapes. There were exhibited extracts, filters, siphons, bottling wire, corking machines, colorings, bottleware—indeed, every branch of the bottling trade was represented.

Instructive exhibits were made by the cork manufacturers. The best quality of cork comes from Spain, although the cork tree—a species of oak—grows in Portugal, Italy, Southern France, and Algiers. When the tree is about fifteen years old the first stripping, known as virgin cork, is taken off. This bark is thin, covered with irregular indentations, and is of no practical use. Ten years after this the tree may be again stripped, the bark having attained a thickness of from one to one and a half inches; and so on in periods of ten years, the quality said to improve with each operation. The bark is steamed or soaked in water, pressed, and slightly charred before fires, in order to close the pores and toughen it, and in this shape it is sent to the manufacturer. By circular knives the bark is cut into strips varying in width according to the length of the desired cork.

The corks are cut from the strip by a rapidly revolving cylindrical knife, the axis of the cork being parallel with the bark. The corks to be tapered are taken to a circular knife, revolving horizontally, against the edge of which they are held, one by one, by a machine which may be said to resemble a lathe. The cork is placed against a loosely journaled foot-piece, while against the other end is pressed a slowly revolving spindle. This device raises and presses the cork to the edge of the circular knife, the device being adjustable at any angle to obtain the desired taper.

NEED OF A MANUFACTURING REFORM.

There is one department of manufacturing production that lacks not so much good workmanship as proper material; that is, the department of manufacturing for domestic purposes. It would almost seem as though the producers think that anything is good enough for the household, so long as it makes a pretense at convenience and has some meretricious ornamentation.

A most attractive and convenient form of cooking utensils is now made of tough iron enameled inside and out. In most respects it is much superior to utensils of tin or those of cast iron; the tea pots and coffee urns being particularly useful. But the hinges break after a little use, the ornamental tops come off, showing that they were merely attached for a temporary purpose, and even the handle drops off, being merely soft soldered on.

In lamps for burning kerosene the vexation is fully as great, while the danger is more. The glass reservoirs for the oil are barely stuck into sheaths of the flimsiest sheet brass at the tops of the standards by means of plaster of Paris that soon loses all its cohesiveness by the slightest overflow of oil; and yet in nine times out of ten the lamp is moved when lighted by lifting by the glass reservoir. The thin brass tops are always getting out of shape; they hardly sustain the weight of chimney and shade. The rag wheels, or the toothed wheels which serve to raise and lower the wick, may turn on thin wire axes or refuse to turn at all. Sometimes these appliances are so insufficient that the lighted wick drops through the tube down into the oil.

If price would secure good products these annoyances and dangers would not be so vexatious, but the higher priced artistic and ornamental lamps are no better made, have no better material, are no more secure than the cheaper sorts.

This singling out of two common and necessary articles as evidences of lack of honest work and material is not intended to be a marked rebuke to these particular departments; this "skrimpiness" and "Cheap John" makeshift method runs through almost all the products of manufactures for household use, and a long list might be made of articles of everyday use which become useless almost before their usefulness is established, because the makers use glue instead of nails, nails instead of screws, soft solder instead of brazing, sheet tin instead of iron or steel, pewter instead of tin, and unskilled labor instead of honest work. There is room for improvement.

THE height and velocity of clouds have been determined in England by means of photography. Two cameras, placed about 600 feet apart, are provided with instantaneous shutters simultaneously released by electricity. The observer measures the angle of inclination of the cameras and the position of the cloud as photographed on the two plates, and from these data a trigonometric calculation gives the distance and height of a cloud with great accuracy.

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ASPECTS OF THE PLANETS FOR JANUARY.

JUPITER

is morning star until the 19th, and then evening star until the 7th of August. There is no question as to which star shall head the list during January, for Jupiter puts on his proudest aspect on the 19th, when he reaches opposition. This event occurs at 10 o'clock in the evening, when the regal planet will be well toward the zenith, and can be seen in his best estate. Though Jupiter never shines with the bewitching brightness that distinguishes Venus in her period of greatest brilliancy, he enjoys a great advantage over his fair rival. Since he is an outer planet, he may be seen at opposition, opposite the sun, rising about sunset, and making his transit, or meridian passage, at midnight. Since Venus is an inner planet, she is never seen much more than 45° from the sun, either three hours after sunsent or three hours before sunrise. Jupiter seems to make the circuit of the sky. Venus seems to oscillate in straight lines east and west of the sun as if she were fastened to him by an invisible chain. In reality, both planets revolve around the sun the same as the earth. The different aspects they take on are simply the way they look to terrestrial observers, the giant planet traveling outside of our domain, the fairest of the planets traveling within our boundaries.

We never look upon Jupiter when in opposition without rejoicing that when the vast nebulous mass that once filled and extended far beyond the limits of the solar system quickened into life, and threw off the concentric rings that formed the planets, the largest rings condensed into the planet Jupiter. Observers on the other planets are for this reason privileged to behold the magnificent spectacle of a planet second only to the great sun himself, a miniature solar system with its revolving moons, a telescopic wonder on which the eye rests with ever new delight.

The huge planet has not yet cooled down, his primeval fires still blaze, and he gives out light and heat to the satellites that surround him, and as readily yield to his sovereign power as their mighty lord bows to the sun's resistless sway. Observers on this planet, nearly 500 million miles away, can watch the process of world making on Jupiter's mighty mass. Exceeding the earth in volume 1,300 times, his cooling will be proportionally slow.

In the belts that diversify his disk, in the huge spots that from time to time stir his mass, in the agitation of the immense cloud atmosphere that conceals his fiery nucleus, we behold on a grand scale the progress of the cooling process which millions of years ago agitated the earth's lesser bulk before it developed to the perfection of its present condition as an abode for animate life. Just as surely will the prince of planets reach, latest of all the sun's family, the same perfection of development. When, millions of ages hence, the time arrives, the earth, like the moon, will have passed into the period of inevitable decay, and, preceded by Mercury, Mars, and perhaps Venus, will be floating through space as a dead world. Viewed in this light, every changing belt, every new spot, every sudden rift is a revelation in Jovian language of the tremendous disturbances that will eventually bring order out of chaos, beauty out of desolation.

The red spot and the bright spot have not actually disappeared, although as the planet sped on its course away from the earth no traces of them were seen later than May. As the planet again approached us after conjunction, Mr. Denning found on the morning of the 6th of October that the red spot was again visible, although very faint. At times the shape of the spot came out distinctly, notwithstanding its feebleness, while the indentation or hollow in the great south belt near the spot is a very conspicuous figure. Later, on the same morning, Mr. Denning saw the equatorial white spot as it crossed the central meridian of Jupiter. It was very bright and seemed to preserve the conspicuous appearance it presented in 1880. Observers will therefore have an object in the telescopic study of Jupiter besides the enjoyment of the brilliant spectacle. The red spot, the white spot, the intensity of the coloring in the belts, all have a meaning. Fortunate is he who can decipher it!

High up in the north, at his nearest point to the earth, above the horizon the entire night, the brightest of the swarming stars that adorn the crown of night—such is Jupiter at opposition, and superbly will he shine during the crisp and clear moonless nights of January.

The right ascension of Jupiter on the 1st is 8 h. 17 m.; his declination is 20° 14′ north; and his diameter is 43·4″.

Jupiter rises on the 1st about half past 6 o'clock in the evening; on the 31st he sets at 4 o'clock in the morning.

VENUS

is evening star. If Jupiter holds the first place, she unquestionably wins the second. She is now a beautiful object in the western sky for nearly two hours after sunset. Traveling from superior conjunction to eastern elongation, she is constantly receding from the sun in her eastern course, and, at the same time, approaching the earth. Observers who watch her movements will note her progress, and easily discern her increase in size and brightness, and the longer time she is above the horizon, and will rejoice that during the entire winter she will be the peerless starry gem outshining all others in the western sky.

Venus is moving rapidly northward, advancing 13° in that direction during the month, and greatly changing her position in regard to the sun, being now 2° 30′ north of the sunset point, and at the end of the month 10° north of the sunset point.

A charming aspect of Jupiter and Venus in their present phase is that they are above the horizon together during the whole month, Jupiter rising in the east before Venus sinks below the horizon in the west, the one reigning in the eastern sky, the other holding her court in the western. Jupiter now rises fifteen minutes before Venus sets. At the end of the month, Jupiter will rise before sunset, and Venus will not set till nearly 8 o'clock. They will therefore be visible for more than two hours, and, as one is apparently traveling east and the other west, they will seem to approach nearer each other.

The right ascension of Venus on the 1st is 20 h. 30 m.; her declination is 20° 40′south; and her diameter is 11·4″.

Venus sets on the 1st about half past 6 o'clock in the evening; on the 31st she sets at ten minutes before 8 o'clock.

SATURN

is evening star, and secures the third place on the list in the order of beauty and brightness. He changes his position scarcely at all during the month, slightly retrograding. Thus his path is easy to follow. Though far exceeded in brilliancy by Jupiter, he is beautiful to behold, with his soft and serene light. Nearly half way to the zenith when the gathering shades of night reveal his presence in the sky, making his transit on the first at half past nine o'clock, and then sinking slowly in the west, followed by a retinue of the brightest stars that twinkle in the sky, and taking precedence of Jupiter and Mars on the celestial track, Saturn cannot fail to win an admiring tribute from every beholder during the starlit nights of January.

The right ascension of Saturn on the 1st is 4 h. 10 m.; his declination is 19°·6′ north; and his diameter is 19″.

Saturn sets on the 1st not far from half past 4 o'clock in the morning; on the 31st he sets about half past 2 o'clock.

MARS

is morning star, wins the fourth rank in the order of interest, and completes the quartet of planets visible during winter nights that are easily recognized by unscientific observers. He is growing wondrously ruddy in hue, and increasing in size as he rapidly approaches that point in his course when our planet will lie directly between him and the sun. Therefore he is very near his brightest phase, while his northern declination is increasing, always a favorable condition for observation. He is easily recognized as a brilliant red star southeast of Jupiter and northwest of Regulus in the handle of the Sickle.

The right ascension of Mars on the 1st is 9 h. 40 m.; his declination is 17° 54′ north; and his diameter is 13·2″.

Mars rises on the 1st a few minutes before 8 o'clock in the evening; on the 31st he rises about 5 o'clock.

MERCURY

is evening star until the 20th, and then morning star. On the 4th, at 11 o'clock in the morning, he reaches his greatest eastern elongation, being 19° 16′ east of the sun. He is then visible to the naked eye in the west soon after sunset, but his southern declination is not favorable for visibility. Venus will help to point him out, as he is a little way west of her, and a degree farther south. On the 4th, Mercury sets an hour and a half after the sun, and a half hour before Venus. With so bright a starry guide, and these directions to follow, any quick-eyed observer may hope to find the planet that loves to hide in the evening glow.

On the 20th, at 3 o'clock in the afternoon, Mercury has completed his course as evening star, coming into inferior conjunction with the sun and passing to his western side to commence his short circuit as morning star.

The right ascension of Mercury on the 1st is 20 h. 3 m.; his declination is 22° 3′ south; and his diameter is 6·2″.

Mercury sets on the 1st about 6 o'clock in the evening; on the 31st he rises about 6 o'clock in the morning.

URANUS

is morning star. He is in the constellation Virgo, and is stationary nearly the whole month.

The right ascension of Uranus on the 1st is 11 h. 54 m.; his declination is 1° 26′ north; and his diameter is 3·8″.

Uranus rises on the 1st at 11 o'clock in the evening; on the 31st he rises at 9 o'clock.

NEPTUNE

is evening star. He still holds his one claim to distinction, heading the procession of outer planets in the time of his appearance, making now his transit at half past 8 o'clock in the evening.

The right ascension of Neptune is 3 h. 6 m.; his declination is 15° 36′ north; and his diameter is 2·6″.

Neptune sets on the 1st about half past 3 o'clock in the morning; on the 31st he sets about a quarter after 1 o'clock.

THE MOON.

The January moon fulls on the 12th at twenty-seven minutes after 10 o'clock in the morning, New York standard time. On the 8th, at two minutes after one o'clock in the morning, the moon makes a close conjunction with Neptune, being 6′ north. She will occult the planet in some localities. On the 9th, at fourteen minutes after 2 o'clock in the morning, she is in conjunction with Saturn, being 1° south. She will occult Saturn in some localities between 25° and 71° south declination, the only time during the year. On the 13th she is in conjunction with Jupiter, on the 14th with Mars, on the 17th with Uranus. On the 26th, two days before her change, she is at her nearest point to Mercury. Her last conjunction is the most interesting, for on the 30th the two days' old moon hangs her silver crescent a few degrees north of the lovely evening star. Planet and crescent, though the approach is not near, form a picture on the celestial canvas of which the eye never grows weary.

Patents in England.*

On the first day of next month—January, 1884—the new patent bill of Great Britain goes into force, by which a great reduction is made in the cost of obtaining patents there and considerable of the red tape required under the old system is done away with.

The cost for a patent in England will hereafter be about the same as a United States patent, and Scotland, Ireland, Wales, and the Channel Islands will be included in the protection.

Persons desiring to obtain patents in England, however, must not overlook the fact that if the article to be patented has been introduced into the country, or copies of the United States patent have been in such way open for general inspection that the public may be presumed to have knowledge of them, as in a reading room, library, etc.—before a patent has been applied for—a valid patent cannot be obtained.

The English law differs materially from ours in the matter of showing ownership in inventions. No examinations are made to determine this, and patents are granted jointly to the inventor with others, although there must be a declaration from the inventor that he is the true and first inventor. The doing away with examinations, to determine if the invention possess novelty, will prevent the vexatious delays so often attending the obtaining of a patent through our Patent Office.

The new law likewise provides that each application for a patent must be confined to one invention. The original declaration and provisional specification go to an examiner only to see that the invention is fairly described and correctly entitled. In case two applications for the same thing are pending in the office at one time, such cases will be decided upon by the head of the Patent Office, subject to appeal by the applicants to the law officers.

A large number of cases are being prepared to be filed in the London Patent Office as soon as the new law goes into effect. A much larger proportion of our patentees will, undoubtedly, seek protection for their inventions in Great Britain than have heretofore done so, for the cost now will be small compared with the expense of obtaining a patent under the old law.

Coverings for Steam Pipes, etc.

A little more than a year ago several fires in New England cotton mills were attributed to pipe coverings, and it was thought the felted, fibrous substance thereof, with possibly a little grease, had caused spontaneous combustion. This theory was discarded on investigation, but it led to an examination of the qualities and efficiency of the different boiler and pipe coverings in the market, for which purpose Prof. John M. Ordway, of the Massachusetts Institute of Technology, was specially appointed. His conclusions are, that the best coverings are those mostly of light, fibrous, or porous substances; such as hair felt, slagwool, charcoal, rice chaff, and silica, or "fossil meal," while a paste or mortar plastered on is generally inferior. A moderate air space is recommended, the best ribs or props to hold the case off from the pipe surface being plaster rings cast in halves and clamped on the pipe by tying a string or wire around the two halves. Silicated charcoal and slagwool may be applied directly to the pipe, being inclosed with cloth, or a casing of sheet metal or straw board; while for the Southern States rice chaff, moistened with water-glass at 30° B., and sewed up in a cloth wrapper, is recommended.

The Eucalyptus.

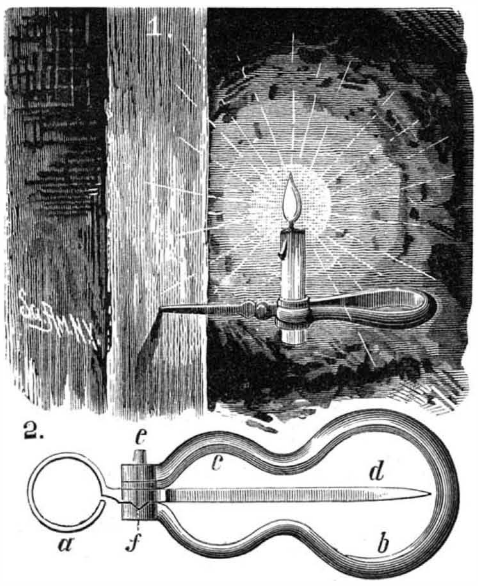
Where there is surplus moisture to dispose of, as, for example, a cesspool to keep dry, a large eucalyptus, states the Pacific *Rural Press*, will accomplish not a little, and a group of them will dispose of a vast amount of house sewerage. But if you have water which you do not wish to exhaust, as in a good well, it would be wise to put the eucalyptus very far away. Daniel Sweet, of Bay Island Farm, Alameda County, recently found a curious root formation of the eucalyptus in the bottom of his well, about sixteen feet below the surface. The trees to which the roots belonged stand fifty feet from the well. Two shoots pierced through the brick wall of the well, and sending off millions of fibers, formed a dense mat that completely covered the bottom of the well. Most of these fibers are no larger than threads, and are so woven and intertwisted as to form a mat as impenetrable and strong as though regularly woven in a loom. The mat when first taken out of the well was water soaked and covered with mud, and nearly all a man could lift, but when dry it was nearly as soft to touch as wool, and weighed only a few ounces. This is a good illustration of how the eucalyptus absorbs moisture, its roots going so far to find water, pushing themselves through a brick wall, and then developing enormously after the water is reached. Mr. Sweet thinks one of the causes of the drying up of wells is the insatiable thirst of these vegetable monsters.

* Note.—Persons desiring to know as to the cost of patents in England under the new law and how to obtain them, will be furnished with full information by calling at the office of this paper, or they will receive a pamphlet by mail which will give the facts as to securing patents there, and in all other foreign countries.

MINER'S CANDLESTICK.

The candlestick may be conveniently carried in the pocket when arranged as shown in Fig. 2; it may be secured to perpendicular surfaces, hung upon ledges, or placed upon flat or inclined places, the candle being held upright. The two sides of the handle-frame form a spring, and to the circular head of one side is secured a pin, which passes loosely through a hole in the other head which is made with a V-shaped groove as shown. Upon the pin, between the heads, are placed the hook, *c b*, and the point, *d*, which turn upon the pin. Upon the rear end of the point is a sleeve, *a*, for holding the candle, the sleeve being made as a spring for holding candles of different sizes.

On the point at the pin are V-shaped projections which fit in the V-shaped grooves when the candlestick is folded and also when the point is turned out parallel with the frame.



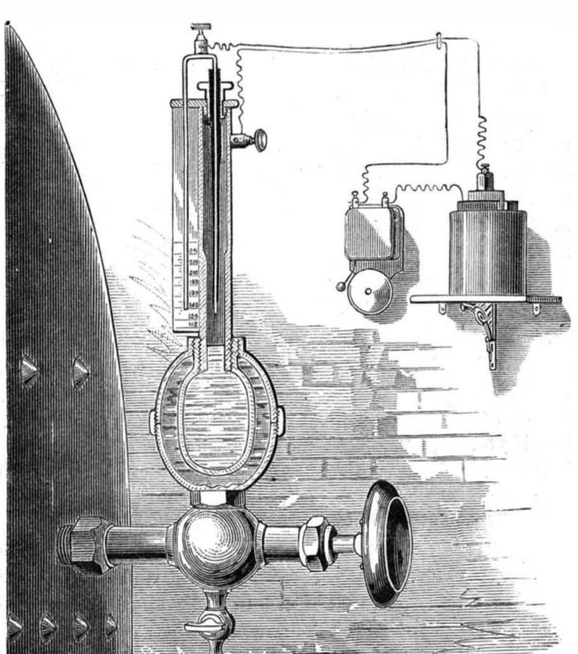
PATENEAUDE'S MINER'S CANDLESTICK.

The projections, when turned in any position not in the plane of the frame, spread the sides of the frame, thereby causing it to grasp the point and hook with increased force for holding them at any angle desired. When turned out the point can be thrust into perpendicular surfaces as shown in Fig. 1. The hook, *c b*, which, when folded, lies upon the inner surface of the frame, is adapted for suspending the candlestick from ledges of rock or other projections. By turning the hook downward the candle may be made to stand in a vertical position when the device is placed upon an inclined surface. It will be readily seen that the candlestick can be arranged to suit almost any position.

This invention has been recently patented by Mr. Cyrille Pateneaude, of Helena, Montana, and further information may be obtained by addressing D. P. Patenaude, of same place.

ELECTRIC ALARM FOR STEAM BOILERS, ETC.

The object of this invention is to provide an electric alarm



ELECTRIC ALARM FOR STEAM BOILERS.

apparatus more especially intended for use as a low water indicator for steam boilers; it is also applicable to ovens, furnaces, and other contrivances where the heat within must be regulated. The device consists of a mercury bulb inclosed in a sectional globe which forms a chamber around the mercury bulb, as shown in the engraving which represents the device in vertical section and attached to the side of a boiler. The chamber communicates with the interior of the boiler through the valve stem, to which the globe is attached. In the plate which closes the upper end of the tube of the thermometer-like device, is fitted a thumb nut through which passes the insulated arm of a bent rod. The insulating material on the arm is threaded to match the screw threads of the nut, so that by turning the nut the bent rod may be raised or lowered to suit the temperature at which it is desired to have the alarm given.

The other arm of the rod is of the same length as the first, and reaches down in front of a graduated plate attached to the thermometer tube, thus serving as an indicator for setting the rod with reference to the degree marks on the plate. In the upper right hand corner of the engraving is shown the battery and electric alarm, which are connected by wires to the bent rod and mercury tube. When the water in the boiler stands above the low water line, the water entering the chamber through the stem will prevent the entrance of steam, and the mercury in the bulb will have the same temperature as the water, causing it to stand in the tube somewhat below the lower end of the arm. When the water in the boiler falls below the low water line, steam will enter the chamber, and, being of a higher temperature than the water, will cause the mercury to rise in the tube until it comes in contact with the end of the arm, when the electric circuit is completed and the alarm sounded. In the spindle is fitted a screw plug for cutting off communication between the chamber and boiler in case it should be desired to unscrew the apparatus. The upper end of the mercury tube is enlarged above the end of the rod in order to prevent all danger of overflow of the mercury in case of excessive heat.

These alarms are being manufactured by Messrs. McKenna & Carley, 12 Cortlandt St., N. Y. City.

Lines of Study in Electricity.

The Institution of Civil Engineers (London) recognizes the importance of discussing the subject of electricity, and in its list of papers to be received are the following topics: Electro motors, their construction, efficiency, and power; gearing for dynamo machine motors and other high speed engines; the transmission and distribution of electricity over large areas for lighting and for motive power, including electrical railways and hoists; electrical measuring instruments; submarine telegraph cables, their manufacture, laying and repair, including deep-sea sounding methods and appliances; telpherage, or the automatic transportation, by means of electricity, of goods and passengers.

Laboring and Managing.

Some old fashioned notions about the value of example have induced managers of mechanical establishments to become shop hands and to spend their time among their workmen as one of themselves, sharing their employments. To a certain extent such a practice, occasionally, may have a beneficial effect on the workmen without injury to the business. But there are cares and duties connected with the successful prosecution of any business that are not wholly those of the employes. A business must be managed as certainly as the work must be done, and it requires an unusually versatile man who can be one of his own workmen and their own manager at the same time. If to these dual duties he adds that of the proper oversight of his financial and general out-shop business, he must be a rare man to make a success. It may be a matter of personal pride to be able to boast like Bounderby, Gradgrind's friend, but it may be a costly indulgence; for draughting, correspondence, the reception of customers, the overlooking of bills, and the supervision of books as much demand the care and eye of the master as the direct guidance of the workmen. This last can be delegated to a salaried foreman, or to a first class workman, with an addition to his pay for responsibility; but the others cannot be safely left to any but the proprietor himself.

MECHANICAL TELEPHONE.

The mechanical or acoustic telephone, herewith illustrated, will transmit and receive speech with great clearness and naturalness of tone. The mouth piece, *a*, has a central aperture for the passage of sound waves to the diaphragm, *c*, whose edges are secured within a rabbet of the mouth piece. The diaphragm is about 7 inches in diameter and is made of spruce wood, which possesses great sonorousness combined with strength sufficient to sustain the tension of the line wire. The mouth piece and diaphragm are held to the wall on a bed piece, *b*, by the tension of the line wire. The bed piece is recessed at both sides, *f g*, and centrally apertured for the passage of threads connecting the line wire to the diaphragm. The front recess, *f*, affords a space between the diaphragm and the center of the bed piece for free action of the diaphragm, promoting clearness of enunciation when the instrument is used as a receiver, and the rear recess, *g*, secures a small marginal support for the transmitter, thereby avoiding a large contact with the wall and preventing excessive vibration.

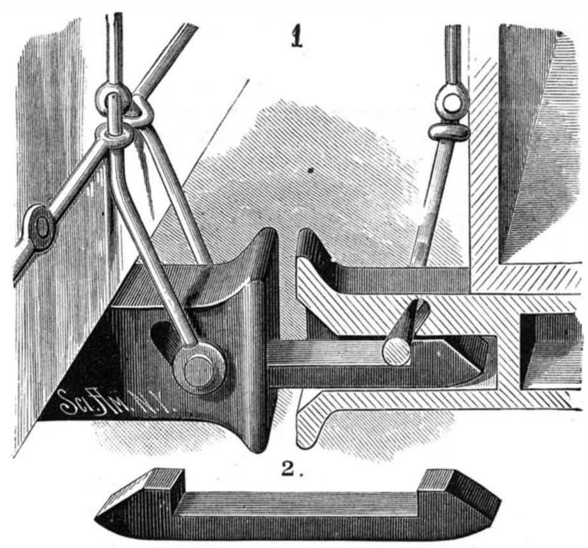
To avoid indistinct articulation and the ringing sounds common to acoustic telephones, the line wire is connected to the diaphragm by silk cords, which are twisted about the end of the wire to obtain a firm connection therewith, and which diverge into three or more strands that are secured to a metal ring, *c*, between which and the diaphragm a rubber or leather ring, *d*, is interposed. The line wire is made of strands twisted together and coated with varnish to bind them and prevent them rubbing upon one another. This construction of the line wire makes it strong and protects it from the weather, and, combined with the silk cord connections, aids largely in clear transmission over line wires of considerable length.

This invention has been patented by Mr. A. G. Miller, of Leyden, New York.

CAR COUPLING.

The drawhead is provided with the usual longitudinal opening, and in each side with a short slot which is inclined from the bottom to the top, and from the front to the rear. A bolt passes through the drawhead and through the slots. The ends of a stirrup having an ∧-shaped top are mounted on the ends of the bolt. Coupled to the top of the stirrup is a rod passing through suitable guide eyes on the end of the car and extending to the roof. Two levers, pivoted on the end of the car, extend to the sides of the car and have their inner ends coupled to the top of the stirrup. The drawbar has its ends beveled, and its top provided with a recess extending to near the ends, thus forming a head on the upper surface of the bar at each end.

When the drawbar is held in one drawhead and is inserted in the other, its beveled end will strike the bolt in the latter,



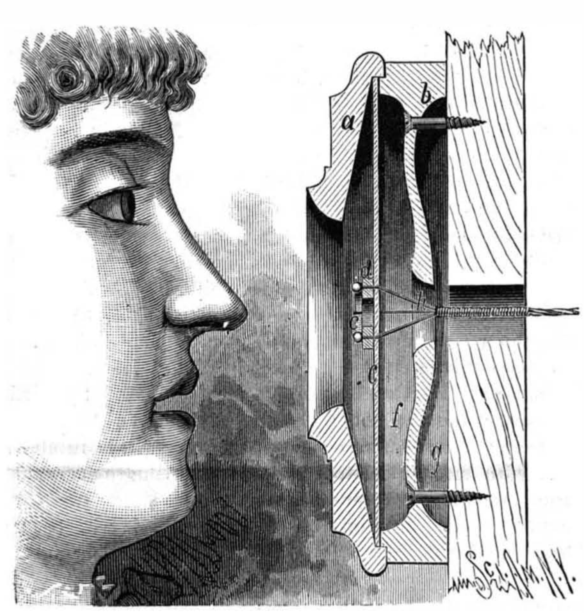
TAYLOR'S CAR COUPLING.

raising and keeping it raised until the head has passed, when the bolt drops and the cars are coupled. When the cars are to be uncoupled, the bolt is raised by means of the vertical rod or the levers extending to the sides of the car. The draw bar can then be withdrawn. Fig. 1 shows the device with the draw bar in position; Fig. 2 is a side view of the drawbar alone.

This invention has been patented by Mr. Benjamin Taylor, of Morrillton, Arkansas.

Sewers and Sewer Gases.

At a recent meeting of the Medical Society of the County of New York, Dr. Stephen Smith, as a member of the Committee on Hygiene, criticised the Department of Public Works for the little it had done in the way of ventilating the sewers, and the wrong principle on which they were operating. "Practically," he said, "it is equivalent to having open sewers running through the streets of New York," to have the perforated covers to the manholes in the streets, as we now have them, for a means of ventilation. The Doctor



MILLER'S MECHANICAL TELEPHONE.

suggested that "the gases should be drawn out by the action of forces which are constant and altogether independent of atmospheric changes, and delivered into the external air at an altitude to render it impossible for them to penetrate any room occupied by human beings at any time."

Instead of this plan the suggestion has been advanced with considerable potency, that the city should provide pumping machinery at suitable stations on the North and East Rivers, wherefrom water could be furnished in abundance for flushing the sewers periodically, as well as for use in large fires. It is not in the very distant future, we trust, when the sewage of all large cities will be utilized for agricultural purposes, in which way it can, in most places, be made to pay the most of the expense of removal. But we don't want to wait until that time for some radical improvement in the New York system.

Xerotine Siccative and Gas in Coal Bunkers.

The report of the committee appointed by the Lords of the Admiralty to inquire, in connection with the loss of Her Majesty's ship Doterel, into the subject of explosions of gas in coal bunkers, and as to the explosive power of xerotine siccative, has been published in the form of a Blue-book. The committee report that the solvent which has been employed in the liquid driers known as xerotine siccative consists of the more volatile products of the distillation of petroleum, commonly known as petroleum spirit, or kerosene. This liquid product is composed of a mixture of light petroleum oils, the most volatile of which evaporate freely at temperatures varying between 50° and 80° (Fahrenheit). If, therefore, this liquid be exposed to air at ordinary temperatures, inflammable vapor will escape readily and rapidly from its surface, and if it be thus exposed in a confined space, the air which the latter incloses will become impregnated by the inflammable vapor with a rapidity proportionate to the prevailing temperature, and to an extent sufficient to produce in a more or less brief period a rapidly inflammable mixture or an explosive mixture, if the quantity of liquid which evaporates bears the necessary relation to the volume of oxygen contained in the inclosed atmospheric air. The explosive mixture produced is, in fact, quite analogous in its nature and behavior to a mixture of coal gas or of fire-damp and air, and is capable of producing similarly violent and destructive explosions. The experiments which the committee made led them to the conclusion that the explosion which resulted in the loss of the Doterel had been brought about by the production of such a large body of flame as had ignited the powder in the magazine of the ship.

Egyptian Mechanical Methods.

Petrie, who is the author of a treatise on ancient metrology, has lately turned his attention to ancient Egyptian processes. Though much labor has been bestowed on the literary remains of Egypt and the description of monuments, little attention has been given to finding out the tools and methods by which their results were reached. The first conclusion to which Mr. Petrie comes is that the stone cutting was performed by means of graving points far harder than the material to be cut. These points were bedded in a basis of bronze; and in boring, the cutting action was not by grinding with a powder, as in a lapidary's wheel, but by graving with a fixed point, as in a planing machine. From discovering spiral grooves in diorite and granite, at least $\frac{1}{100}$ of an inch in depth, the author supposes that an instrument was used of sufficient hardness to penetrate the material that far at a single turn. In this, however, he was corrected by Mr. Evans. The simplest tool used was a straight bronze saw, set with jewels: but there is proof of one circular saw which must have been 6½ inches in diameter. For hollowing the insides of stone objects, the inventive genius of the fourth dynasty exactly anticipated modern devices by adopting tubular drills varying from $\frac{24}{100}$ of an inch in diameter and $\frac{2}{100}$ of an inch in thickness to 18 inches in diameter. Other drills, not tubular, were used for small holes, one measuring $1\frac{2}{10}$ inches long and $\frac{8}{100}$ of an inch in diameter. But this is surpassed by the Uaupes of South America, who drill holes in rock crystal by the rotation of a pointed leaf shoot of plantain, worked with sand and water. The writer of this note has seen, in Porto Rico, stone beads of the hardest material, 2 inches long, bored longitudinally with an orifice $\frac{1}{16}$ of an inch in diameter. The Egyptians understood rotating both the tool and the work. For the finishing of vases, a hook tool must have been used; but the early Egyptians were familiar not only with lathes and jewel turning tools, but with mechanical tool rests, and sweeping regular arcs in cutting. In addition to the tools mentioned, are to be noticed those for dressing out drilled cores, stone hammering and smoothing, saws with curved blades, mallets, chisels, adzes, and bow drills. For marking and indicating the plane of the stone, red ocher paint was used in a variety of ways, well studied out by Mr. Petrie. Rock excavation, both for saving the stone and for the creation of vaults and chambers, was altogether an affair of drilling. Granite bowlders were utilized in the pyramids, but the best stones were taken from quarries. The method of handling these immense masses is not known. Mr. Petrie concludes with a sensible remark upon the oft alleged inhumanity of the pyramid and temple builders. To require a man every six years to serve upon the public works, during the season when he could do nothing else, would certainly not be a great hardship.—*Science, from Journ. Anthrop. Inst.*, xiii., 88.

THE MAGNETIC STATION AT THE SAINT MAUR PARK OBSERVATORY.

Mascart's Registering Magnetometer.—It is well known that terrestrial and magnetic force frequently undergoes irregular and sudden variations in its direction and intensity, so that observation, even repeated, of the direct reading apparatus is not all-sufficient in times of disturbance. For the continuous registering of magnetic phenomena, Mr. Mascart has called in the aid of photography, the extreme sensitiveness of gelatino-bromide of silver allowing such a result to be obtained in a manner that is at once sure and economical.

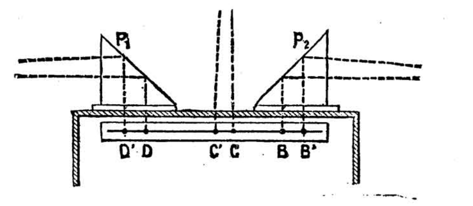


Fig. 3.—THROWING THE IMAGE ON THE SENSITIVE PAPER.

The most widely used registering apparatus is the one known by the name of the "Kew magnetometer," and this, up to recent years, has been almost exclusively employed in those few observatories in which the study of terrestrial magnetism is organized in a complete way.

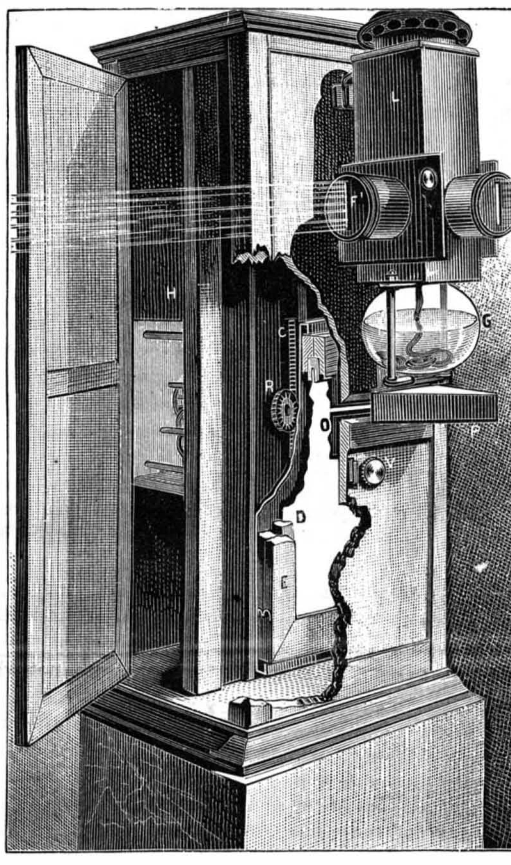


Fig. 2.—THE MAGNETIC REGISTER.

Mr. Mascart, without sacrificing anything to accuracy, which is an absolute condition in so delicate observations, has devised a registering magnetometer in which the cost of the apparatus is considerably reduced, and which permits of a reduction of the magnetic vaults to the least dimensions, of the use of one source of light for the three compasses, and of a registration of all the elements upon the same sheet of paper, thus facilitating a comparison of the different results.

The Mascart registering magnetometer, set up at the Saint Maur Park Observatory, is placed in the easterly vault of the Magnetic Cottage. This vault is rectangular in shape, and is ventilated by three air vents of a structure such as is shown in Fig. 1. As the registering must necessarily be done in darkness, there is arranged vertically before each air vent, outside of the cottage and at about 8 centimeters from the wall, a shutter which, while it allows of the necessary ventilation, proves an obstacle to the entrance of the light. Besides this, black curtains hang freely in the interior, in front of each aperture, and render the darkness of the vault complete.

The general arrangement is shown in Fig. 1. The variation apparatus were constructed by Mr. Carpentier. They are the same as those that serve for direct observation, and which we have already described, and are, like them, fixed on masonry pillars. We shall advert to the fact that these compasses are three in number: the *declinometer*, D, for declination; the *bifilar*, B, for the horizontal component; and the *balance*, C, for the vertical component. Each apparatus is provided with a fixed mirror and with a movable one which follows the deviations of the magnetized bar. In the declinometer and bifilar the front aperture of the case contains a converging lens of a focal length of about 1·10 m. In the balance, this lens is replaced by a suitable curvature of the side of the prism that serves to right the images.

The registering apparatus (H, Fig. 1), properly so called, is represented in detail in Fig. 2. It was constructed by Mr. Duboscq. In order to allow its internal arrangement to be seen, a portion of the front of the clockwork case is removed in the cut. This case is divided lengthwise into two parts by a wooden partition. In the back part there is a clockwork movement, H, with pendulum and weights, and the front part forms a camera obscura for holding the photographic frame, E. This latter slides into a grooved holder, which, through the intermedium of a rack, C, and a ratchet wheel, R, actuated by the clock, is capable of descending its whole length during an interval of twenty-four hours.

The luminous source consists simply of a small gasogen lamp, G. When the combustible liquid is of good quality, and the wick is properly regulated, this lamp will burn with a sufficiently constant intensity for about thirty-six hours, and care being taken to fill it every day at a certain hour, regularity in the light is secured. The flame is situated in the center of a lantern, L, affixed to the side of the case, and provided on each of its three external sides with a metallic mounting carrying a field lens and a vertical slit, F¹, whose width may be modified at will. These mountings may be moved vertically or horizontally for facilitating regulation.

The clock is fixed in such a position that its pendulum swings in a plane parallel with the magnetic meridian. One of the slits allows a luminous ray to reach the declinometer, the second allows one to pass to the bifilar, and the third to the balance.

The system as a whole is so arranged that the luminous images of the slits, after being reflected from the mirrors, are sent to the sensitized paper.

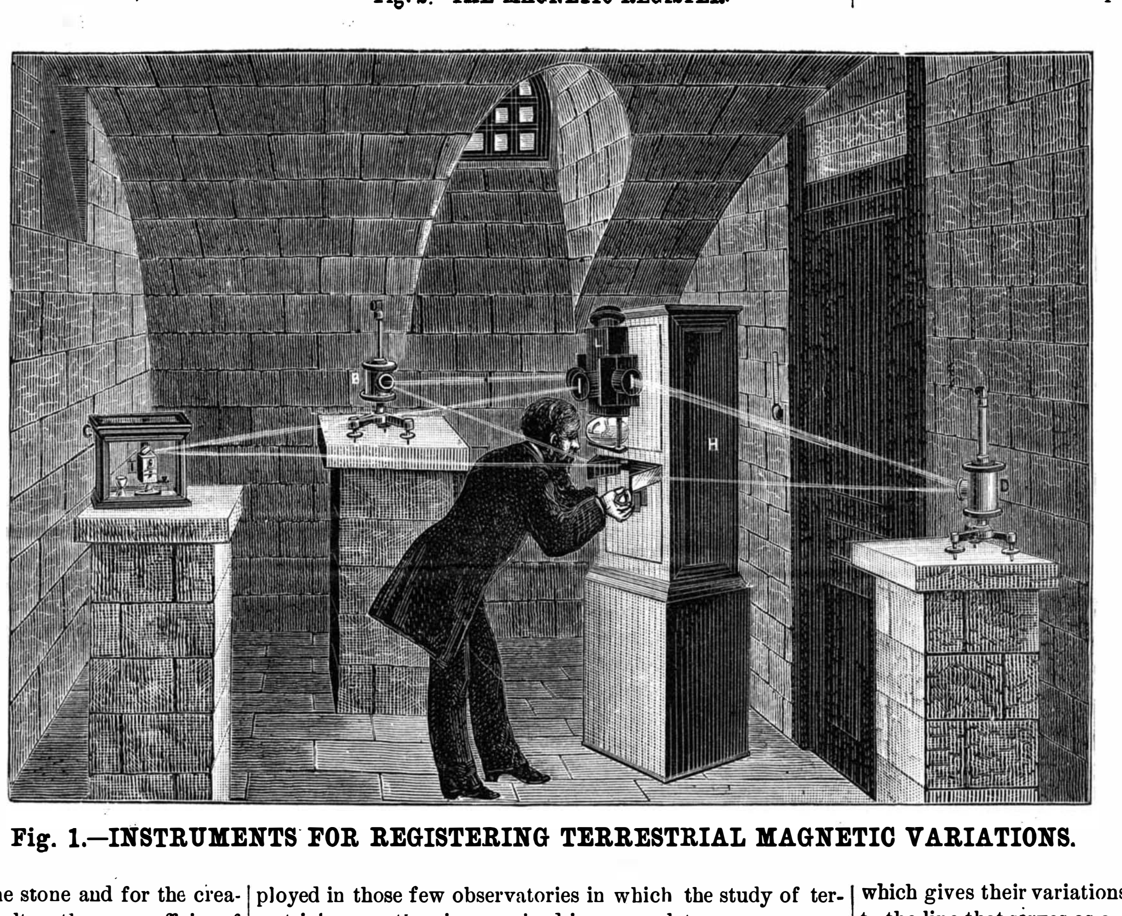


Fig. 1.—INSTRUMENTS FOR REGISTERING TERRESTRIAL MAGNETIC VARIATIONS.

Fig. 3 will give an idea of the arrangement. The reflected rays that proceed from one of the side instruments, the declinometer, for example, fall upon a right angled prism, P^1, which sends them to a narrow window (in the front side of the photographic frame) that may be closed at will by a shutter, O, actuated by an external screw, V (Fig. 2). By a proper regulation of the slit, the two images, D and D^1 Fig. 3), reflected by the fixed and movable mirrors, are made to form sharply upon the sensitized paper. The bifilar gives in the same way, through the prism, P^2, two images, B and B^1, of the corresponding slit. The prisms, P^1 and P^2, each covers a third of the width of the paper. The intermediate third remains free and receives the images, C an C^1, directly from the slit corresponding to the balance—these images having beforehand been refracted by the prism adapted to the apparatus. There are thus obtained on the paper six traces, three of which are datum lines of each of these elements, and the three others so many curves which gives their variations. The distance from one curve to the line that serves as a datum point to it is proportional to the angle that the two mirrors make with each other.

The hour is likewise registered upon the paper. The clockwork movement is so arranged that the paper holder shall descend exactly 1 centimeter per hour, so that the total length of the curves is 24 centimeters. The paper is held in the frame between two plates of glass, one of which (that against which the sensitized surface rests) is transparent, and carries 25 horizontal dashes, separated 1 centimeter apart. These present themselves by turns before the window, intercept the light for a few instants, and produce on the lines the breaks that are noticed in Fig. 4. But the paper is not always replaced at the same minute, and, on another hand, it is never certain that the holder will be raised to the same point. The window, being closed during the few instants necessary for the change of the paper and for the renewal of the lamp, it suffices to note exactly the hour at which it is opened after raising the holder, and to afterward inscribe such hour upon the sheet.

The hour may likewise be marked by a periodical disturbance of the magnetized bars. To do this there is adapted to the clock an electric contact, which closes a circuit for a few instants every hour, at the moment the minute hand is at twelve. This circuit contains a small pile, and the current passes into three bobbins without iron placed near each instrument. There result from this, hourly oscillations of each bar and a temporary disturbance in the corresponding curve.

Finally, there are likewise obtained on the paper the different inscriptions that mark the curves; as, MAGNETISM, *Saint Maur Park, Horizontal Component*, etc. These inscriptions are transparent on the blackened glass that forms the back of the holder. In order to produce them upon the sheet of paper, we begin by covering the sensitized side of the latter, and then expose the frame for a few seconds to the light of a candle. The sensitiveness of the paper is such that this short exposure suffices for a good photographic impression of the inscriptions through the sheet. The frame is taken from the holder every day at noon, and the paper is taken out and replaced by another. Then the frame is put back in place and raised by a cord to the upper part of the dark chamber, where it is held anew by the ratchet-wheel.

The action of the light on the gelatino-bromide of silver paper appears only on developing the proof. The image is revealed by the well-known oxalate of iron process, and is afterward fixed by means of hyposulphite of soda. On coming from the bath the proof exhibits itself as shown in Fig. 4, save that there is no date, this being added by hand after drying. This figure, moreover, is a reduction.

The images being revealed, there remains nothing more to do but translate the curves into numerical values. It is necessary, then, to proceed first to the graduation of the apparatus. For the declinometer, we revolve the case, and consequently the fixed mirror, by a known angle which is indicated by the lower graduated circle; the datum line is thus moved, and the distance of the two images of the mirrors before and after the rotation gives the angular value of the millimeter on the paper. In the same way, on turning the winch to an angle of only 90°, for example, we observe by the displacement of the movable image the influence due to the torsion of the suspending thread, although such influence is very slight.

From these experiments are deduced the angular value that a distance apart of one millimeter represents upon the paper. The object of graduating the two other apparatus is to find out to what fraction of the vertical and of the horizontal component the ordinate of the curve corresponds.

For this purpose we place successively near the declinometer, the bifilar, and the balance, in a special position and at a uniform distance, for five or ten minutes, an auxiliary magnet supported by a comparing rule. The action of this magnet modifies the position of each of the three bars, and produces a sudden movement of the movable image. These separations, which leave their trace on the paper, permit of determining, by calculation, to what fraction of the components one millimeter on the paper corresponds. The sensitiveness of the various apparatus is so regulated that the variations of the different elements shall be always comprised within the limits of the paper. It is by analogous experiments that we measure and verify from time to time the value of one division of the scales of the direct reading apparatus. The ordinates of the three curves give, then, the variations in the three elements, save the corrections of temperature relative to the two latter. Every day, moreover, the results of the registering apparatus are controlled by those that are given by the direct reading variation apparatus.

The Mascart registering magnetometer formed part of the scientific apparatus carried by the French Cape Horn expedition. It is operating at present at the Petit Port Meteorological Observatory, at Nantes, and other stations are taking measures to have it in use before long.

It is to be hoped that the economic features connected with this apparatus, that are well in harmony with the modest sum at the disposal of country observatories, will quickly make the use of it general. A comparison of the results obtained simultaneously at different stations will furnish science with documents, on the importance of which it were useless to dwell, and which up to the present time have been lacking for the study of that so little known portion of the physics of the globe called *terrestrial magnetism*. —*Th. Moureux, in La Nature.*

A HARTFORD, Conn., correspondent, referring to the recent remarkable sunsets, says that they are very common in Norway, where, if very red, they are taken to indicate rain; but if of a lighter hue and clear, the weather thereafter is likely to be fine for many days.

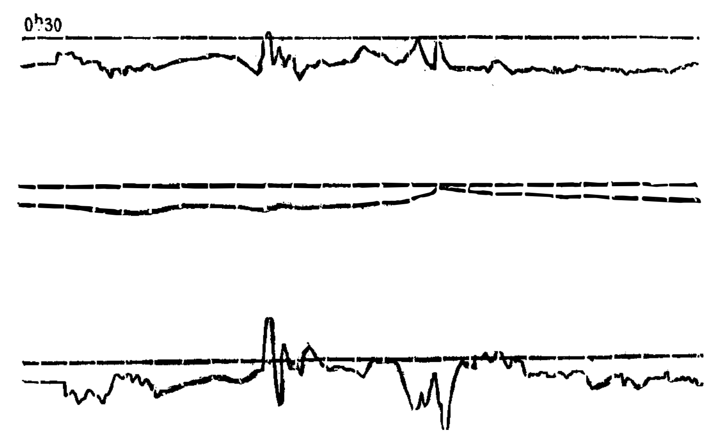


Fig. 4.--SPECIMEN OF THE REGISTERED CURVES.

Ropes vs. Leather Belts for Driving Machinery.

At the October meeting of the New England Cotton Manufacturers' Association reference was made to the adoption, by many English mill owners, of ropes for driving machinery instead of the gearing formerly so largely used, or the belting so universally employed in this country. These ropes are run in V-shaped channels in the pulleys; and for transmitting say 700 horse power, mention was made of twenty of them being run on a wheel 12 feet in diameter, conveying power to wheels 7 feet in diameter, the ropes being 2 inches in diameter after stretching. In favor of this system was urged, first, the very low cost of the rope as compared with good belting; second, its lightness, and the consequent saving in power in running; and third, the convenience with which power could be added by putting on additional ropes to the full extent of the number of grooves on a pulley, with the security, also, of never having to stop the machinery for a break down, as no more than one or two ropes would ever be likely to break at one time.

Notwithstanding these apparent advantages, we do not apprehend there is any danger of rope being substituted for leather belts in any of our factories. The English manufacturers never had a full idea of how well power could be conveyed by leather belting until we taught them.

Ten years ago their large belts were generally made so that there were ridges at the laps, and they could not have that thorough pulley contact necessary to the effective transmission of power; but our belt manufacturers, at the very commencement of the business, made their belts of an even thickness throughout, skiving down the ends, forming the laps to a perfect match. The English manufacturers were for years very incredulous as to the possibility of conveying high powers by belting, as was done in this country, and they used gearing in a much larger ratio than ever we did. But to go from gearing to rope traction seems, indeed, like stepping from one extreme to the other. The ropes used are not supposed to lie in the bottom of the grooves of the pulleys, but are held in and pinched by the crotch which the sides of the grooves form. This makes the transmission of the power a direct pull to force the rope into the groove, which it must as rapidly leave with the rotation of the pulley. The life of a rope thus used, therefore, can in no way compare with that of a good leather belt, which, when properly put up, and of sufficient size for the work required of it, will last almost a lifetime. American belt manufacturers have equipped many factories in England and Scotland and on the Continent of Europe, and we do not believe that any mill owner, either here or there, will ever go from the use of such belts to the employment of ropes for driving machinery.

Reflex Nervous Influence.

It has oftentimes been cast up to physicians, by those who ought to know better, that the mysterious and ill-defined influence of "reflex action," is utilized as a shield to cover ignorance, and as a loophole to crawl through and escape when confronted with a morbid condition, the intimate nature and etiology of which they are unable to fathom.

That some men have availed themselves of this convenient and comprehensive term is undoubtedly true; but that such a thing as reflex action is a reality, and that it is a much more potent etiological factor of disease than is ordinarily believed, is also true.

By reflex action we mean that an impression made upon some nerve termination in one portion of the body is carried along this nerve to a center, and from there reflected, as it were, along some other nerve to a part of the body remote from the point of first impression, at which latter point its power to disorder healthy action is made manifest, while no morbid phenomena are observable at the point from which the irritation has really arisen.

This is a plain definition of "reflex action," devoid of all technical and superfluous words; and that diseased conditions frequently have such origin, no one of experience will deny.

But the general practitioner, we fear, does not take this factor sufficiently into consideration in the formation of his opinion of the cause of disease, and since, therefore, his remedies are directed rather to the effect than to the cause of the effect, he is met oftentimes with failure, when, did he but realize the actual influence of reflex action, and look to the proper point for his cause, and guide his therapeutics accordingly, he would have much better results.—*Med. and Surg. Reporter.*

How to Boil Linseed Oil.

First be sure that you have the pure linseed oil. There is much sold as such manufactured out of peanuts. The test is simple. Nut oil has a sharp, acid taste, smells just like sour peanuts, is darker and thicker than the other oil, has a clinging tendency when rubbed on the finger, dries with a gloss even in priming coats, and is very much given to gumming up when sanded. Pure linseed oil has a bright amber color, runs freely, sparkles when flowing from the can, tastes smooth and mild, and has the smell of a flaxseed poultice. When you are satisfied that you have the genuine oil, and wish to boil it thoroughly, first take, say about one-half pound of red lead and the same quantity of sugar of lead, put into five gallons of the oil, and place over a slow fire so as to boil evenly. Do not let your fire get either too hot or too low; keep an even temperature, if possible; coke or charcoal is preferable to either hard or soft stone coal. Avoid a wood fire, as, after the oil gets to boiling heat, a sudden flame shooting up might ignite the entire lot. Let it boil seven hours full; the red lead and sugar of lead will then become dark brown. Stir all the time while boiling slowly, and only one way; do not change the direction of the stroke or you will burn the oil, just as you would starch. After you have taken it from the fire, cover it up and let it stand to cool off, say over night. The sediment will settle; pour out the oil and strain; your oil is boiled, and a better article you could not have, as all the fatty substances are destroyed. This is the English method, used in all the carriage factories in the United Kingdom.—*U. S. Carriage Monthly.*

Geological Changes at Salt Lake.

Mr. G. K. Gilbert has recently, according to *Science*, given some rather disturbing suggestions to the people of Salt Lake City (Salt Lake *Weekly Tribune*, concerning the probability of destructive earthquakes there. He describes the slow and still continuing growth of the ranges in the Great Basin by repeated dislocation along great fractures, the earth's crust on one side being elevated and tilted into mountain attitude by an upthrust that produces compression and distortion in the rocky mass, until the strain can no longer be borne, and something must give way. Suddenly and violently there is a slipping of one wall of the fissure on the other, far enough to relieve the strain, and this is felt as an earthquake; then follows a long period of quiet, during which the strain is gradually reimposed.

Such a shock occurred in Owen's Valley, along the eastern base of the Sierra Nevada, in 1872, when a fault scarp five to twenty feet ~~high and forty~~ miles long was produced. A scarp thirty or forty feet high is known along the western foot of the Wahsatch Range, south of Salt Lake, and other scarps of similar origin have been found at the bases of many of the Basin ranges. The date of their formation is not known; but it must be comparatively recent, because they are still so little worn away. Wherever they are fresh, and consequently of modern uplift, there is probable safety from earthquakes for ages to come, because a long time is needed for the accumulation of another strain sufficient to cause a slipping of one wall of the fissure on the other.

Conversely, when they are old and worn down, the breaking strain may even now be almost reached, and an earthquake may be expected at any time. This is the case at Salt Lake; for, continuous as are the fault scarps along the base of the Wahsatch, they are absent near the city. From the Warm Springs to Emigration Cañon they have not been found, and the rational explanation of their absence is that a very long time has elapsed since their last renewal. In this period the earth strain has been slowly increasing. Some day it will overcome the friction, lift the mountains a few feet and re-enact on a fearful scale the catastrophe of Owen's Valley.

A California Mirage.

According to the San Francisco *Call*, visitors to the Cliff House on the afternoon of November 12 were repaid by a clear view of the North Farallon, which, from the Cliff House point of view, is absolutely below the horizon. The clearly defined heights, seen as though they were within a dozen miles of shore, were at first thought to be the sail-draped masts of some ocean ship, and when they were identified as the cliffs of the North Farallon, there was great interest displayed by the residents and visitors at the Cliff House. In addition to the well worn marine glasses, a telescope was brought into use, and the unusual sight of islands known to be below the line of the horizon, but plainly pictured in the mist-producing mirage, was regarded with intense interest. The effect, just before the setting of the sun, was as though far out in the ocean some jutting rocks had been utilized for the building of gracefully outlined castles, and when the light disappeared in the cloudless western horizon, and with it the beautiful mirage, the effect was as though the observers had been gazing on "castles in the air." So clear was the atmosphere that the South Farallon, with its light house tower clearly discernible, was seen as long as the already set sun left a golden streak of light in the west. The whole effect was beautiful in the extreme, and so rare that it held enchanted every one who chanced to be where it could be seen, until darkness came and hid all view of the ocean.

Painting Iron.

The value of red lead as a preservative for iron has been generally accepted. Wrought iron requires a hard and elastic paint, which will hold itself together even if the scale beneath gives way. The following experiments, made under the auspices of the Dutch State railroads, may be instructive. Iron plates were prepared for painting as follows: Sixteen plates, pickled in acid (hydrochloric), then neutralized with lime (slaked), rinsed in hot water, and while warm rubbed with oil. The same number of plates were cleared of scale, so far as it could be removed by brushing and scraping. Four plates from each set were then painted alike—namely, four plates with coal tar and four plates with iron oxide A, another set with iron oxide B, and the remaining set with red lead. They were then exposed three years, and the results observed were as follows: The coal tar on the scrubbed plates was quite gone, that put on the pickled plates was inferior to the others. The iron oxide A on the scrubbed plates was inferior to the other two, while on the pickled plate it held well. The oxide B was found superior to that of A, but inferior to red lead, while the plates covered with red lead stood equally well on both prepared plates, and were superior to all others. From these results it is evident that pickling the iron removes all the black oxide, while scrubbing does not. It is also shown that the red lead unites with oil to form a hard, oxy-linseed oil acid soap, a harder soap than that given by any other combination. The red lead is shown by those experiments not to give way under the scaling; it is more adherent to the surface, more elastic and cohesive. On the Cincinnati Southern Railroad, experience extending over some years has shown that red lead has proved the most durable paint in the many miles of iron trestle and bridgework. It is found that the iron oxide is washed away by the rain and perishes in spots, although a valuable paint if frequently renewed. Red lead, on the other hand, is more expensive than iron oxide and is difficult to be obtained pure. It is adulterated with brickdust, colcothar, and other substances, and has lost its high repute.

Referring to white lead as a material for painting iron, one authority observes that "white lead should not, if possible, be used in priming iron, nor in any priming coat; moreover, it is a less desirable overcoat than iron oxide. The class of iron paints compounded of ores of natural iron rust, combined with clay or some other form of silica, are very useful, as they contain no water nor sulphuric acid. Magnetic oxide, or pure iron oxide, is an excellent protection for iron, says one writer; it is impossible to scrape it off. It is also of value in woodwork, and resists the action of salt water and sulphurous gases, so destructive to most paints. There is no doubt the great protective element in paint is the oil, and the conditions required for success are stated to be to prevent the drying part of the oil from becoming hard dry; the soft-keeping, non-drying acids must be kept from flying away in such a quantity as to reduce the oil to a brittle mass. In other words, the elastic qualities of the oil must be protected from the action of the oxygen.

Vegetable Wool, or Silk Cotton.

BY JAMES COLLINS.

Kapoc, or kapok, as it is more usually rendered, is a Malayan word, signifying cotton or a cotton-like substance, *i. e.*, silk cotton; real silk being known as *sutra*. *Kapas* is also used in Malay for cotton or silk cotton, the same vernacular name obtaining in Bengalee and other dialects; but in this latter case the term is restricted to true cotton plants (*Gossypium eps*).

Kapok silk cotton is furnished by the *Eriodendron anfractuosum*, DC., the *Bombax pentandrum* of Linnæus. The plant has been placed in various natural orders, some giving it a place in Bombaceæ, others in Sterculiaceæ or in Malvaceæ.

The tree is from 50 to 60 feet in height, the trunk being prickly at the base and the branches growing out horizontally. There are five to eight leaflets, lanceolate in shape, and either entire in their margins or serrated toward the apex. The capsule, or fruit, is five celled and five valved; the cells contain many seeds, covered with silky or cottony hairs, which form the kapok or vegetable silk. The gum furnished by the tree, when mixed with spices, is used in India in bowel complaints, and the seeds yield a dark colored oil. The tree is of rapid growth, and is lofty and imposing in appearance. It is found in India, the Malayan Archipelago, and in Africa and other countries. In the East generally, kapok is used for stuffing pillows, etc., and for tinder; but it has been found that the smoothness of the fiber prevents cohesion, or "felting," so necessary and important for spinning purposes. In Africa the tree is looked on with veneration, and is termed the "god tree," in some districts it being looked upon as a sacrilege to cut the tree down. Still the trunk is used for forming canoes, and although the wood is soft and liable to the attacks of insects, if soaked in limewater it becomes much more durable. The silk cotton, either alone or mixed with cotton, is largely utilized in Africa. The young leaves are used as food, and form not a bad substitute for "Ochro" (*Hibiscus esculentus*).

Another tree yielding silk cotton in India is the *Cochlospermum gossypium*, DC., the *Bombax gossipinum* of Linnæus; a member of the tea order (Terustrœmiaceæ). It is a tree attaining a height of 50 feet, and the soft silky hairs surrounding the seeds are used for stuffing purposes. The tree has large, conspicuous, yellow flowers, and is not uncommon in Southern India, Travancore, and Coromandel. The *Calotropis gigantea*, or Mudah tree (nat. ord. Asclepiadaceæ), also yields a like substance.

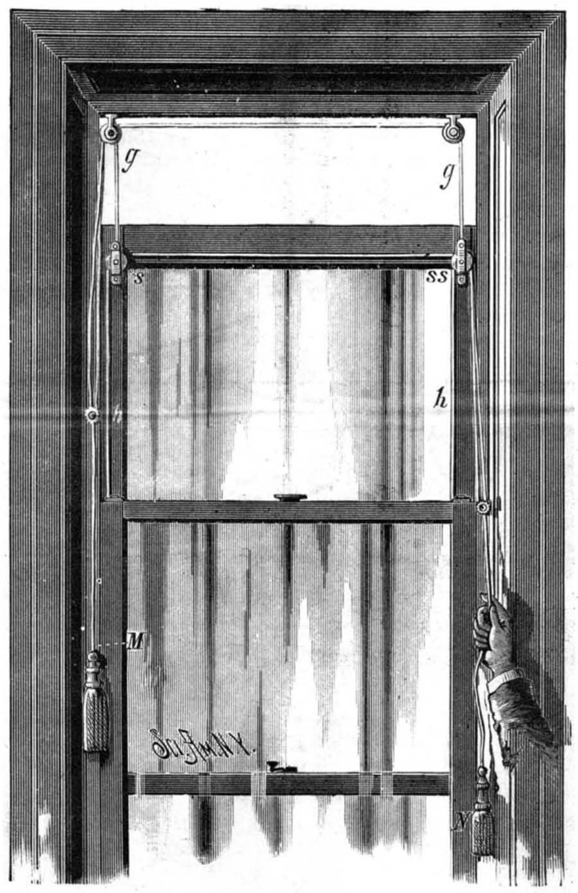
In America, both North and South, various so-called "milk-weeds," as *Asclepias verticillata*, and other plants, such as species of *Bombax*, etc., yield silk cottons, while the *Asclepias syriaca* obtained the attention of European agriculturists as early as 1785, and paper has been made from the cortical fibers of this plant. The young shoots of the plant, too, are said to equal asparagus in flavor.

These are only a few of the plants yielding silk, cotton which might be mentioned. Silk cotton has made its appearance in the markets from time to time, and in 1851 the jurors of the Great Exhibition recommended this substance for stuffing purposes and in mixed fabrics, and notices respecting it have occasionally appeared in this *Journal*. For the lining of quilts, quilted petticoats, etc., silk cotton seems to answer admirably, but its want of cohesion, or non-felting qualities, renders it of no use for spinning purposes, except as a mixture to impart a silky gloss to the fabric so mixed. The price is low, it is light in weight, elastic, and soft, and is said to resist the attacks of insects.—*Journal of the Society of Arts.*

WINDOW SASH ADJUSTER.

The lowering and raising of the upper sash of a window is usually an awkward matter, and in large plate glass windows one of considerable difficulty. Either a pole or a chair must be brought, or else the lower sash is lifted, and the upper one then drawn down or pushed up from the outside.

The accompanying engraving shows a simple and per-



RUSSELL'S WINDOW SASH FASTENER.

manent attachment for adjusting the two sashes, which are balanced in the usual manner by weights in the box-frame.

A double side-pulley, S S, and a single one, S, are screwed to the face of the upper sash, and through these pulleys is reeved a cord, *h*, whose ends are attached to the top rail of the lower sash. A similar cord, *g*, is reeved through a double and a single pulley screwed to the upper portion of the window frame, its ends being attached to the top rail of the upper sash as shown in the figure. The pulling cords, M and N, carrying thimbles at their upper ends hang from the loops of the cords, *g* and *h*.

By pulling down the cord, N, either the upper sash may be lowered or the bottom one raised, as desired. [On holding the *lower* sash by pressure of the hand or a clamp, the cord, N, draws down the upper sash; on holding the *upper* sash by its cord, M, the cord, N, will draw up the lower sash.]

The upper sash is raised and closed by pulling the cord, M; the lower sash is drawn down and closed by the hand, or by a cord not shown in the engraving fastened at one end to its top rail.

This invention has been patented by Mr. S. H. Russell, No. 10 Cedar Street, New York city, from whom further information may be obtained.

Coke for Foundry Purposes.

Coke is being successfully introduced for foundry purposes in New England and elsewhere in preference to anthracite. The advantages claimed for coke over anthracite are: 1. A duty 30 per cent higher than anthracite. 2. A rate of smelting from 30 to 50 per cent higher than that of anthracite. 3. A less powerful blast is needed. 4. The castings are softer.

Affairs at the Patent Office.

[SPECIAL CORRESPONDENCE.]

WASHINGTON, D. C., December 17.

As those applications for patents on which the final fees were paid on the 13th inst. will not be issued until January 1, 1884, all the patents which will be issued in the year 1883 have now been determined upon, and the total issues for the year may be obtained. A calculation shows that during the year 1883 there have been issued 21,196 patents, 167 reissues, 1,020 designs, 902 trade marks, and 906 labels. The total number issued since July, 1836, when the record was first started, is 289,793 patents, 10,418 reissues, 14,465 designs, 10,769 trade marks, and 3,743 labels.

These figures indicate in some degree the immense amount of labor performed by the Patent Office, and the record for the present year shows how rapidly the spirit of invention is increasing.

During the past week the speaking telephone interference cases were heard before the Examiners-in-Chief in Appeals from the decision of the Examiner of Interferences. The occasion was a notable one from the number of distinguished counsel who appeared for the different claimants, among them Mr. Roscoe Conkling.

These interferences were declared in 1878, and they involve not only the art or method broadly of transmitting articulative speech by throwing electrical undulations corresponding to the sonorous vibrations of the spoken words upon a wire, but the various forms of application that had been suggested up to that time for carrying this method into practical operation. Seven parties now lay claim to the merit of this striking invention, viz.: Alexander Graham Bell, J. W. McDonnough, Thos. A. Edison, Elisha Gray, A. E. Dolbear, Francis Blake, and J. H. Irwin. A vast amount of testimony was submitted, and the Examiner of Interferences, after a long delay, announced his opinion last June in a pamphlet of 350 printed pages.

This opinion is an epitome of the case. The first thirty pages are devoted to an examination of the state of the art as described in prior publications. An explanation and construction of the various issues involved occupies the next thirty-five pages, and in two hundred and seventy-one pages following the Examiner traces the history of the invention of each party as disclosed in the testimony. The conclusion is then drawn that Bell is entitled to judgment of priority for the fundamental invention of the telephone as a whole and for the greater part of the particular devices involved in the interference. Mr. McDonnough is, however, adjudged the first inventor of the telephone receiver, which is a constituent and necessary part of any speaking apparatus, and Mr. Edison is awarded a particular form of the water telephone, an instrument now out of use and of very little importance.

While the Examiner enters upon a minute investigation of the facts of the case, he declares that he is controlled to some extent by certain technical presumptions arising upon the face of the papers. These state that he is not entirely clear that Bell had any knowledge, at the time his application was filed, of any practical apparatus for speaking purposes, but that he must assume, as in other cases, that the invention was made at least as early as that time. The Examiner's rulings upon these points, as well as his findings of fact, were arraigned as errors upon the appeal. It was argued before the Board that the controversy should be determined upon its merits, and not upon strained constructions of the issue and technical presumptions at variance with the facts in the case. The hearing was concluded on December 15, and it will probably be some months before the Board will formulate its decision. FRANKLIN.

Wire Fence Telegraphing.

An experimental work has been going on for a short time along the Milwaukee and St. Paul Railroad Branch and the Brandon Branch, about 30 miles in length, the object being to determine whether or not the barbed wire of the fence on either side of the road can be utilized for telegraphic purposes. The fence wire was placed in proper condition for a sufficient distance to make a satisfactory test, the wire being run under the surface at road crossings. Superintendent of Telegraph Simpson decides that the plan is not practicable. Telegraph work can be done over the fence wire at this time, he says, but during the winter months, when huge snow banks completely cover the fence, the line would be made useless. There are thousands of miles of wire fence along the Western lines, and it has been contended that they should be utilized for this purpose.

A New Treatment for Neuralgia.

The latest agent introduced for the relief of neuralgia is a 1 per cent. solution of hyperosmic acid, administered by subcutaneous injection. It has been employed in Billroth's clinic in a few cases. One of the patients had been a martyr to sciatica for years, and had tried innumerable remedies, including the application of electricity no fewer than 200 times, while for a whole year he had adopted vegetarianism. Billroth injected the above remedy between the tuber ischii and trochanter, and within a day or two the pain was greatly relieved, and eventually quite disappeared. It would be rash to conclude too much from these results, in the face of the intractability of neuralgiæ to medication, but if it really prove to be as efficacious as considered, hyperosmic acid will be a therapeutic agent of no mean value. —*Lancet.*

Flour Mill Insurance.

We published a few weeks ago a list of flour mills burned in the United States during October, in which the loss reported upon each mill was $10,000 and upward. From this list we find that there were twelve mills burned, with a loss of $265,000 in all, not speaking of the lesser cases, which foot up probably $15,000, making in all a loss of about $280,000. If we multiply this by twelve for the entire year, it would make a grand total of $3,420,000; but October would not be the proper month to average from, for reasons which will be recognized by millers themselves. Not one of those fires originated from any cause other than might have occurred in any large business, and taking the number of mills in the country, and the large amount of capital invested, this loss is low compared with other businesses of like proportions.

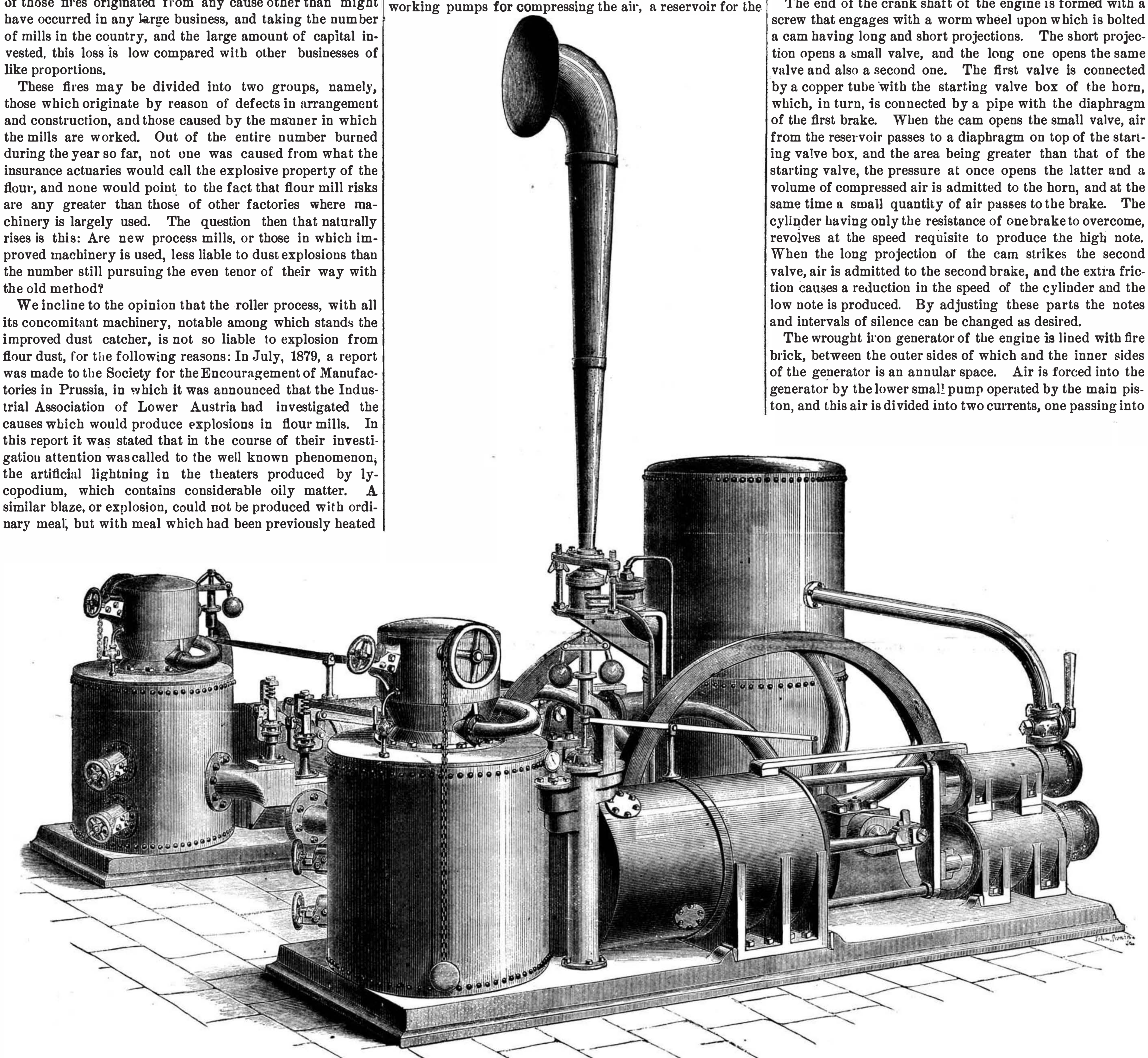
These fires may be divided into two groups, namely, those which originate by reason of defects in arrangement and construction, and those caused by the manner in which the mills are worked. Out of the entire number burned during the year so far, not one was caused from what the insurance actuaries would call the explosive property of the flour, and none would point to the fact that flour mill risks are any greater than those of other factories where machinery is largely used. The question then that naturally rises is this: Are new process mills, or those in which improved machinery is used, less liable to dust explosions than the number still pursuing the even tenor of their way with the old method?

We incline to the opinion that the roller process, with all its concomitant machinery, notable among which stands the improved dust catcher, is not so liable to explosion from flour dust, for the following reasons: In July, 1879, a report was made to the Society for the Encouragement of Manufactories in Prussia, in which it was announced that the Industrial Association of Lower Austria had investigated the causes which would produce explosions in flour mills. In this report it was stated that in the course of their investigation attention was called to the well known phenomenon, the artificial lightning in the theaters produced by lycopodium, which contains considerable oily matter. A similar blaze, or explosion, could not be produced with ordinary meal, but with meal which had been previously heated up to 30° C. the phenomenon would result precisely as with lycopodium.

It was probable that in the mills the meal was heated, and in consequence much more easily ignited. The report gives as a reason why explosions were so few in former times, that the millers used to wet the grain, whereas it was not the case in these times. If the chemical constituents of meal are considered, the question assumes an entirely different aspect. All cereals, with the exception of buckwheat, contain a certain quantity of oily matter; for example, of a thousand parts of flour 18·50 are oleaginous; of rye, 21·09; barley, 26·31; oats, 39·00, and of corn as much as 48·37. These figures are taken from the work of Moleschoot on "Chemistry of Food." The presence of this oleaginous ingredient accounts for the explosive property of flour and meal. The grain having been crushed between the burrs under heavy pressure and a great amount of friction, a great deal of heat must necessarily be engendered by the operation, and a large quantity of moisture containing this oil is set free, and a spark from a stone or the flame of a lamp is sufficient to ignite at once the oil distributed among the fine particles of dust and flour, and an explosion takes place. At present time, by the roller system, no oil is lost from overheating, very little dust is made, and that which is made is taken charge of by the dust collector, and kept "out of harm's way." There is a great deal of difference in the fire risk on flour mills now, compared with a few years ago, and a careful investigation will show, we believe, the possibility of materially reducing rates, except perhaps in cases where these establishments are grouped together in considable numbers.—*Milling World.*

FOG SIGNAL APPARATUS.

The fog signal apparatus shown in the annexed engraving consists of one pair of "Buckett" caloric engines working pumps for compressing the air, a reservoir for the compressed air, automatic gearing for opening the valves at given times and sounding the signal, and Prof. F. H. Holmes' patent double note "Siren" fog horn. The apparatus herewith illustrated is for light ship or signal station use when it can be placed near the engines, but when it is necessary to separate them, other means are adopted for operating the horn automatically.



FOG SIGNAL APPARATUS

The siren produces its powerful sound, which in calm weather may be heard twenty miles, by means of two slotted cylinders, one fixed and the other revolving within it. The slots, as they pass one another, stop, or cut off, the passage of compressed air or steam, and thus cause a series of vibrations and, consequently, a musical note, the pitch of which depends upon the speed of the revolving cylinder. In order to vary the note it is only necessary to control this velocity.

The double note horn is formed with a casing within which is a fixed slotted cylinder and a revolving cylinder moving upon a spindle. The slots are formed in each cylinder at opposite inclined angles, so that the motive fluid impinging against a number of inclined planes causes the inner cylinder to revolve with great rapidity. As this cylinder revolves it carries with it two disks, attached to the common spindle, and upon their peripheries are pressed levers under the action of small pistons operated by diaphragms to the outer surface of which compressed air is admitted. When the high note is required only one brake is put on, but for the low note both brakes are on, thereby reducing the speed of the revolving cylinder. While the notes are being sounded the pressure of air in the reservoir diminishes; but as the air for operating the diaphragms comes from the same source, the force on the brakes decreases in the same ratio, and the friction on the disks being reduced, the cylinder continues to revolve at a uniform speed, and the pitch of the note is constant.

The end of the crank shaft of the engine is formed with a screw that engages with a worm wheel upon which is bolted a cam having long and short projections. The short projection opens a small valve, and the long one opens the same valve and also a second one. The first valve is connected by a copper tube with the starting valve box of the horn, which, in turn, is connected by a pipe with the diaphragm of the first brake. When the cam opens the small valve, air from the reservoir passes to a diaphragm on top of the starting valve box, and the area being greater than that of the starting valve, the pressure at once opens the latter and a volume of compressed air is admitted to the horn, and at the same time a small quantity of air passes to the brake. The cylinder having only the resistance of one brake to overcome, revolves at the speed requisite to produce the high note. When the long projection of the cam strikes the second valve, air is admitted to the second brake, and the extra friction causes a reduction in the speed of the cylinder and the low note is produced. By adjusting these parts the notes and intervals of silence can be changed as desired.

The wrought iron generator of the engine is lined with fire brick, between the outer sides of which and the inner sides of the generator is an annular space. Air is forced into the generator by the lower small pump operated by the main piston, and this air is divided into two currents, one passing into the annular space referred to, whence it descends beneath the fire bars and so through the fire; the other passing into the upper part of the generator, above the fire, where its oxygen enters into instantaneous combustion with the carbonic oxide formed by the air which has passed through the fire. The intense heat causes expansion, and a valve allows a portion of the gas to enter the cylinder and actuate the piston, giving motion to the engine, as shown in the engraving. The upper small pump supplies air to the reservoir for operating the siren. For the engraving and for the description from which the above notes were taken we are indebted to *The Engineer*, of London.

Greenport Harbor.

A correspondent writing from Greenport, N. Y., dissents from our statement, in the SCIENTIFIC AMERICAN of December 8, that there were no good harbors in Long Island Sound west of New London, and adds that the harbor of Greenport is of sufficient depth to accommodate the Great Eastern. He also says an effort is being made to obtain a Congressional appropriation for building a breakwater there, which would render the harbor a spacious and convenient harbor of refuge for all vessels passing through Long Island Sound.

THE NEEDLE FISH, SEA HORSES, AND RAG FISH.

The needle fish (*Syngathus acus*) is an extremely slender fish, which sometimes reaches a length of sixty centimeters. Its color is pale brown with dark brown transverse bands. This fish is found on all the eastern coasts of the Atlantic Ocean from Northern Europe to the promontory of the Cape of Good Hope, also in the Mediterranean and Black Seas. Their favorite dwelling places are in the submarine meadows and sea marshes, where the long-leaved sea grass grows luxuriantly. Here they may be seen between these sea weeds, often clinging together in a mass, and in various positions, some with the head upward, others with the head directed downward, some in a horizontal position, and all slowly swimming forward.

The breast and caudal fins are very small, and the curious dorsal fin seems to be the only one that is of any use as an organ of motion. Their food consists of thin shelled crabs, worms, etc.

The manner of propagation was discovered by Erdstrom. The male has a furrow beginning at the tail and running about two-thirds the length of the body; the side walls are a little curved. This furrow is closed by two valves, lying with the edges close to each other. In fall and winter these valves are thin, and fall together in the furrow, but in April, when the spawning season approaches, they enlarge and the sac is filled with mucus. In May the female lays her eggs in the furrow, in a row, the edges close, and the embryo fish remain in it until the end of July. In case of danger the young fish are taken into the furrow.

The flesh of this fish is hard and firm, and agreeable to the taste. In some places the fish are salted.

The sea horse (*Hippocampus antiquorum*) resembles greatly the animal from which it takes its name. Its length is from fifteen to eighteen centimeters. Its color is a pale ashen brown, which in certain lights changes into blue and greenish tints.

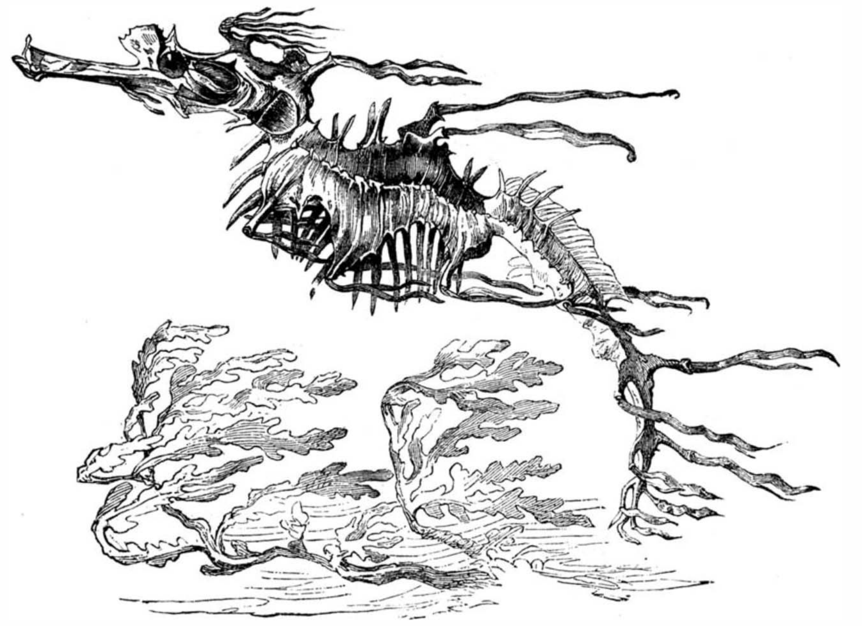
From the Mediterranean Sea, which is regarded as the true home of the sea horse, it extends in the Atlantic Ocean to the Bay of Biscay, and yet farther north to the shores of Great Britain. Like the needle fish it is only found where the bottom of the sea is covered with a rich growth of plants, for between these plants it seeks and finds its food. Here it may be seen sitting upon the plants almost motionless. Lukis, who has observed their manner of life in captivity, gives a good description of them. He writes: "When swimming they hold themselves in a perpendicular position. They wind their tail around the sea grass, and look carefully around in the water in search of food, rushing after it with great dexterity as soon as perceived. The sea horse, like the chameleon, has the power of moving either eye at will, independently of the other, and this in connection with its changing color makes it a very interesting object to the spectator. Their food consists mainly of very small crabs, invisible to the naked eye, which they pluck off from the leaves of the sea plants. This food can only be obtained for them in sufficient quantity if one lives by the sea, otherwise they die sooner or later from starvation. A good many of them die soon after being caught, and if a thunder shower rises they often all die with one clap."

Propagation takes place in the same way as with the needle fish. Gessner says "Its flesh is poisonous, and induces dangerous illness." It is probable that the ancients had a practical knowledge of this. Gessner writes further that "the flesh dried and pulverized, and taken as a medicine, is a wonderful help to those bitten by a mad dog. A powder of this dried flesh will also alleviate side ache."

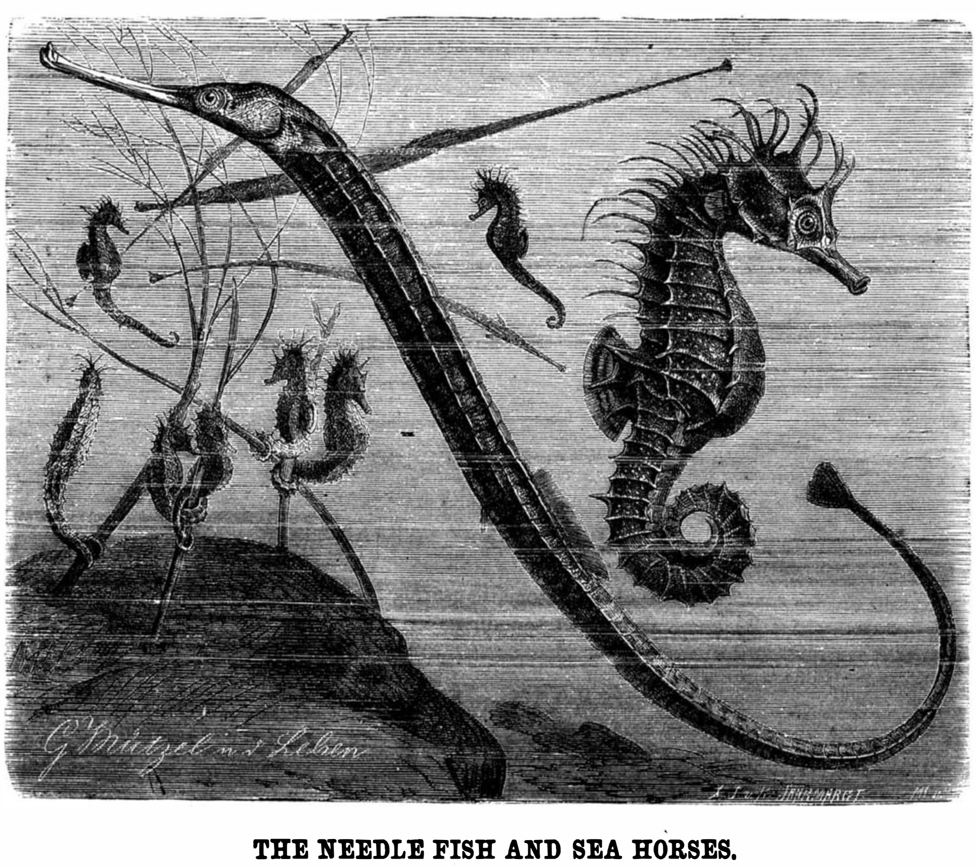
In the sea about New Holland there is found a species of fish resembling the sea horse, which we will call the rag fish. They are distinguished by an abundance of thorny points, and ribbon-like appendages, hanging down from all sides of the body, like rags from a garment. The dorsal fin is exclusively upon the tail. The short thorns are strong and pointed, the ribbon-like continuation inflexible, the remaining appendages thin and flexible. The fins, with the exception of the dorsal fin, and the small pectoral fins appear to be stunted, and their place supplied by these appendages, by means of which it attaches itself to the sea plants. Its color when living is red, but when dried it is leather color.

Its habits are not known, but probably they are the same as the other sea horses.—*From Brehm's Animal Life.*

THE Missouri River, which forms a new bed for itself somewhere with every freshet, is threatening to make Leavenworth an insular city.



THE RAG FISH.



THE NEEDLE FISH AND SEA HORSES.

Riveted Joints.

The literature of the strength of riveted joints is already extensive; we have no intention of augmenting it. What we are about to say concerning them at present bears relation to workmanship, and not to proportions. No doubt workmanship affects the strength of structures joined by means of rivets; but the fact is not taken too much note of by those who carry out experiments and tabulate results for the benefit of engineers. It is very commonly assumed that a riveted joint is a riveted joint, and that suffices. As a matter of fact, however, there are wide differences in the qualities of riveted joints, and more attention should be paid than is paid to the circumstance. Thus it is very commonly assumed that a single riveted joint properly proportioned has a strength of 56 per cent of that of the solid plate.

We have ourselves seen machine riveted seams tested, which broke with less than 30 per cent of the strength of the plate, albeit that externally the seam was to all appearance a good and well made seam; and we believe that in practice seams with a strength equal to that given for them in text books such as Fairbairn's are rarely met with except in the very best class of work. Attention has been called to the subject by more than one correspondent; and the discussion now being carried on in our correspondence columns by practical men may be expected to elicit some information which will usefully supplement that acquired with the testing machine. Our purpose in writing this article is to direct the discussion in question, and to call to the minds of our readers those points which most deserve consideration. Riveted work may be classed under three heads: First, work such as suffices for bridges and girders, the joints of which need not be water or steam tight; second, a superior kind of riveting, such as that employed in iron ship building; and third, boiler riveting, which ought to be as good as possible.

Now as regards the first, there appears to be a general consensus of opinion that nothing can be better for it than the hydraulic riveter, but it does not appear that the machine can be used with sufficient facility in the actual erection of iron structures to enable hand riveting to be wholly dispensed with. No doubt many of our readers have used the hydraulic system, and can tell exactly what percentage of work can be done under it, and what percentage must be done by hand; and to simplify matters, and so keep discussion as useful as possible, we would suggest that a typical bridge be had in mind—let us say a railway bridge, with one span of 180 feet, and two spans of 75 feet each, plain lattice girders, the larger 16 feet deep and the shorter 7 feet, the whole to be floored with flat iron plates, the rails to be carried on longitudinal timbers supported by cross girders.

What proportion of machine riveting is possible on such a bridge, if put up in England, say, ten miles from a town? Concerning ship work there can be no doubt that the use of the machine system is rapidly extending, and there is now hardly a hole or corner in a ship's hull into which the machine will not find its way. Dispatch is the great object had in view in this class of work; but no one has yet supplied much information concerning the places where hand riveting can be done as well and more quickly than machine riveting. It seems to be tolerably plain that such do exist, and that there are places where a couple or three men can begin and finish a seam of rivets in the time that would be occupied in fixing a machine in place. No doubt there will be differences of opinion on this point—the advocates of machine riveting holding one thesis, and the supporters of the old system another. It is more than probable that the truth lies between the two. The results of practical experience can alone be relied on to settle the point.

When we come to deal with boilers we get on very delicate ground. It is not to be denied that many men who are very particular about the workmanship of their boilers will not have machine riveting at any price. They rely entirely on skilled labor, and no doubt a thoroughly well made locomotive boiler is the most beautiful and perfect specimen of hand riveted work that can be had. Such boilers as made in this country require no calking. The workmanship is exquisite, and one result is that the strength in the seams in locomotive boilers is often in excess of that laid down in text books, the 75 per cent for a double riveted seam rising to as much as 78 per cent, or a little more. It is urged that machine riveting cannot produce such results; it is far too inflexible; it takes no account of the heat of a rivet, or its quality, whereas an experienced man knows exactly what to do with a rivet, and feels his way, so to speak, along a seam in a way that the machine cannot do.

As bearing on this point, we may say that cold riveting has been extensively practiced in the United States. The high pressure boilers used on the muddy rivers consist of wrought iron tubes, seldom more than 3 feet in diameter, $\frac{3}{8}$ inch thick, and about 30 feet long. These are arranged side by side, with a large furnace at one end, and in many cases a flash flue running straight to the chimney. Such boilers will work with water far too dirty to be used in a tubular boiler. They carry pressures of about 150 pounds, and the seams are made up with cold rivets of a peculiarly soft and ductile iron. It is said that these joints stand far better than any hot riveted joint that could be made, and we have no reason to doubt that this is true of the very thin plates used. Going to the other end of the scale, we have the modern marine boiler, with plates $1\frac{1}{8}$ inch thick and rivets $1\frac{1}{4}$ inch. It is asserted by one party that such rivets cannot be closed by hand in a satisfactory fashion, and that the aid of machinery must be called in; but, on the other side, it is pointed out that boiler fronts have always to be put in by hand, and that this hand riveting is quite as good as the machine work, and it is also contended that machine riveting is so far from securing tightness that every rivet head has to be calked inside the boiler, to make certain that it will not leak.

Many able engineers hold views entirely opposed to these, and assert that the best kind of boiler work cannot be produced at all without the aid of machinery. The arguments they urge in favor of machine riveting, as a matter of workmanship, are that it compels the rivets to fill the holes, and effectively closes the plates on each other. The arguments against it are that split heads are apt to be produced, and that the rivets not only fill the holes, but now and then burst the plate; and that in most cases, unless unusual care and vigilance are employed, the iron will be severely strained, and a bad instead of a good boiler produced. On none of the points we have stated as open to discussion do we express any opinion; that diverse views are held by experienced practical men is, however, indisputable, and we must beg our readers, no matter which side they take, to bear in mind that there is another side, and that impartial men will like to hear both before arriving at a conclusion.—*The Engineer.*

ENGINEERING INVENTIONS.

A cable grip apparatus has been patented by Messrs. Henry Dods and Frank Hindes, of Virginia City, Nev. It has a compensating spring device to relieve the shocks of gripping the cable, and prevent the slipping of the grip on the cable; also a specially devised frame, bed plate, and slide, enabling the clutch to be so worked as not to injure the cable.

A car coupling has been patented by Mr. Timothy C. O'Donovan, of Walker's Mills, Pa. It consists in a combination with a drawhead having a flattened cross rod of a coupling link with a transverse groove, and an enlargement for receiving the cross rod of the drawhead, which link can be swung so that its hook can catch on the cross rod of the opposite drawhead, whereby the cars will be coupled.

A mine railroad has been patented by Mr. John G. Thompson, of Cuba, Ill. In an inclined or sloping road for working cars in opposite directions at the same time by a rope doubled around a drum at the upper end of the road, the road being single track with a turnout, the rope is so arranged within the single track, and branching into and along the turnouts, that the switches work automatically, and the cars cross the rope without obstruction or delay.

An improved gauge cock has been patented by Mr. Michael J. Fitzgerald, of Fort Wingate, N. M. In combination with the stock and main and transverse passage, the plug has a weighted lever, and both of its passages are so made as to be entirely shut off from the passages of the stock in its closed position; the weighted lever can always be relied upon for keeping the cock closed except when purposely opened to test the water in the boiler.

MECHANICAL INVENTIONS.

An insertible saw tooth of improved form has been patented by Mr. William B. Risdon, of Trenton, N. J. The tooth is made with a toe, a perforation, and a slit at its heel to adapt it to be secured in a saw plate with a shoulder and a recess at the rear end by a rivet wholly within the tooth, thus putting no strain upon the plate, and in no way affecting its trueness.

A bolt header has been patented by Mr. Benjamin McKillen, of Verona Mills, Mich. It is a tool with handled and pivoted die jaws, having rabbet grooves in the lower side to be secured between and on the jaws of a vise. The tool affords great facility for making well defined angles to square shanks, and may also serve as a holder for rods of different kinds of work for setting and truing the parts.

An improved mechanical movement has been patented by Mr. Francis W. Goodyear, of Springfield, Mass. It is intended to make reciprocating motion more readily convertible into rotary, and is applied in a simple manner to various hand and foot power machines. There is a ratchet action in which no springs are used, and the whole movement is practically noiseless.

An improved piano pedal stool has been patented by Mr. William Winter, of Albany, N. Y. The invention consists in a stool provided with foot levers connected by connecting rods and elbow levers pivoted on a bar of the stool and adapted to operate the pedal levers of a piano or like instrument. The stool is provided with devices for easy and rapid attachment to the instrument or pedal lyre. The angle levers are provided with pads to protect the pedal levers from being injured.

An apparatus for dyeing with hydrocarbons has been patented by Mr. Eugen Rau, of Hartford, Conn. It is a dry dyeing machine with an apparatus for saturating the previously dried fabric in a color dissolved in benzine and oil; it has a wringer for taking out surplus color, and a drying chamber, from whence the fabric is conveyed between endless blankets through a highly heated finishing chamber where it is subjected to steam pressure, the whole in one continuous operation, and with no waste of color.

A gas valve for ice machines has been patented by Mr. Richard Thoens, of New Orleans, La. It is designed for the minute regulation of the flow of gas, being especially intended for use in connection with ice machines in which ammonia gas is used. The valve stem is packed by rubber washers, between which is a metal washer, and these washers are clamped between metal rings with beveled surfaces, the rubber washers spreading to close tightly against the stem and the inner surface of the valve body.

An improvement in saw mills has been patented by Mr. Walter P. Scofield, of Hawthorn, Fla. It consists in a contrivance of belt shifting devices, whereby a trip block on the log carriage will automatically shift the belt from the loose to the tight pulley of the feed shaft, to rotate the latter only when the log setting apparatus is to be operated; the driving shaft is supported steadily its whole length by pivoted bearings, and there is a locking device for the connecting rods of the oppositely acting friction wheels of the setting apparatus to lock the wheels out of contact with the set works drive wheel.

AGRICULTURAL INVENTIONS.

A cultivator has been patented by Mr. Charles D. Reed, of Polo, Ill. According to this invention, as the standards and plows are moved laterally a bar keeps the couplings parallel, so that the shovels will always be held at the desired angle with the line of draught, thus always doing good work, however they may be moved laterally.

A corn planting attachment for plows has been patented by Mr. Philip Dougherty, of Fort Dodge, Iowa. A jointed spout can be so adjusted to the depth of the intended furrow and the width of the furrow slice that the seed may be dropped in the outer part of the previous furrow and will be covered by the furrow slice, the seed being dropped as the plow is drawn forward.

A corn planter has been patented by Mr. William P. Lanham, of Star, Mo. The seed dropping slides are operated by the revolution of the drive wheels, and are so arranged and held in place that they will drop more or less seed as required. A pawl carrying wheel has adjustable slides and arms to engage with crank arms of markers, and held up by springs, so that markers are forced down to mark the soil by the revolution of the drive wheels.

A cotton, corn, and tobacco fender for raising the leaves of plants while soil is being thrown around the stalks by the plow, has been patented by Messrs. M. F. Duncan and R. E. Coyle, of May's Lick, Ky. The fender is constructed in combination with the plow beam, with its forward end pointed and curved slightly inward and its rear end curved outward and upward, so that as the plow is drawn forward the fender raises the leaves of the plants.

Mr. Obadiah Wilson, of Plainville, N. Y., has obtained a patent for an improved method of conveying tobacco from the field and depositing it in the drying house. The invention consists in a truck with four wheels and provided with a removable rack upon which the plants are placed after they have been cut. They are then transferred to the drying house and the rack is removed bodily from the truck, which obviates the necessity of rehandling the plants, saving time and labor, and lessening injury to the crop from handling.

MISCELLANEOUS INVENTIONS.

An improved suspender end has been patented by Mr. Jacob Katzenberg, of New York city. It is composed of colored braid with a lining of chamois leather and an interposed piece of cloth, the ends being thus made more durable and less liable to stretch out of shape, while the braid is kept out of contact with the shirt of the wearer.

An improved fire escape has been patented by Mr. John Schmittknecht, of New York city. It provides for a shaft let into the wall of a building, or placed against the same, the shaft having ladder rounds, and being provided at its upper end with a skylight, so protected with bars or grating as to prevent clandestine entrance.

A combined register and ventilator has been patented by Mr. William H. Maxfield, of Maysville, Ind. It consists in a special construction and combination of parts whereby the whole is made to present an ornamental appearance, great facility is afforded for removing and cleaning the interior, and it may be readily operated from opposite ends of its air box.

An automatic vehicle brake has been patented by Mr. Richard R. Pace, of Lineville, Ala. The invention consists in levers pivoted on thills held to the front axle by shackles, the levers carrying brake shoes at the outer ends, and having the outer ends connected with the thills by extensible braces. The brake can be so locked as to be made inoperative when desired.

An improved window cornice, that is convenient and readily adjustable, has been patented by Mr. Michael Leuz, of New York city. The center piece has grooves and stop blocks, and there are sliding end pieces with end T-bars and set screws, the combination being such that the whole is strongly made and readily fitted to the place desired.

Letters patent have been granted to Mr. William A. Whitney, of Hudson, Mich., for an improved wheelbarrow in which the legs and braces are, by a combination of bolts and metal devices, connected rigidly and closely to the handles, so that the wheel barrow frame will be very strong, and can easily be taken apart and put together again.

A vegetable grinder and slicker has been patented by Mr. Edward Schmitz, of Winsted, Conn. A grating cylinder, which may be changed for a cutting cylinder, is devised so as to be suitably revolved in a sort of hopper, whereby the grinding, grating, or cutting of cabbages, potatoes, and other vegetables may be readily accomplished, for domestic use or for feeding cattle.

An improved hot blast stove for blast furnaces has been patented by Mr. Charles Alger, of Hudson, N. Y. The invention consists in the peculiar construction of the air heating pipes, which can be made of wrought iron if desired, and are faced inside and outside with firebricks, those inside being made of different widths, so as to form a rough inner surface.

A washing machine or improved washboard has been patented by Mr. A. E. Kiel, of Montrose, Iowa. The board has three roll sets, each set consisting of a ribbed, a smooth, and a corrugated roll, the rollers not to be in contact but as close as possible without touching, and the grooved rollers being of greater diameter than the plain ones, the whole to shorten the time and lessen the labor of washing.

An improved grain weigher and measure has been patented by Mr. James E. Kemble, of Vicksburg, Mich. By a combination of valves in a circular case, inside of which is another circular case, suitably pivoted and divided by partitions, one loaded side falls to discharge a weighed load, while the light side rises to be filled, the weigh bar being provided with a weight which can be secured in any position to adjust the measure to weighing regularly any desired quantity.

A razor guard has been patented by Mr. James P. Tryner, of Denver, Colo. It is formed of a strip with a forked arm at each end, in the ends of the prongs of which rollers are journaled, one being slightly above and the other slightly below the cutting edge of the blade; one of the prongs has a check plate, and on the upper surface of the strip is a spring for pressing the blade upward, the whole to prevent the razor from cutting the person using it.

An improved measure for measuring grain, vegetables, etc., has been patented by Mr. William A. Carpenter, of Bankers, Mich. In a metal cylinder having its top and bottom edges turned over wire rings, a wooden ring surrounds the upper part of the cylinder, and a wooden bottom rests upon a bottom flange made by turning the edge of the cylinder over a wire, the whole making a measure simple in construction yet strong and durable.

A combined vault cover and ventilator has been patented by Mr. T. W. Langill, of New York city. The casing has a grate at its upper end and a water receiving channel plate at the lower end, the cover resting upon the inner flange of the channel plate, and provided with a sliding rod, a connecting bar, and a lever, whereby the water received upon the cover will flow into the channel plate, and the cover can be readily raised and lowered.

An improved bottling device has been patented by Mr. Alfred Rigny, of New York city. In a tube open at both ends, the upper part carries a lateral supply pipe, and there is a valve at the lower end, operated by a rod through the tube. The tube is calculated to occupy the exact space required to be left empty for corking the bottle, and it can be readily moved from one bottle to another without any waste of liquid.

An improved fifth wheel for wagons has been patented by Mr. Thomas Evans, of Gravesend, N. Y. It is formed of two circular channel plates with interlapping flanges and corresponding central depression and wearing surface, in combination with a circular skeleton frame with conical rollers journaled in its rims. By this means the friction between the upper and lower parts of the fifth wheel is greatly reduced, and the turning of the wagon is made much easier.

A bee hive of new and improved construction has been patented by Mr. Edward Meyer, of Hallettsville, Texas. The bees can, in this hive, be fed and watered very conveniently, a peculiarly made water tank being attached; the honey can be removed without permitting the bees to escape, and there is no danger of being injured by the bees while removing the combs, while the arrangement is such that none of the enemies of the bee can enter the hive.

A rotary leader link for fishing lines forms the subject of a patent which has been issued to Mr. Earl Ludwig Bollermann, of New York city. It is for hand lines, with a weight or sinker at the end which goes into the water, and is so arranged that, when the fisherman throws out his line, the snells with their hooks will not become tangled up with or wrapped about the line, but will fall in their proper places, no matter how much the line may be twisted.

Mr. Morris H. Marcus, of Edenburg, Pa., has patented an improved sample dummy. The invention consists in a dummy for cloth or rolled goods, made of wood or other suitable material, with its body of the required shape of the roll of goods to be represented, and having reduced ends, on which are secured and mounted pieces of selvage till a bulk is obtained equal to that of the body of the dummy. This is covered by a piece of the goods, thus representing a solid roll of cloth which is specially adapted for window show.

A folding cot of improved construction for use in hotels and hospitals has been patented by Emily F. Vance, of Gallipolis, Ohio. Two pairs of legs are united at the upper ends by longitudinal rails, the legs being crossed and pivoted in the usual way. A quilted bottom or sheet is lined and partly stuffed with cotton batting, and a pillow is provided at each end, which can be removed very easily and readily. The cot requires no mattress, and can be folded compactly.

A cap for receiving the fulminate for firing explosives in blasting rock, etc., has been patented by Mr. George Freund, of Durango, Colo. A metal tube is threaded internally and externally to within a short distance from the lower end, where a suitable fulminate is placed and the lower end closed by a cap. A threaded cap with a conducting wire is screwed on the upper end, or a fuse is then inserted. The tube can be screwed in a giant candle of explosive material, the flange fitting on the upper end of the candle.

A feed governor for cotton gins has been patented by Mr. Henry P. Schaefer, of Schulenberg, Tex. Most gin saws now suck or draw in the cotton fastest at the central part of the saw shaft, drawing the cotton from the edges of the feed board toward the center. By this improvement a thinner layer of cotton is fed at the center, the suction of the central saws drawing in from the thicker edges such portion as will make the whole supply to the gin saws even and regular and prevent all choking.

A new process of and apparatus for distillation has been patented by Mr. James G. Pontefract, of Pittsburg, Pa. The heat is applied from direct fire, steam jacket, or steam coil, and the fermented mash, beer, etc., are agitated during the distilling process in such manner as to prevent lees or solid particles from adhering to the side or bottom of the still and thus burning or scorching, this being accomplished by causing a stream of the liquid being distilled to be constantly withdrawn and forcibly injected back into the still while in operation.

A machine for wetting paper has been patented by Mr. John W. Morrison, of Omaha, Neb. The quires are fed to feed rollers, from whence they are taken by fingers so adjusted that only the under side of the paper may be wetted in a water tank, or the whole may be submerged, as desired, and thence the paper is conveyed out through other rolls to a receiving table, the whole being done as fast as the operator can feed the paper, and so each quire will receive just the same amount of water, according to the gauge at which the machine is set.

An improved washing machine has been patented by Mr. E. W. Bush, of Armstrong, Mo. The object of the invention is to produce such a combination of parts as will facilitate the application of rubbing devices to an ordinary wash tub. There is a false bottom, below which the dirty water collects, and the false bottom being provided with radial ribs, the clothes to be washed are spread on the false bottom, and a disk is rocked to and fro over them in a horizontal plane by means of a suitable handle. The machine can be readily adapted to or easily removed from any tub.

A tobacco moistening tray has been patented by Mr. Charles N. Swift, of New York city. A shallow tray with perforated cover carries a sheet of bibulous material in such a way that a single supply of water will last considerable time, and the tray requires but little attention, so being well adapted to place in show cases, etc., where the cigar boxes may be arranged upon it. The same inventor has also obtained a patent for a moistening pad of some bibulous substance covered by a perforated plate, and supported on a plate folded at the edges over both the bibulous substance and the perforated plate.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

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

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

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) W. M. asks: Is there any advantage in having a large number of notches in the quadrant for a locomotive reversing lever? Why would not nine or even seven do as well as fifteen, and the quantity of steam regulated by the throttle lever instead of altering the traverse of the valve? A. Of course working steam expansively, to the extent that the work required will permit, is more economical than "throttling," and the greater number of notches are used to adapt the expansion more accurately to the work.

(2) W. M. L. asks whether there is any difference in the effect on the health between the heat of a wrought and that of a cast iron furnace. A. We suppose there is no difference, if the temperature of the radiating surface is the same in both cases. But wrought iron heated by steam is better than cast iron at a red heat.

(3) W. W. writes: Am I likely to damage a steam boiler (8 horse) by painting it outside with coal tar? A. No; not injurious, but better heat it before use, to drive off the higher constituents.

(4) O. H. R. asks how to keep an engine boiler when the engine is not running. A. If the boiler is laid off for a length of time, after cleaning thoroughly fill entirely full of fresh water and close all openings; a little lime thrown into the water will be beneficial. Outside remove all the masonry where it touches the boiler, and paint as well as possible with fish oil.

(5) J. S. writes: 1. I have a lot of sewing machines to redecorate. I use a rubber stamp. Turpentine and all oily substances rot rubber. Could you give me the formula of a size to hold the gold leaf on said machines? They have been japanned and baked. A. A good gold size japan should not act injuriously upon a well vulcanized stamp. 2. Would it require a high temperature to do a good job of japanning? A. Yes. 3. Are there different grades of japan which should require different degrees of heat? Yes. The heat varies with the different grades and makes. 4. What kind of thermometer must I ask for? It must rate over 300 degrees. A. A good thermometer of Fahrenheit's scale, from 32 degrees to 400 degrees, with metal back and well guarded to prevent breaking by the heat. 5. Could you send me the address of an importer of French metal? A. We are not familiar with the term French metal. What is it used for?

(6) F. M. F. asks: 1. Of what is Professor Crookes' radiometer made? A. It consists of a fly or vane having four aluminum arms, to the extremities of which are fixed thin disks of mica blackened upon one side. This fly is poised upon a very fine needle point, and inclosed in an exhausted glass bulb. 2. In what SUPPLEMENT are directions given for making a dynamo electric machine? A. In SUPPLEMENT No. 161. 3. About how much would it cost, how much power would be required to run it, and how many arc lights would it run? A. It would cost about $35, would require ¼ horse power, and it might run one very small arc lamp.

(7) A. G. A. writes: 1. I have made a small induction coil. Will you please tell me through your valuable paper how to make a magnet for the coil by which I can regulate the shock? A. Bind the bundle of wires together with fine iron wire, or inclose it in a thin sheet iron cylinder, and vary the strength of the current by changing the depth to which the bundle is inserted in the coil. 2. Will a solid iron bar do in place of a bundle of iron wires? A. It will not be so efficient as the bundle of wires.

(8) F. T. H. asks: 1. Would it be lawful to make and use a telephone exactly like the one described in SUPPLEMENT, No. 142? 2. Would it be lawful to sell such a telephone? A. 1 and 2. See advertisement relating to telephones in another column of this paper. 3. Will this telephone work 1½ miles? A. Yes. 4. Has the resistance of the telephone bobbin anything to do with the length of the line? A. Within certain limits it makes practically no difference. 5. I understand that the resistance of a telegraph instrument must equal the resistance of the line and battery. When two are used, should the resistance be divided? A. The circuit produced by the telephone is of great intensity, and capable of operating through great resistance. 6. How is it with three or more instruments? A. Three or more instruments may be used in the telephone circuit. 7. Where can I get directions, working draughts, etc., for making a galvanometer? A. In Frick's "Physical Technics," Ganot's "Physics," or any of the modern elementary works on electricity. You will also find much information on the subject in the SCIENTIFIC AMERICAN SUPPLEMENT. 8. How shall I prepare a carbon plate, in order to solder a metallic connector to it? A. Copper them. This you can readily do in any of the forms of sulphate of copper battery. 9. Would vulcanite be as good as wood for the tube in the center of the induction coil described in SUPPLEMENT, No. 160? A. Probably better. 10. If the coil were excited by the dynamo described in SUPPLEMENT, No. 161, and connected with a 5-strand barb wire fence 600 feet long, would an unpleasant shock be given any one touching the fence in dry weather? A. If the wires were well insulated, yes. 11. Suppose the dynamo described in SUPPLEMENT, No. 161, should be made twice as high, and of double width and thickness, would the proportions be correct? A. Yes. 12. If double magnets were used as in Weston's machine, would the armature have to be enlarged, and, if so, how much? A. If you desire to make a large machine, you would do well to examine the Weston, Edison, or Siemens machine. The armature of these machines are different from that described in the SUPPLEMENT referred to, and are necessarily somewhat larger. 13. What number wire should I wind the magnets and armature with for incandescent lighting, and how many lamps would it light? A. For a machine twice the size of that in SUPPLEMENT, No. 161, wind the armature with No. 16 wire and the magnets with No. 12. It would probably run two or three Edison lamps. 14. Can I get any better design than this for a dynamo, one sufficient for 15 incandescent lights, and if so, please let me know where to procure it? A. See answer to No. 12. 15. What size ports should a 2⅜ x 3½ inch engine have, 60 pounds pressure, 200 revolutions per minute? A. Supply ports $\frac{3}{16}$ x 1½ inches; exhaust $5\frac{1}{16}$ x 1½ inches. 16. At what fraction of its stroke should the steam be cut off to secure the best results? A. Two-thirds. 17. A gasometer rises and falls irregularly, with a 40 foot stroke—how can its altitude be recorded in an office 6,000 feet away? Is there anything in the market for this purpose? A. There is no easy way of doing this. The distance is so great that no mechanical device, unless very well made, and strong, would be accurate. An electrical device something on the burglar alarm principle might be used, contact pieces being placed at intervals on the side of the gasometer.

(9) Perham writes: We have occasion to mark a great number of cotton flour sacks for shipment. Pencil and colored chalk obliterate too freely before reaching destination. Can you recommend something to use for this purpose, and where can it be obtained? A. Try the following: Melt together six parts of tallow soap and six parts of beeswax; when thoroughly melted and mixed add one part of lamp black or Prussian blue. Run into moulds to form crayons of suitable size.

(10) S. T. writes: In SUPPLEMENT, No. 407, page 6,495—the Electric Furnace—how is the electric arc applied to the various crucibles to be effective? A. One of the electrodes is made in the form of a crucible.

(11) P. W. asks: 1. I would like to know what is the best metal to use for insulating electric wire, and how applied? A. Metals are not insulators; gutta-percha, India rubber, and various gums are insulators. 2. What has the size of wire to do with the conductive power, and what metal is best? A. The resistance of a wire is inversely in proportion to its sectional area. Silver is the best conductor. Copper is next. 3. Is lead non-conductor or partial? Lead is a poor conductor. 4. Does the atmosphere absorb any of the electric current passing over wires (in all kinds of weather)? A. Yes. 5. If so, would a perfect insulator prevent it? A perfect insulator would prevent it, but such a thing is not known.

(12) C. R. asks for a good formula for porcelain collodion for transparencies? A. The following from Dr. Vogel's book will probably suit you:

A. Pyroxylin........................1 gramme.
Ether..............................40 cu. cent.
Transparent alcohol...............40 "

Left to settle.

B. Magnesium chloride. ....1 gramme.
Alcohol.......................10 c. c.

To be filtered.

C. Silver nitrate, 20 grammes, dissolved in water, 30 c. c., to which is added alcohol, 70 c. c.

To be filtered.

D. Citric acid, powdered, 18 grammes, dissolved in boiling water, 18 c. c., to which is added alcohol, 162 c. c.

To be filtered.

Six hundred cubic centimeters of solution *A* are poured into a bottle of yellow glass; 50 c. c. of *B* are added and well shaken; next 60 c. c. of *C* are poured in and shaken for five minutes; finally 40 c. c. of solution *D* are added, and the whole is left eight to ten days, when it will be fit for use.

(13) E. H. S. asks for a receipt for a varnish for boots. There is no waterproof varnish that I know of that does not injure the leather.

A. Beeswax...............................18 parts.
Spermaceti...........................6 "
Oil of turpentine......................66 "
Asphalt varnish.......................5 "
Powdered borax.......................1 "
Vine twig, black......................5 "
Prussian blue.........................2 "
Nitro benzol..........................1 "

Melt the wax, add powdered borax, and stir till a kind of jelly has formed. In another pan melt the spermaceti, add the asphalt varnish, previously mixed with oil of turpentine; stir well, and add the wax. Lastly, add the color, previously rubbed smooth with a little of the wax. Perfume with nitro benzol. Apply in small quantities, wipe with a cloth, and brush.

(14) J. W. H. asks: 1. How is nitrate of antimony made? A. According to Ad. Wurtz, the neutral antimony nitrate is not known, but a basic nitrate is obtained by dissolving the antimony protoxide in fuming nitric acid. 2. How is the potassium bichromate solution prepared that is used in the two fluid cells, *i. e.*, bichromate solution in the glass jar with the carbon and dilute sulphuric acid in the porous cup with the zinc? A. Potassium bichromate, 2 parts, dissolved in water, 20 parts, to which is added sulphuric acid, 1 part. 3. Please give me the composition of the cell used in medical batteries? A. Mercuric chloride.

(15) L. S. asks how to prevent steel springs from rusting. Whatever is applied must not crack in bending. A. You do not mention the kind of spring. Oiling might answer in some cases. A thin coat of fine japan baked on would prevent rust. The springs might be coppered.

(16) S. S. asks for the most economical method for using a hydraulic pressure pump to produce the required pressure for a washstand? A. The best method to produce the effect of a city water works is to put a tank in the attic and use the pump for keeping up the supply. If your building is low, so that an elevated tank is not available, you may have an air tight tank upon the same floor and use a force pump for putting water into the tank and an air pump for keeping up the pressure. A pump could be constructed for pumping both air and water.

(17) F. X. A. asks for a good, cheap way to manufacture emery paper. A. In large manufacturing establishments emery paper is made by feeding the paper into a machine, where the glue is rolled upon the paper, and the emery is distributed automatically. The old way is to brush the glue on by hand, then hold the sheet over the emery box and pour the emery over the paper with a shallow pan. The paper must be previously moistened so as not to curl.

(18) O. G. asks whether the beet sugar industry is carried on to any extent in this country, or, if not, whether any experiments have been made in this direction. A. There have been many trials to make beet sugar in this country. They have not been successful. The beets seem to lack the sweetness or sugar principle necessary to satisfy the requirements of the American market. Experiments have been made in Illinois, Wisconsin, and California, which proved unprofitable, also in Delaware and Maine. Address the Commissioner of Agriculture, Washington, D. C., for reports upon the beet sugar interest in the United States.

(19) C. H. M. asks how large and where the largest engine is in this country. A. We believe in the steamer Pilgrim—110 inches diameter of cylinder and 14 feet stroke.

(20) H. A.—Use eight or ten cells of plunging bichromate battery for running a small incandescent electric light. Use twenty or more cells for the arc light.

(21) G. A. L.—At the close of 1882 there were in the United States 15,551 passenger cars, 5,366 baggage, mail, and express cars, 710,451 freight cars of all classes.

(22) J. P. B. asks: What would best dissolve thin paint skins, so as to make them suitable to apply to leaky roofs or around chimneys? A. Dissolve half a pound sal soda in 1 gallon rain water, cover the paint skins with this solution, and then soak them for a couple of days in the mixture. Finally heat them, adding oil to reduce the mixture to a proper consistency for painting, and strain. Benzine may also be used to dissolve the skins.

(23) W. L. T. writes: In SCIENTIFIC AMERICAN, October 27, 1883, is an article in regard to catechu for dissolving boiler incrustation. I wish to know how much catechu to put in a ten horse power traction engine; how to get it in the boiler, and how often would you advise one to use it. A. Dissolve in water and send it through feed pump. The whole process is described in article referred to. 2. Also what is good to keep a boiler from foaming? A. We cannot give you a remedy for foaming till we know the causes; foaming has various causes. 3. How do they tell the horse power of an engine, say an 8 inch bore, 12 inch stroke, 200 revolutions per minute? A. Refer to rule in SCIENTIFIC AMERICAN SUPPLEMENT, No. 253.

(24) H. C. A.—Use ordinary copal varnish, or picture varnish. See answer to query No. 7, SCIENTIFIC AMERICAN for July 7, 1883.

(25) J. V. R. asks: What proportion of gallic acid and sulphate of iron to a quart of water would constitute a good writing fluid? A. The proportion of iron sulphate is generally about one-third that of the galls, and the solid ingredients about one-fourth that of the water. Thus:

	Superior ink.	Inferior ink.
Tinct. of galls	225	62
Iron sulphate	75	31
Gum	25	31
Water	1000	1000

(26) R. S. writes: I am building an engine 3x3 for a 20 foot steam launch. I intend using an upright tubular boiler, and want to use oil as fuel if possible. Please let me know what size boiler I require, and also the amount of square feet of heating surface, to run my engine at 500 revolutions a minute. Is burning oil practical? And if so, how should lamp be arranged? A. We think you should have a boiler with not less than 50 to 60 feet fire surface, for burning oil. 2. Burning oil has been practiced successfully in the "Oil Region" and on locomotives. 3. The arrangements are varied, but generally the oil is sent into the furnace by a current of steam through an injector, the oil and steam mixing as they pass into the furnace. Steam must be first got up in the usual way.

(27) A. D. B. asks: 1. What size boat will the 4½ horse power engine made by James Leffel & Co. drive up a river? A. Boat 24 feet keel by 6 feet beam by 3 feet 6 inches hold. 2. What would be the size of a screw wheel for the same boat? A. Propeller about 34 inches or 36 inches diameter and 3 feet pitch. 3. How many pounds would the boat carry, and at what rate of speed? A. With engine making 250 revolutions per minute, should make about 8¼ or 9 miles per hour in still water, and carry 2¼ to 3 tons according to model and weight of boat.

(28) H. D. asks how many Bunsen cells (two quarts each) will be required to run an incandescent electric light. A. 40.

(29) J. A. K.—First telephone was invented and made by Phillipp Reis, in 1860.

(30) J. L. writes: Could you furnish me with a receipt for making a good sticking gum, similar to that used for envelopes of letters? A. Use the following:

Dextrine.................................2 ounces.
Acetic acid...............................1 "
Water.....................................5 "
Alcohol...................................1 "

Add the alcohol to the other ingredients when the dextrine is completely dissolved.

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