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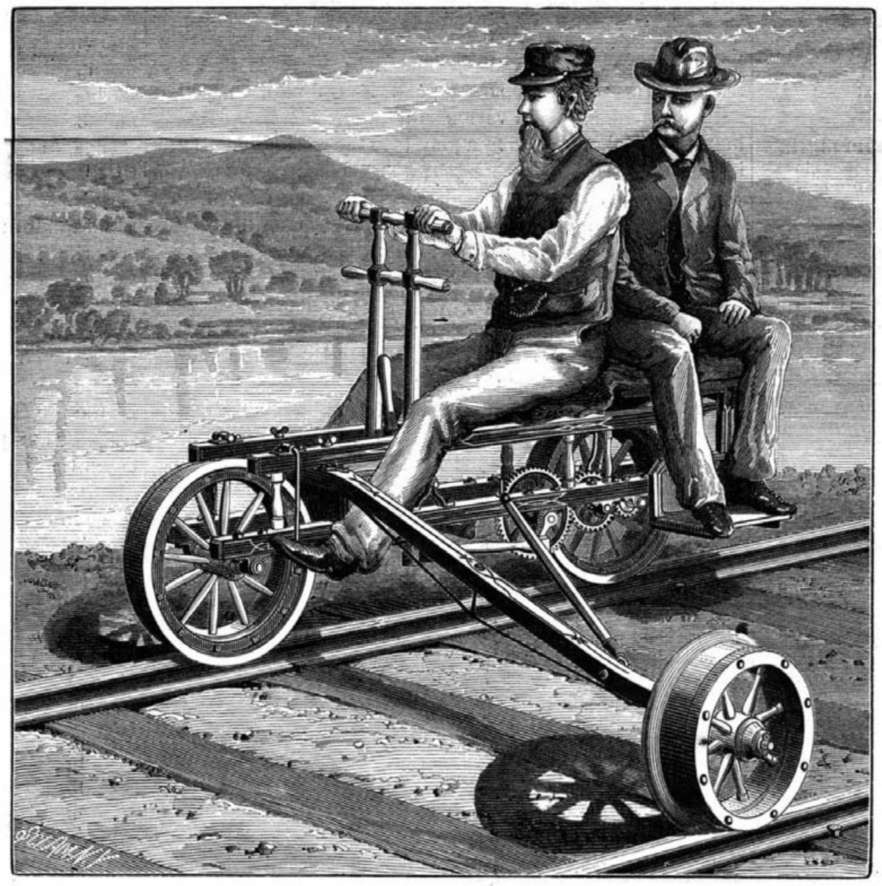
THREE WHEELED INSPECTION CAR.

The car herewith illustrated facilitates a close inspection of a railroad, and it is claimed that by no other device can this be done so effectually. It is propelled by one person and has a device for carrying a second, thereby enabling a road master or inspector, when convenient, to avail himself of the services of a spare section hand or other man for the purpose of propelling him over the line, he being free to note all defects in alignment or surfacing.

In this way he can visit personally a large portion of the sections under his charge in a single day, stopping wherever the men are at work, giving his directions and calling attention to defects while they are fresh in his mind, and in this way keeping his track at all times in the best possible condition, as it is well known that in this department it is only a close attention to the details of the work that is rewarded with success. The car is propelled by a rowing motion and auxiliary foot power. The frame, wheels, and arm are made of white ash, the frame being firmly held together by bolts. The arm is stiffened by an iron brace. The tires are cast iron, the axles and crank shaft are iron, the crank and stirrups of malleable iron. The arm is adjustable and can be removed at will, thus securing economy of space in transportation. The car weighs about 140 pounds, and is made with either a 17 or 20 inch driver, geared 3 or $4\frac{1}{3}$ times, as may be most expedient. There are some 4,000 of these cars now in use both in this country and Europe.

The manufacturers, the Sheffield Velocipede Car Company, of Three Rivers, Mich., should be addressed for further information.



THREE WHEELED INSPECTION CAR.

THE BARNEY AUTOMATIC DUMPING BOAT.

What to do with city refuse has been a question to the health departments of our large cities for years. If it is deposited in the harbor it tends to create bars obstructive to navigation, and if thrown into the sea light and dry from the decks of scows just outside the harbor, much of it drifts to the adjacent shores, making a nuisance if not breeding disease. The only effectual manner and place for its disposal appear to be by sinking it far enough out at sea to prevent it from choking navigable channels or contaminating adjacent shores. This is done by the system illustrated in the accompanying engravings, known as "The Barney Automatic Dumping Boat" plan.

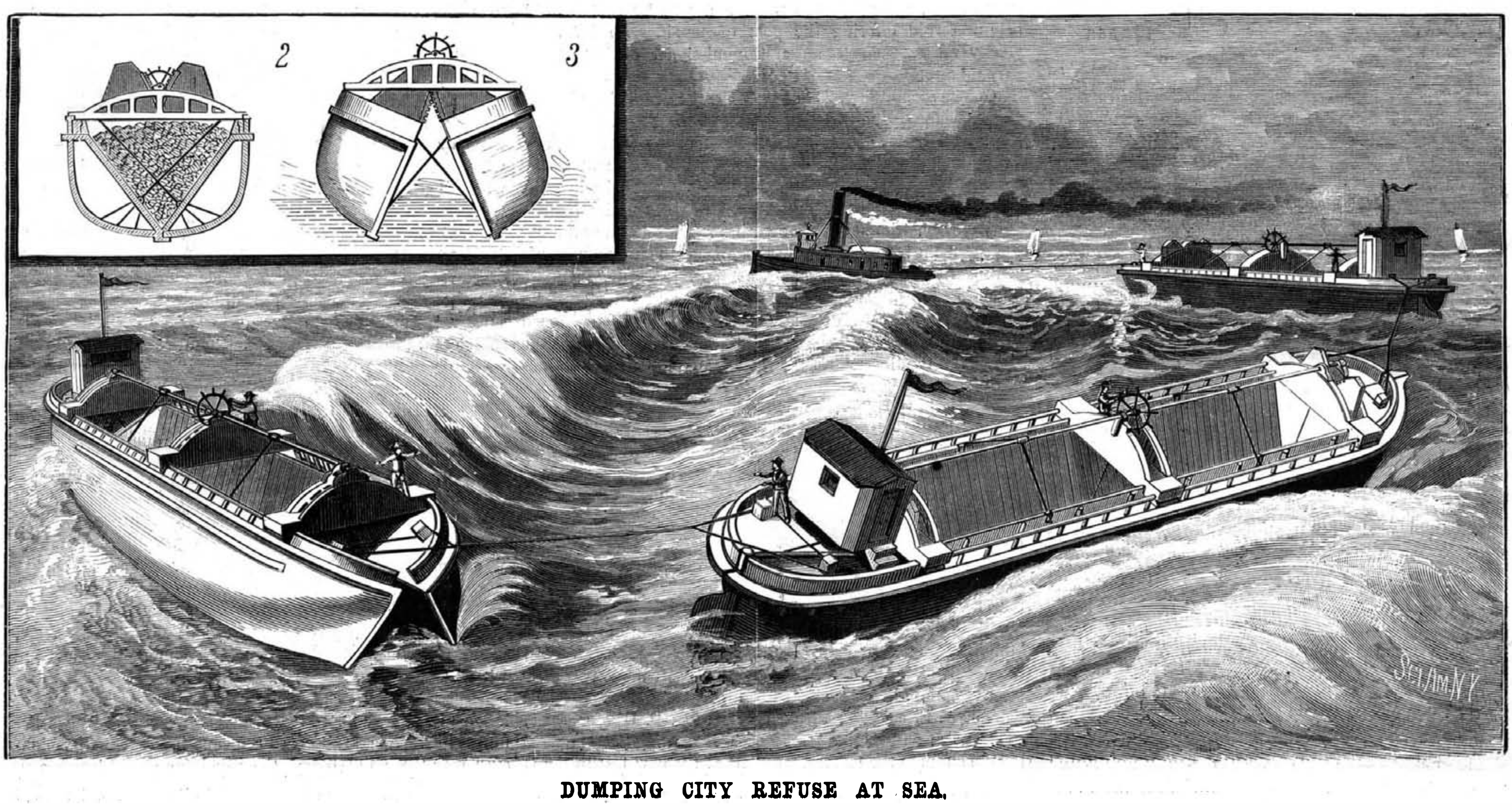
The boats built on this system are not flat scows carrying all their load on deck and far above the water line, but are serviceable sea boats, capable of riding the waves without danger, and cannot sink unless wholly destroyed. The load is the ballast of the boat, and insures steadiness until the cargo is emptied, when the natural buoyancy of the boat is its assurance of safety. Each boat is in two longitudinal sections, or consists of two pontoons hinged to bridges above the deck and presenting the appearance of an entire boat, as seen in cross section in Fig. 2. Each pontoon, or half, is air tight, and the load is carried between the two, occupying a V-shaped space shown in the same figure, extending from the outer edge or gunwale to the keel. The bridges connecting the two pontoons are hinged to their outer edges, and are connected by a shaft running the entire distance, by turning which three segments of gears controlling the position of the pontoons are opened, the whole operated simultaneously by one man at the center bridge. This work is simply that of releasing the load, and of securing the two pontoons together after the releasing, as the pontoons work automatically, opening by the gravity of the load, and closing by the displacement, or the force of the water on their outsides. So the mechanism is very simple: the two longitudinal halves of the boat are hinged to three rigid connecting bridges at their upper edges and connected by geared segments of one-eighth of a circle, or 45 degrees. The two halves or sections are held together by connecting rods, or tension rods, as seen in Figs. 2 and 3.

It is not intended that the boat, as a whole, shall be water tight. In fact, the meeting of the two air tight pontoons at the common keel is far enough from being hermetical, that it is intended the sea water shall come up by absorption and capillary attraction and saturate the entire load of refuse. This increases its density and its facility to sink quickly to the bottom. So, after the cargo is dumped into the sea, the pontoons may be held apart by means of friction beams, as in Fig. 3, while the sea washes the load space between them, cleansing the walls with the sea brine. This is seen, also, in the last boat in tow in the principal engraving.

This method of dumping and cleaning has manifest advantages: The load can be instantly emptied and the boat can be cleaned in a few minutes. The load is discharged into the water six feet below the sea level instead of being scattered on the surface of the waves, and being thoroughly saturated is prepared to sink, instead of being light and ready to drift. Two men, instead of twenty, is the complement of these boats A trip with a tow of these boats from New York city will not occupy half the time required by the old fashioned scow system.

They have been tested by this city for fifteen months, and have proved a great saving of time and expense over the old method. With these boats the danger to the harbor from dumping the city refuse may be placed out of the question.

(*Continued on page* 276.)



DUMPING CITY REFUSE AT SEA.

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NEW YORK, SATURDAY, NOVEMBER 3, 1883.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 409,

For the Week ending November 3, 1883.

Price 10 cents For sale by all newsdealers

A CONVENTION OF INVENTORS.

For several weeks past printed circulars have been sent through the mails addressed to prominent patent owners in the name of "The Resident Inventors of New York," signed by Mrs. M. A. Forbes as secretary, calling for a national convention of inventors, to meet at Lyric Hall, this city, on October 22 and 23.

The alleged objects of the convention, as stated in the call, are to protect inventors and owners of patents against the encroachments of an organized hostility to our patent laws. Also to promote the introduction of new inventions.

In accordance with the call, the "convention" began its sessions on the 22d ult., about fifty persons being assembled with the object, according to the New York *Times*, of forming an association to secure for themselves full legal rights and protection against piracy and infringement. Three lady inventors were present—Mrs. Cunningham, who has evolved a cloth cutting machine; Mrs. White, the mother of a washing apparatus; and Mrs. Jones, whose talent has found scope in various directions. Mrs. Adams, a lady who is about to bring a play into the world, and who is known better under the *non de plume* of Della Dusane, was also present, presumably with the intention of availing herself of the benefits of the society, which, when formed, will extend its privileges to authors. The temporary President, Mr. Dee R. Shryock, of the American Postal Telegraph Company, said that inventors were the people who advanced the interests, prosperity, and civilization of the country more than any other class. He alluded to the Wadleigh bill, now before the Senate, as being full of unjust discriminations and ungrateful selfishness which fell nothing short of infamy. Mrs. M. A. Forbes said that the Constitution of the United States did not provide for the protection of intellectural workers. There were powerful combinations to-day made expressly for the purpose of destroying the patent system. There existed, she said, nearly 100 Western railroad companies organized to utilize and appropriate, without paying, the work of the inventors, the grangers, the mill men, and the boot and shoe manufacturers, sanctioned and encouraged by the National Board of Trade. The measures that had been introduced into Congress since 1875 had been such as to render it imperative that the inventors of this country should organize to endeavor to secure the rights of intellectual workers, among whom authors and others might be included. During the proceedings Thomas L. Clingman, ex-member of Congress from North Carolina, came in, and stated that he was interested in the movements of the association, as he had taken out patents of electric light in America and Europe. He felt the necessity for patentees to protect themselves.

A committee of five elected Mr. J. A. Price, of Pennsylvania, President of the convention, and Mrs. M. A. Forbes Secretary, Mr. F. W. Warner being afterward appointed Assistant Secretary. Mr. Price said he thought the broadest title of the association was that of American citizenship. A committee of fifteen to draught the constitution, by-laws, and regulations for the association was appointed, each member being made the representative of a State. A committee of three, to draw up memorials to send to Congress embodying the ideas of the association, was composed of Mr. Price, Mr. Warner, and Mrs. Forbes. A telegram from Mr. E. M. Marble, ex Commissioner of Patents at Washington, was then read. He offered to become permanent president of the association. An Irishman named King, who had been disturbing the harmony but relieving the monotony of the proceedings, violently opposed this offer. He saw no reason why Mr. Marble should thrust a telegram in such a manner upon them, and called the missive a "sugar coated pill." He preferred offering the post of president to Mr. John Kelly rather than to an ex-Commissioner of Patents at Washington.

On the second day, 23d of October, the disturbing element in the shape of the turbulent little Irish agitator, Mr. King, described by one of the ladies present as a "dynamiter and a bad man," only prevailed at the commencement of the proceedings. Mr. King surreptitiously departed when the payment of fees was announced. An old lady, Mrs. Harriet F. Donlevy, who is well known in many societies as a lover of argument for argument's sake, opposed many movements with scriptural quotations. A memorial was drawn up to Congress in respect to existing wrongs and threatened injustice to a most useful class of citizens. It was petitioned that skilled persons be employed to make a digest of all the matter in the library of the Patent Office, with abbreviations of all inventions, so arranged as to correspond with the classification in the office. It was also asked that the statute which limits the term of a home patent to that of the earliest expiring foreign one be repealed. It was urged that the President should be given power to conclude arrangements for an international union for reciprocal protection and legislation for patents. It was then decided that the title of the association should be the American Patent Protective Association, its objects being to foster inventive talent, stimulate inventive genius, facilitate inquiry, and diffuse information. The association proposes to establish bureaus of scientific and legal information, and to promote the introduction of valuable discoveries and improvements. Mr. E. M. Marble, ex-Commissioner of Patents at Washington, was unanimously elected president of the association; Mr. J. A. Price, First Vice-president; Mr. P. H. McNamee, Treasurer; and Mr. F. W. Warner, Recording Secretary.

We suppose the material support of the new institution is to come from the fees and commissions to be charged for the introduction of inventions and the supply of legal information. In the matter of "fostering" inventive talent and "stimulating" inventive genius it would almost seem as if the proposed labor was superfluous, over thirty-two thousand applications for new patents being filed last year in the Patent Office. The existing laws appear to furnish all the stimulants required in that direction.

THE OIL STONE.

Twenty years ago the oil stone was found only on the joiner's bench and possibly on that of the machinist, and its sole use was the sharpening of the edges of tools. To-day its use has extended beyond this province of edging tools to that of grinding, reducing, finishing; in fact, invading the limits of the grindstone, emery, rottenstone, tripoli, and reaching almost to rouge. This stone, which is a slate known in science as novaculite—from *novacula*, a razor—is cut and dressed in hundreds of varying forms for differing purposes. In any hardware or mechanic furnishing store it may be found in all manner of shapes under the name of "slips," adapted for sharpening tools of all forms. In dentists' supply stores it may be seen in twenty or more cylindrical and circular forms, and so minute as to be used at a rapid rate of revolution even between the teeth of dental-suffering humanity. Some of these cylinders, ovoids, cones, and edged wheels are so minute that a pea looks large by their side; yet they are all veritable grindstones.

In the manufacture and finishing of the metals, the oil stone, or novaculite, plays an important part. Our recent exaction as to fits and measures can hardly be filled except by the use of this stone, and it is in demand for truing turned surfaces and planed areas of iron and brass, slowly grinding down the imperfections left by the finish file and the corundum wheel. Recently its powder has largely usurped the place in mechanics' valuation of flour of emery or emery of the higher grades. It is found that a finish "for fit" can be readily obtained by its use in much less time than that by the scraper; and that it does not leave embedded particles of quartz or corundum to keep up a perpetual wear. This material is not strictly an *oil* stone; it can be used with any vehicle, water, benzine, or kerosene oil; it is amenable to all of these. Perhaps its best use is with water, especially when the stone is of the harder sorts, as the Ouachita.

MAKING WIND POWER AUXILIARY.

The subject of storing the wind power evidently attracts much attention, and many suggestions have already been made, but it is manifest that no one has brought forward as yet any plan for doing practically the work intended. The ingenious soul mentioned in our paper of October 13, who runs his arastras with a current of sand, deserves a world of credit, and in his own case has at his command the means desired, for out in New Mexico or Arizona (where he appears to be) sand is to be had in abundance, and is the only thing of which that can be said. But alas! our supply of sand is limited, nor have we always a hillside to which we can raise it, and what we need is something of which we can avail ourselves everywhere.

Now, though the full answer to the question of storage may be too much for us at present, yet if we can contrive to secure a portion of the wind power sufficient to practically reduce the expenses of running our machinery, while we have the same steady supply of power as now, we shall surely have made a step in advance. Some weeks since (July 28), we made some remarks on one means by which this might perhaps be accomplished. Let us see if figures will show us that the thing is possible to such an extent as to make it worth attempting. We will base our calculations on the same amount of power as that formerly assumed; that is, a factory needs and uses a steam engine which gives it twenty horse power as its regular motive energy. Acting on the plan which we propose, this engine serves as an air compressor, for no other presents itself whereby we may combine the action of the steam and the wind in the same movement We need therefore a reservoir which shall be common to both, and it is at this point that we must begin our calculations.

For the sake of convenience it will probably be better to divide our space, two cylinders instead of one, though this of course is not necessary. A diameter of eight feet with a height of ten gives us in round numbers 500 cubic feet of contents. Such a reservoir, built of three-eighths iron, and sufficiently fitted to bear a pressure of sixty atmospheres, will cost about $450. The two, therefore, holding 1,000 feet we may set at $900.

This amount of air compressed to the degree stated will furnish twenty hore power steadily through a working day of ten hours, without needing renewal.

But we do not propose to supply it from the steam engine alone or chiefly; we will bring in the wind power. At such point as is convenient wind wheels are erected in number and extent as required. A simple, solid, durable, and inexpensive wheel can be built after the following plan:

A vertical hard wood shaft of twelve feet is firmly supported at top and bottom, where it revolves freely in common iron bearings. Six (or eight) blades project four feet, plain, solid, of inch pine board. We have thus a wind wheel, twelve feet high, and eight feet in diameter.

A semicircular shield, concentric with the wheel, but of larger diameter, is fitted with a movable vane. When the mill is to run at its full speed the vane is so set that, whichever way the wind blows, the revolving shield leaves constantly one-half of the mill exposed to its force, and the ful

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power of the wind is exerted. This will doubtless be the case at almost all times; should it ever be advisable to let the mill lie still, the vane can be changed to a position at right angles, and at once the shield is presented directly to the current of the wind, and the mill is entirely sheltered.

Much more elegant and expensive windmills can be built, and yet not be one particle more effective. Such a mill will run for years without a dollar spent for repairs; it runs at the utmost speed of a gale, and needs no checking.

At the average speed of the wind in New York a mill of this size is good for a steady half horse power; that is, it will give 84 hours of one horse power per week, for night and day, week days and Sundays are pressed into the service. If, therefore, the manufacturer has space on which he can build fifteen such mills, he has at his command the full force of his twenty horse engine. The expense of building them will not exceed $800.

Here, then, is our case. We have the wind wheels each driving its air pump leading to the receiver, and we have the steam engine similarly connected. We will assume that by the action of one or the other or both, we have the receiver stored with air at a pressure of 1,000 pounds. At starting work in the morning there is no occasion to think of steam, for there is on hand a reserve of force sufficient for the day's running, and the engine lies idle. The work goes on, but so do the wind wheels go on, for they take care of themselves and need no attention, and they never can make a revolution without adding to the stock of compressed air. When the factory shuts down at night, the chances are very strong that the pressure in the receiver is as great as it was at starting, or if not it will probably be fully up by morning.

A factory thus fitted will run with no outlay for current expense of power during a very large part of the year, and it certainly does seem as though the plan was worth a trial. It does not solve fully the problem of storing the wind power, but it may perhaps help us in that direction.

A.

ASPECTS OF THE PLANETS FOR NOVEMBER.

NEPTUNE

is morning star until the 12th, when he becomes evening star. He retains until that time his pre-eminence among the planets on the morning roll, being the first to make his appearance in the field. On the 12th, at 4 o'clock in the morning, the event in his synodic period most interesting to terrestrial observers takes place. He is then in opposition with the sun. As the word implies, he is opposite to the sun, rising when the sun sets and setting when the sun rises. He is at his nearest point to the earth; the sun, the earth, and Neptune being in a straight line, with the earth in the center.

An observer on the sun, endowed with visual power to take in the system at a glance, would behold the earth and Neptune, far beyond, directly in line. He would also find, just before the time of Neptune's opposition, six of the seven planets on one side of the sun, leaving Venus as the sole planetary representative on the other. The movements of the planets as seen from the sun would be far less complicated than they are as seen from the earth, who is herself traveling around the sun, and changing constantly her position in regard to the other members of the system. Neptune at opposition is under the most favorable conditions for being seen with the telescope. Though the third planet in size, he is too far distant ever to be visible to the naked eye. He is now among the small stars of the constellation Aries, near the boundary line of Taurus, and nearly west of Aldebaran, the only bright star in his neighborhood. A good telescope sweeping the field where he lies will quickly detect his presence. For a small, ill-defined sphere will suddenly spring into being, while the surrounding stars will remain mere points of light.

Neptunian astronomers have an advantage over terrestrial ones, and can find little difficulty in measuring the distance of the fixed stars. While the earth has 180,000,000 miles—the diameter of her orbit—for a base line, Neptune sweeps round the sun in an immense orbit whose diameter, or base line for measuring the distance of the stars, is 5,550,000,000 miles. But there are disadvantages to counterbalance this advantage. It takes Neptune 165 of our years to revolve once around the sun, and astronomers there must wait more than eighty years to make measurements in opposite points of his orbit. The sun as seen at this far away planet measures 64″ in diameter, a little more than the greatest apparent diameter of Venus as seen from the earth. Our glorious sun to the Neptunians is therefore but a brilliant star, giving only a thousandth part of the light we enjoy.

The right ascension of Neptune is 3 h. 12m.; his declination is 16° north; and his diameter is 2·6″.

Neptune rises on the 1st at half-past 7 o'clock in the evening; on the 30th he sets about half-past 5 o'clock in the morning.

SATURN

is morning star until the 28th, and then evening star. On the 28th, at 11 o'clock in the evening, Saturn is in opposition with the sun, the culminating point of his size and brilliancy for the present year. He will be a superb object for observation during the month, rising now an hour and a half after sunset, coming every evening earlier above the horizon, and shining so serenely in the evening sky that he needs no one to point him out as he travels on his way near the Pleiades and Aldebaran, with whom he has long kept company. Very clear sighted observers may see him in an elongated aspect, on account of his widely open rings. A telescope of moderate dimensions will give a surpassingly lovely picture of this unique planet, and every one interested in astronomy should make an effort to obtain a telescopic view of this wonder of the skies.

On the 1st, at midnight, Saturn is in conjunction with Alpha Tauri, or Aldebaran, the star being 3° 30′ south. This is the second conjunction of the same planet and star during the year, the previous one having occurred on the 13th of August, at almost the same point in the sky, with only a difference of 10′ in declination. Therefore Saturn is nearly in the same position in the heavens he occupied in August, although he has been wandering in his orbit in true planetary fashion, sometimes straight forward, sometimes backward, and sometimes stationary.

The right ascension of Saturn is 4 h. 29 m.; his declination is 19° 46′ north; and his diameter is 19″.

Saturn rises on the 1st at half-past 6 o'clock in the evening; on the 30th he sets a few minutes before 7 o'clock in the morning.

JUPITER

is morning star throughout the month, and when his regal head appears above the eastern hills star gazers pay involuntary homage to the brilliant planet that unerringly pursues his stately course in the star depths, and is visible through the entire night. Observers will not need to sit up late to obtain a glimpse of him, for he rises now at half-past ten o'clock, and, rising four minutes earlier every night, will be above the eastern horizon at half-past 8 o'clock at the close of the month.

On the 22d he is stationary near Praesepe, the same luminous cluster in Cancer that Mars immortalized by his passage through it in October. Those who desire to observe a planet in a stationary phase will find an illustration in Jupiter, who scarcely varies his position during the month.

The right ascension of Jupiter is 8 h. 25 m.; his declination is 19° 35′ north; and his diameter is 37·6″.

Jupiter rises on the 1st at half-past 10 o'clock in the evening; on the 30th he rises at half-past 8 o'clock.

MARS

is morning star, but contributes no incidents to the annals of the month. He is in the constellation Cancer, though he makes his way into Leo before the month closes. His increase in size and ruddy color is plainly perceptible, his apparent diameter having doubled since the 1st of October. As he rises 22 minutes after Jupiter, he can readily be found. Mars illustrates direct motion at present, that is, he is moving eastward according to the signs of the zodiac.

The right ascension of Mars is 8 h. 47 m.; his declination is 19° 18′ north; and his diameter is 14·6″.

Mars rises on the 1st ten minutes before 11 o'clock in the evening; on the 30th he rises a quarter before 10 o'clock.

URANUS

is morning star, and pursues his slow and solitary way among the insignificant stars of Virgo. He, like Mars, is moving in a direct course, but at present is an object of little interest.

The right ascension of Uranus is 11 h. 47 m.; his declination is 2° 5′ north; and his diameter is 3·5″.

Uranus rises on the first about 3 o'clock in the morning; on the 30th he rises a few minutes after 1 o'clock.

MERCURY

is morning star until the 26th, and evening star the rest of the month. On the 26th, at 1 o'clock in the morning, he is in superior conjunction with the sun, passing behind and below him, and reappearing on his eastern side as morning star. He takes no active part in the events of the month, but contents himself with pursuing the swift tenor of his way.

The right ascension of Mercury is 13 h. 38 m.; his declination is 8° 17′ south; and his diameter is 5·4″.

Mercury rises on the first about half-past 5 o'clock in the morning; on the 30th he sets about half-past 4 o'clock in the evening.

VENUS

is evening star during the whole month, the only planet that plays this part without change. She will not long remain at the foot of the list, but will soon put forth her claims to notice, when the other planets will hide their diminished heads. Though setting now forty minutes after the sun, at the end of the month she will be above the horizon a little more than an hour after sunset and can be easily seen. Her place will then be far south in the constellation Sagittarius, 2° 35′ south of the sunset point.

The righ ascension of Venus is 15 h. 9 m.; her declination is 17° 25′ south; and her diameter is 10·2″.

Venus sets on the 1st about half-past 5 o'clock in the evening; on the 30th, she sets about half-past 5 o'clock.

THE MOON.

The November moon fulls on the 14th at forty-one minutes after 11 o'clock in the morning, New York time. None of the planets lie near the moon's path until she nearly reaches the full, when she is in conjunction with Neptune, the planet being 15′ south. On the 15th, at noonday, she is in conjunction with Saturn, being 1° 2′ south. Observers in some localities between 28° and 71° south declination will see Saturn occulted, making the eighth occultation of this planet during the year. On the 19th the moon is at her nearest point to Jupiter; on the 20th she is near Mars; on the 23d she is near Uranus. On the 29th, the new moon is in conjunction with Mercury.

OCCULTATION OF BETA CAPRICORNI.

The moon the day before the first quarter occults Beta Capricorni, a star of the third magnitude in the constellation Capricornus. The immersion of the star takes place five minutes after 8 o'clock in the evening, Washington mean time. The emersion occurs four minutes after nine o'clock, Washington mean time. The occultation continues 59 minutes. The phenomenon is a beautiful one, is worth taking pains to see, and the hour of exhibition is convenient. As the moon travels with her dark edge foremost from new to full, her illumined side being next the sun, observers will see the star apparently blotted from the sky as it disappears behind the unillumined portion of the moon.

New Form of Electrical Accumulator.

Julius Elster and Hans Geitel show that Zamboni's dry piles can be used as accumulators. The copper pole of the pile is connected with the positive, and the tin pole with the negative poles of a Holtz machine. After the latter has been worked for a few minutes the dry pile is found to be charged. After repeated discharges the pile is found to contain a charge of considerable intensity. The authors recommend the following form of pile: The plates of the pile are strung by means of a needle upon a silk thread and then stretched between the poles of a Holtz machine. A pile of 11,000 pairs of plates of one square centimeter surface, after ten minutes charging, gave shocks one millimeter long and made a Geissler tube luminous. The light of the tube was continuous at first, but afterward became intermittent. Dry piles were also made of one metal. Plates of lead foil were coated on both sides with tissue paper by means of potash water-glass to which a little oxide of lead was added. A pile of 7,000 of the lead plates one square centimeter in section could be charged so as to exhibit strong polarization. A certain amount of moisture must be communicated to the piles. The superoxide of lead deposited electrolytically acts more powerfully than when deposited in any other way. A pile of 1,000 plates, coated on one side with chemically produced superoxide and on the other with protoxide of lead, gave proportionally much less tension. These piles are well suited to exhibit to a large audience the principle of Plante's or Faure's accumulator.—*Wiedemann's Annalen*; *American Journal.*

Preparation of Butylene.

Puchot says that butylene, C_4H_{10}, can be conveniently prepared from butylic alcohol obtained by fermentation, as follows: 100 parts of sulphuric acid are placed in a flask or retort, and 100 parts of butylic alcohol poured in carefully so that it will float on the acid. The flask is then placed in cold water and shaken until the two mix without much rise of temperature. Then 160 parts of gypsum and 40 of sulphate of potassium, both in powder, are introduced, still shaking the flask until the mixture is homogeneous.

On heating very gently the gas is given off. About 30 parts of butylene are obtained from 100 parts of alcohol, or nearly 40 per cent. The rest of the alcohol collects in the wash bottles, together with other interesting substances.

By the action of chlorine upon butylene in diffused daylight a liquid was obtained homologous with $C_8H_8Cl_2$, but in direct sunlight a substitution took place and formed $C_8H_4Cl_6$. If the flask was heated while chlorine was passing through, he obtained $C_8H_2Cl_6$.

Butylene is one of the constituents of illuminating gas, but its nature is so little known that we are not yet able to separate it from the other constituents of the gas.

A Steamer Comes into Port on Fire.

Late in the afternoon of October 22, the large iron steamship Heimdal, of the Thingvalla line, plying between New York and Amsterdam, came into this harbor with the signal, "I am on fire." Prompt assistance was rendered, the passengers and mails removed, and the ship saved. Including the crew, there were 350 persons on board. In the cargo were 1,000 cases of safety matches, consisting of brands manufactured in Norway, Sweden, and Denmark.

A smell of fire was noticed on the day preceding her arrival here, and upon investigation the matches, in the main hold, were found to be on fire. Steam from the boilers was turned into the hold, which reduced the heat.

The heads of these safety matches may consist of a pasty mass composed chiefly of chlorate of potash and sulphuret of antimony. They are lighted by being drawn across a surface on which is glued red or amorphous phosphorus mixed with very fine sand. This is generally put upon the outside of the box. It is considered probable that the fire was the result of spontaneous combustion.

THE new and thrifty town of Pullman, near Chicago, lies on a flat prairie, and the problem of drainage, which is so difficult to solve in a great many places, had to be met in Pullman. The following is the one adopted, and it is said to be satisfactory in its workings and profitable in its results: Sewers are built to empty into a sunken tank, from which the sewage is pumped through a twenty-inch main to a farm three miles away. The system cost $80,000; the farm yields a profit of $8,500 a year.

AT the beginning of 1882, Sweden possessed a mercantile navy of 4,151 vessels, measuring 530,000 tons, of which 3,397 were sailers, with 450,000 tons, and 754 steamers, with 80,000 tons. The number of sailing vessels had during the year decreased with 184 ships.

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Steam vs. Water Power.

The minimum capacity and height of fall of some of the leading water powers of the United States is as follows:

Holyoke, fifty feet, 17,000 horse power.

Cohoes, No. 3, one hundred and five feet, 14,000 horse power.

Lewiston, fifty feet, 11,000 horse power.

Lowell, thirty-five feet, 10,000 horse power.

Lawrence, twenty-eight feet, 10,000 horse power.

Turner's Falls, thirty-five feet, 10,000 horse power.

Manchester, fifty-two feet, 10,000 horse power.

Paterson, thirty-five feet, 1,100 horse power.

Passaic, N. J., twenty-two feet, 900 horse power.

Birmingham, twenty-two feet, 1,000 horse power.

Fall River, with at least 500,000 more cotton spindles than any other town or city in the United States, is operated wholly by steam power.

Manufacturers have been heard to say they would not move across the street for the sake of substituting water for steam, considering the irregularity of most water powers. A more moderate statement is that of the manager of a prominent woolen mill on the seaboard, whom the writer asked if it would not be cheaper to run his mill by steam than by water. The answer was: "For a mill located as mine is, steam is the cheaper. I use half anthracite screenings and half culm coal from Nova Scotia. The average cost of both kinds of fuel landed on our wharf is $3.25 per ton, and at that figure steam is cheaper than water."—*Textile Gazette.*

Estimating the Value of Tanning Substances.

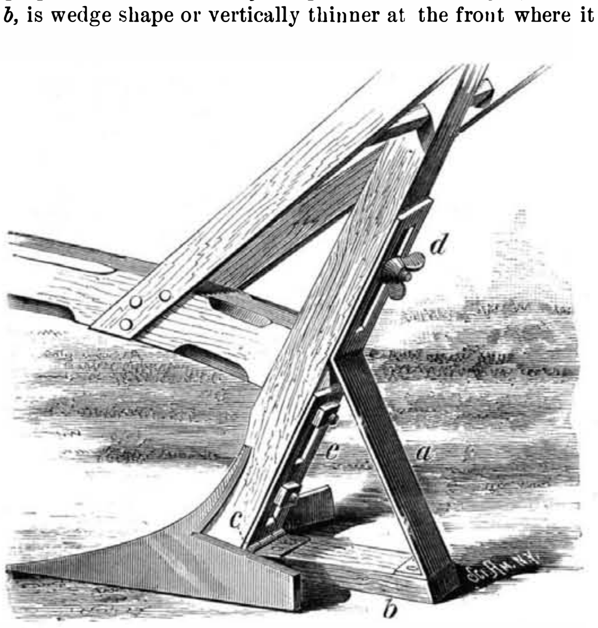
Prof. A. Vogel estimates the tannin in the following manner: 1 gramme of glue (gelatine) is dissolved in 100 c. c. of a solution of sal ammoniac, saturated in the cold, by the aid of heat. When cold it is standardized with tannin in such a way that 100 c. c. of the solution corresponds to 1 gramme of tannin.

Four grammes of the material to be assayed are cut up fine and moistened with water, left standing for 24 hours exposed to the air, then boiled in water, which is to be renewed three times, so that the total quantity of liquid will equal about 300 c. c. The previous moistening renders the extraction much more complete than when it is boiled at first.

When cold 20 c. c. of this solution is mixed with 20 c. c. of the cold saturated sal ammoniac solution, and into this mixture the glue solution is run from a burette, until on taking out a drop on a watch glass and adding a solution of tannin, a slight turbidity is noticeable. The precipitate settles so as to leave a clear solution above.—*Landw. Ver. Bayern.*

PLOW GAUGE.

The plowshare or cultivator shovel is attached to the foot of the stock by a bolt, so that the shovel fits in a recess in the stock, forming a shoulder that takes the thrust of the work. To the back of the stock is an apertured plate, *e.* Back of the plate is a block having a projection fitting in the aperture of the plate so as to form guides in which slides the plate. This projection is slightly thicker than the plate, so that the bolt may be tightened without binding the plate fast to the stock, to which the plate may be tightened by an upper bolt to secure the forward end of the shoe, *b*, at a proper level to suit the style of plowshare. The gauge shoe, *b*, is wedge shape or vertically thinner at the front where it



HOLT'S PLOW GAUGE.

is connected to the plate by a hinge joint, thus allowing a free swing to the rear end, which is connected to the stock by a bent bar, *a*, held to the stock adjustably by a bolt passing through the stock and a block for guiding the plate. The bar is locked by the nut, *d*. The gauge may be adjusted as desired without loosening the connection of the share with the stock, and when it becomes necessary to change the stock it may be readily done by running off the nut, *d*, and swinging the bar and shoe forward on the hinge entirely free from the bolt connections of the plowshare.

This invention has been patented by Mr. Theodore Holt, of Lexington, Texas.

SHEEP GATE.

The design of this invention is to facilitate the feeding of sheep. The gate is constructed with journals upon the projecting ends of the upper bar, which work in slots in the upper ends of the gate posts, and is provided with a lever handle by which it may be raised. To the handle is secured a catch hook, B, which is placed over the pin, C, when it is expedient to keep the gate up. One end of the upper bar of the gate is extended, and from the end of the extension is hung the weighted box, E, so that the weight of the gate is counterbalanced; and as the upper part of the post swivels at A, the gate can be swung open to admit teams or large animals

SCOTT'S SHEEP GATE.

if necessary. The forward part of the slotted upper end of the post, D, is shortened, so that the longer rear part will serve as a stop for the journal of the bar to strike against when the gate is swung shut, thus preventing the journal from swinging over.

This invention has been recently patented by Mr. James W. Scott, of Uhrichsville, Ohio.

Death of a Japanese Student.

Prof. Max Müller, in the London *Times* of Sept. 25, gives the following interesting account of the exemplary life of a Japanese student at Oxford University, whose death is chronicled from his home in Japan.

Kenjin Kasawara was a young Buddhist priest who, with his friend Bunyia Nanjio, was sent by his monastery in the year 1876 from Japan to England to learn English in London, and afterward to study Sanskrit at Oxford. They both came to me in 1879, and, in spite of many difficulties they had to encounter, they succeeded, by dint of hard, honest work, in mastering that language, or at least so much of it as was necessary for enabling them to read the canonical books of Buddhism in the original—that is, in Sanskrit. At first they could hardly explain to me what their real object was in coming all the way from Japan to Oxford, and their progress was so slow that I sometimes despaired of their success.

But they themselves did not, and at last they had their reward. Kasawara's life at Oxford was very monotonous. He allowed himself no pleasures of any kind, and took little exercise; he did not smoke, or drink, or read novels or newspapers. He worked on day after day, often for weeks seeing no one and talking to no one but to me and his fellow worker, Mr. Bunyia Nanjio. He spoke and wrote English correctly, he learned some Latin, also a little French, and studied some of the classical English books on history and philosophy.

He might have been a most useful man after his return to Japan, for he was not only able to appreciate all that was good in European civilization, but he retained a certain national pride, and would never have become a mere imitator of the West. His manners were perfect—they were the natural manners of an unselfish man. As to his character, all I can say is that, though I watched him for a long time, I never found any guile in him, and I doubt whether, during the last four years, Oxford possessed a purer and nobler soul among her students than this poor Buddhist priest. Buddhism may, indeed, be proud of such a man. During the last year of his stay at Oxford I observed signs of depression in him, though he never complained. I persuaded him to see a doctor, and the doctor at once declared that my young friend was in an advanced stage of consumption and advised him to go home. He never flinched, and I still hear the quiet tone in which he said: "Yes, many of my countrymen die of consumption." However, he was well enough to travel and to spend some time in Ceylon, seeing some of the learned Buddhist priests there and discussing with them the differences which so widely separate Southern from Northern Buddhism. But after his return to Japan his illness made rapid strides. He sent me several dear letters, complaining of nothing but his inability to work. His control over his feelings was most remarkable.

When he took leave of me his sallow face remained as calm as ever, and I could hardly read what passed within. But I know that after he had left he paced for a long time up and down the road, looking again and again at my house, where, as he told me, he had passed the happiest hours of his life. Once only, in his last letter, he complained of his loneliness in his own country. "To a sick man," he wrote, "very few remain as friends." Soon after writing this he died, and the funeral ceremonies were performed at Tokio on the 18th of July. He has left some manuscripts behind, which I hope I shall be able to prepare for publication, particularly the "Dharma saugraha," a glossary of Buddhist technical terms ascribed to Nagarguna.

But it is hard to think of the years of work which are to bear no fruit; still harder to feel how much good that one good and enlightened Buddhist priest might have done among the 32,000,000 of Buddhists in Japan. *Have, pia anima!* I well remember how last year we watched together a glorious sunset from the Malvern Hills, and how, when the western sky was like a golden curtain, covering we knew not what, he said to me, "That is what we call the eastern gate of our Sukhavati, the Land of Bliss." He looked forward to it, and he trusted he should meet there all who had loved him, and whom he had loved, and he should gaze on the Buddha Amitabha—*i. e.*, "Infinite Light."

Bisulphide of Carbon a Cause of Insanity.

California physicians who have attended various cases of trouble arising from the poisonous properties of bisulphide of carbon, have become satisfied that the inhalation of the vapor of this substance will produce insanity. The bisulphide is used in Los Angeles County to prevent the spread of the grape disease, phylloxera. Several strong and healthy men who have been exposed to the fumes of the vile stuff have become insane. It may be a subject worthy of investigation whether other deleterious gases may not in like manner affect the human brain.

FENCE.

The fence shown in the accompanying engraving is cheap, yet strong and substantial, requires but little ground space, offers little or no obstruction to the clearing away of weeds from about it, and can be quickly and easily set up, removed, or repaired. The posts have the general form of a ∧ connected at top and bottom by brace bars, and are set in sockets of earthen tiles. The rails rest upon the upper brace bars, the overhang of the inner edges of the tops of the posts serving to lock the overlapped ends of the rails, thus doing away with special fastenings for this purpose. Around the overlapped ends of the top rails a wire is wound, and at regular distances the wire is bent upon itself so as to form eyes in which the clip wires for securing the ends of the lower rails are fastened. The wire hangers are provided for each side of the post, and the ends of the lower rails are kept apart, thereby saving the material that would be necessary if they overlapped, and also facilitating the removal of any particular panel. The ends of adjacent lower rails may

READ'S IMPROVED FENCE.

be connected by splice bars held in place by the clip wires, and in localities visited by violent winds the fence may be anchored by strong galvanized wires passed around the splice bars and fastened to plates firmly embedded in the ground. The fence may be constructed with only one hanger at each panel joint by attaching a double number of clip wires. The panels may be strengthened by crossed wooden or metallic braces. The metallic post shown at the left of the engraving leaning against the fence, may be substituted for the wood.

This invention has been patented by M. John W. Read, of West Salem, Ohio.

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Photographic Notes.

RECOVERY OF SILVER FROM HYPO BATH.

The *Photographische Wochenblatt* recommends the precipitation of silver from the fixing bath with an old oxalate developer that still contains enough protoxide for this purpose. The precipitate is in a very fine state of division, and difficult to filter.

THE FINEST BROMIDE OF SILVER.

For obtaining this salt in an extremely fine state of division the same journal advises saturating ammonia water with carbonate of silver, and neutralizing with bromine water. The precipitate is never curdy, and the liquid smells of carbonate of ammonia.

VARNISHING DRY PLATES.

Alcoholic varnishes are not adapted to gelatine films, hence Wilkinson uses the borax solution of shellac. It may be flowed on the plates while wet. The varnish should be filtered over bone black.

SENSITIVENESS OF DRY PLATES.

According to Pritchard, when the emulsion is dried without heat, say at 30° to 68° Fahr., the plates are more sensitive, and will develop four times as fast as when dried at a higher temperature.

DEVELOPING DRY PLATES.

They should first be soaked in water to soften them, but not too much.

Heating Small Plant Houses.

The following plan for heating small green houses and conservatories, a writer in the *American Garden* recommends: While employed, he says, some years ago, in England, by a gentleman who found that the usual brick flues required more time and attention than could be given by his gardener, I constructed a cistern under the plant stand, the whole length of the house. This tank was made of planks, the joints laid in white lead. Over its entire length was placed a box six inches deep, and containing sand, which served as a cover and was used for the propagation of various plants by cuttings. The heating apparatus consisted of a small copper boiler holding about eight gallons. From the top of this a lead pipe communicated with the top of the cistern, and another pipe, protected against the fire, ran from the bottom of the tank to the bottom of the boiler. The management of this apparatus required but little care and time, while a continuous and uniform heat was maintained at a comparatively small cost.

I have since fitted up a similar and still less expensive apparatus, in which the boiler of the kitchen range supplied the necessary heat, and common iron gas pipes were used for the conveyance of the water.

It will readily be perceived that the large body of warm water will keep up a more steady and uniform heat than could be produced by pipes alone; and if the supply pipe is carried to the extreme end of the tank, the water will be kept in constant circulation.

Various modifications, adapted to existing conditions, might be suggested. For a small room, an ordinary stove could be used; and as there is little or no pressure of steam, almost any metallic vessel that holds water may be made to serve the purpose of a boiler.

Preparation of Hydrobromic Acid.

W. Gruning, in Moscow, has published in the *Pharmaceutische Zeitschrift fur Russland* the results of his investigations upon the preparation of hydrobromic acid on a small scale. He succeeded best when using phosphoric acid to decompose the bromide of potassium, and then conducting the gas into water. He therefore recommends the following method:

Take 100 grammes of coarsely powdered bromide of potassium and 280 grammes of phosphoric acid, specific gravity 1·304. Place them in a glass flask that will hold half a liter (16 oz.) and provided with a gas delivery tube. On heating the flask over a gas or alcohol flame, on a wire gauze, the salt will soon dissolve in the liquid, but as the water evaporates it separates again. The liquid then begins to bump, but not sufficiently to endanger the flask, and this can be avoided by moving the flame to one side. In a short time it will boil quietly again, as the mass is gradually converted into metaphosphate of potassium.

The first portion of the distillate is merely water, and is allowed to escape, then an aqueous acid goes off, and finally pure hydrobromic acid gas, which is passed into distilled water. As bromide of potassium is seldom free from the chloride, it is advisable to collect the first portion apart and test it for hydrochloric acid, which passes off before the hydrobromic acid.

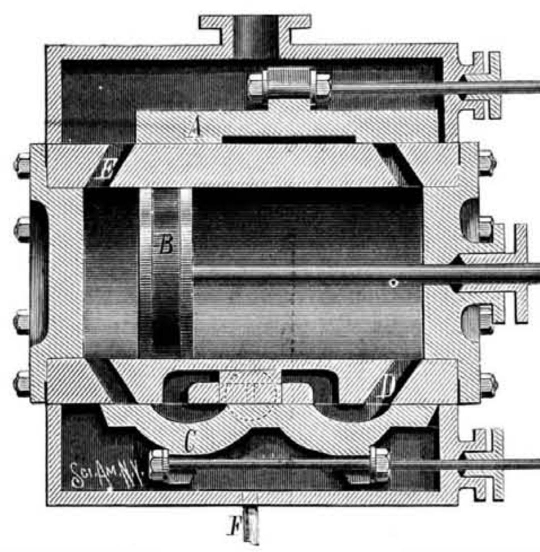
Since hydrobromic acid gas is rapidly absorbed by water, some precaution should be taken to prevent the water from rushing back into the generating flask. He prevents this by using an inverted funnel, which is attached to the delivery tube and dips under the surface of the water. If the water is drawn up into the funnel, its level will be lowered sufficiently to allow air to enter the tube.

Acid of any desired concentration can be obtained in this way, and its strength ascertained volumetrically or by its specific gravity. It yields 80 per cent of the theoretical quantity of 10 per cent acid.

Mount Jefferson Davis is the highest peak in Nevada. Its altitude is 13,075 feet.

SLIDE VALVE.

The invention illustrated herewith refers to that class of engines employing separate slide valves for the admission and exhaust of steam. The admission of steam is controlled by the valve, A, opening and closing the ports, E, and moved by a rod connected to an eccentric. The exhaust valve, represented at C, works within a separate chest placed diametrically opposite the steam valve chest, or at right angles if so preferred. The exhaust valve has recesses which alternately connect the steam exhaust ports, D, from the cylinder with the exhaust passages communicating with the common outlet. The pipe, F, admits live steam for the purpose of holding the valve, C, firmly on its seat. As the valve, C, covers the ports during its whole stroke, no escape



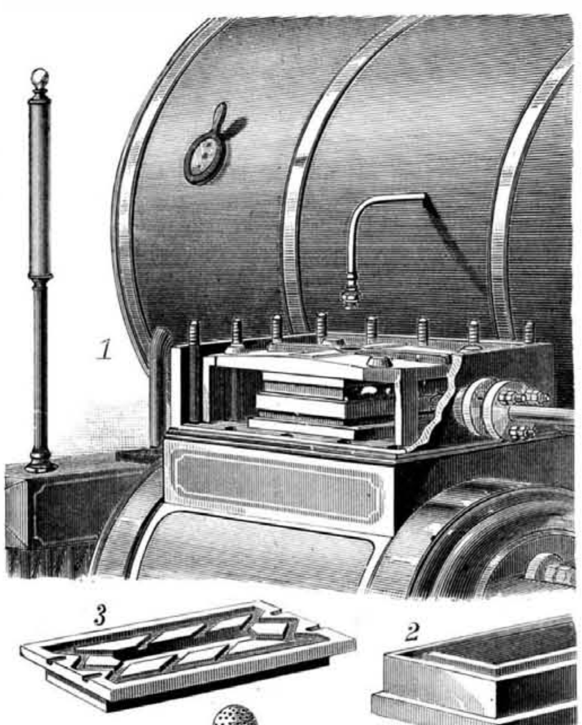
DOTY'S SLIDE VALVE.

of steam is possible. This plan permits the setting of the valves with the greatest precision, and permits also of their being driven by different connections for maintaining any relative adjustment with each other.

This invention has been patented by Mr. Riley Doty, of Leonardsburg, Ohio.

BALANCED SLIDE VALVE.

The accompanying engravings illustrate an invention belonging to that class of slide valves that are fitted to work beneath a face plate placed in the steam chest. The valve —shown in perspective in Fig. 2 and also in Fig. 4, which is a section through the steam chest and valve—is of a rectangular form, and is fitted upon its outside with packing bars set in grooves. The face plate fits closely in the steam chest, with the exception of openings at the corners and at the opposite sides of the steam chest, which are provided to



DE LANCEY'S BALANCED SLIDE VALVE.

allow free circulation of oil and steam. The plate is supported by rests (shown in Fig. 1) cast upon its under side, or by lugs cast upon the inner surface of the chest. The balance plate, Fig. 3, rests upon the packing bars of the valve, and is formed with flanges upon its under side that fit in the top of the valve so that the plate will be moved with the valve. The upper surface of the plate is made with grooves extending around it at a distance from its edges about the width of the packing bars of the valve beneath it. These grooves are connected by cross grooves with the central aperture, so that they are connected with the exhaust cavity of the valve. The object of this is for the purpose of balancing the pressure and for conducting the steam that may leak past the outer edges of the plate to the exhaust. The groove also serves for the admission of exhaust steam and oil between the upper side of the balance plate and the under side of the face plate. At the ends of the balance plate are short grooves for admitting steam between the two plates for lubricating that portion not covered by the other grooves. There are projections upon the face plate for receiving the ends of set screws which hold the plate down. Upon the cover of the steam chest is a valve for admitting air when the engine is running without steam. Fig. 1 shows the valve attached to a locomotive. The valve is giving most satisfactory results on locomotives on different roads and also on stationary engines.

This invention has been patented by Mr. John J. De Lancey, of Binghamton, New York, who should be addressed for further information.

Hot Water for Inflamed Mucous Surfaces.

Dr. George R. Shepherd, Hartford, Conn., says in the *Medical Record*: I have used hot water as a gargle for the past six or eight years, having been led to do so from seeing its beneficial effects in gynecology. In acute pharyngitis and tonsillitis, if properly used at the commencement of the attack, it constitutes one of our most effective remedies, being frequently promptly curative. If used later in the disease or in chronic cases, it is always beneficial, though perhaps not so immediately curative. To be of service it should be used in considerable quantity (a half pint or pint) at a time, and just as hot as the throat will tolerate. I have seen many cases of acute disease thus aborted and can commend the method with great confidence. I believe it may be taken as an established fact, that in the treatment of inflammations generally, and those of the mucous membranes in particular, moist heat is of service, and in most cases hot water is preferable to steam. All are familiar with its use in ophthalmia and conjunctivitis, as also in inflammation of the external and middle ear, and I feel confident that those who employ it for that most annoying of all slight troubles to prescribe for, viz., a cold in the head, or acute coryza, will seldom think of using the irritating drugs mentioned in the books, nor of inducing complete anæsthesia with chloroform in preference to the hot water douche.

Venice and Her Glass Bead Industry.

Beads are largely made in Venice, where glass making has always been a principal industry. It is said that the invention of beads dates from the thirteenth century, and is due to two Venetians—Miotti and Imbriani—who were urged to make experiments by the celebrated Venetian traveler, Marco Polo. Under the Venetian Republic, and for some years after its fall, says our consul at Venice, the exportation of beads had not reduced the importance it has now attained. This was, perhaps, owing to the smallness of the furnaces and to the difficulty and length of the technical processes required for the composition of the paste. The Morelli, however, who in 1670 were the principal bead manufacturers, had four ships at sea carrying beads to the East on their own account, and they became so rich that in 1860 they entered the rank of the Venetian nobility on payment of a sum of 100,000 ducats to the Republic. Since 1815 this industry has become so important as to give at the present time employment to about 15,000 persons. The traffic is carried on with all the world, but the principal exportation of beads is to the ports of Asia and Africa. An extraordinary stimulus was given to this industry a few years ago by the prevailing taste for beads for trimming ladies' dresses. A great extension of the manufacture took place, and the labor was paid so high that all who could do so gave up their usual trades for bead making. But when the demand for beads declined, most of the workmen who had been allured by fancy wages to the bead manufacture were thrown out of work, and compelled to return to their former occupations. Whatever be the cause, bead making has always been the special privilege of Venice, in spite of all foreign attempts to manufacture this article elsewhere. The wages in glass works are for a first master about 8f. a day, for a second master 4½f., and for the ordinary workmen from 2f. to 5f. a day. During the last five years the average annual exportation of beads has been 25,000 quintals, of the approximate value of 5,500,000f.

Liquid Oxygen and Nitrogen.

We are slowly learning more of the liquid and solid states of the elementary and compound bodies formerly known as permanent gases. According to the latest researches, oxygen when cooled to 136° C. (213° F.) liquefies to a colorless transparent liquid at the very moderate pressure of 23 atmospheres, or thereabouts. Nitrogen at the same temperature does not liquefy at a pressure of 150 atmospheres, but yields a colorless liquid, with distinct meniscus, when the pressure is cautiously allowed to fall to a point not lower than 50 atmospheres. It is now well known that ozone, under quite moderate limits of pressure and temperature, is a liquid of intensely blue color, which gives a vapor which can only be compared in color with the brightest blue sky. In this condition ozone is a most potent body, decomposing with explosion upon slight provocation into common oxygen. Pure alcohol is a white solid at about 130° C. (202° F.). At a very slightly higher temperature it is viscous, like oil

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THE BARNEY AUTOMATIC DUMPING BOAT.

(*Continued from first page.*)

If the various public officers having charge over the waters of our harbor are really in earnest in all they have said and caused to be written about the danger of the channels being blocked up, they will at once acknowledge the advantages of this system and encourage its use.

If the present dumping ground is not sufficiently far at sea to prevent danger to the harbor and the drifting of refuse upon the shore, let it at once be removed to a point where no harm can come from it—where the ocean currents will carry the material beyond the influence of tides.

These boats are perfectly capable and were built for the purpose of going far to sea. One of the great advantages of this boat is that they can be readily changed to carry dredging, garbage, or freight, their carrying capacity being over 500 tons. The office of the Barney Dumping Boat Company is at 346 Broadway, New York city.

The German Population of the United States.

The occurrence lately of the bicentenary of the arrival of the first German immigrants in America has directed attention on both sides of the Atlantic to the numerical strength of the German element in the United States. The New York *Journal of Commerce* declares that this can be inferred only very inadequately from the last census returns. The only persons reckoned in it as "Germans" are those born within the present German Empire. Austrian and Swiss Germans are credited to their respective States. The last census has this advantage over its predecessors—that it tells us how many native born American citizens are children of German parents (understanding the term "German" in its restricted application to natives of the present German Empire); 4,883,842 had German fathers, and 4,557,625 German mothers. Other tables enable us to form an estimate of the number of those children who have had both parents Germans; and so we may set down the total number of children having one or both parents Germans at about 5,500,000. To this should be added about 400,000 out of the large number of persons of foreign origin whose actual place of birth is not given; the Germans from Austria, Switzerland, and Luxemburg; and those Alsatians who, although talking German, are classed as French. All these may be set down at 200,000. We may also fairly throw in the number of those Pennsylvanians, etc., who still use German as the language of ordinary intercourse. If all these items be reckoned up, it will be seen that the German American element cannot fall short of nine millions. Should any one think this estimate too high, let him remember there are thousands of descendants of Germans who speak the German language as their mother tongue, and all whose sympathies and connections are with the German element, although in the census they are returned as pure Americans.

Effect of Metallic Poisons on the Spinal Cord.

The affections of the nervous system produced by contamination with certain metals, as lead and mercury, have been studied more extensively clinically than pathologically, and even yet it may be held to be undetermined whether the action of the poison is upon the peripheral or the central apparatus. Dr. Popow has recently put on record the results of anatomical investigation upon animals (chiefly dogs) poisoned by arsenic, lead, and mercury respectively (Virchow's *Archiv*, 93, Heft 2), and in most cases he was careful to administer the poisons in varying quantities, so as to contrast the effects of acute and chronic poisoning.

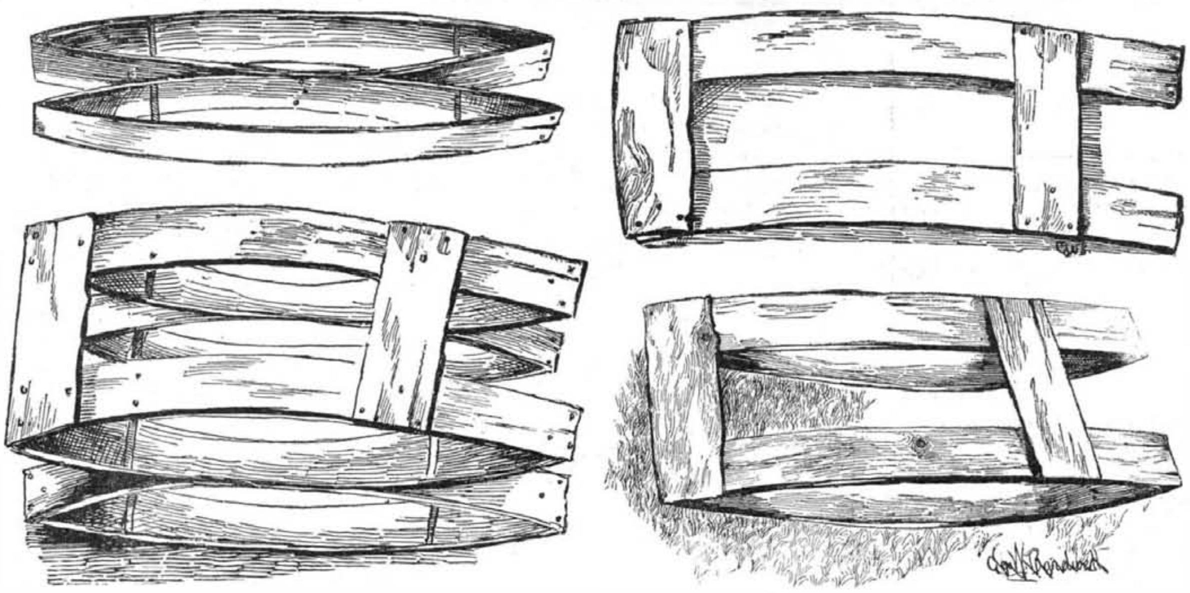
The general result of his inquiry goes to show that marked changes of an inflammatory character occur in the spinal cord, both in the gray and white matter, under all these conditions. In acute arsenical poisoning the spinal cord was softened, the gray matter especially being reddened and swollen; there was proliferation of the nuclei of the blood vessels, and an exudation of a peculiar hyaloid substance. The nerve cells were swollen, their processes dwindled, and their protoplasm granular or vacuolated, while in the white columns the axis cylinders showed irregular thickenings. In chronic poisoning it was difficult to discriminate between the two portions of the cord, the divided surface having a yellowish-red color throughout; the walls of the vessels were thickened, and hyaline masses abounded; the nerve cells vacuolated, or shrunken and pigmented; while free pigment masses, representing traces of hemorrhage, occurred throughout the sections. In other words, there is, in poisoning by arsenic, a central myelitis at first, and later a diffuse myelitis. Very similar changes were found in the spinal cord after poisoning by lead—namely, exudation from blood vessels; a general affection of the nerve cells, beginning as cloudy swelling, and passing into atrophy and pigmentation; and inflammatory swelling of the axis cylinders.

In mercurial poisoning, the early changes consist of hyperæmia of membranes and of the cord, followed by hemorrhages, inflammatory exudation, and changes in the nerve substance hardly differing from those seen in the other two cases. In each instance the peripheral nerves and the nerve roots showed no alteration; so that the conclusion is that the paralysis, spasms, etc., characteristic of the toxic effects of these metals, depend upon a central rather than a peripheral disturbance, all the degenerative changes described as occurring in nerves and muscles being strictly deuteropathic.—*Lancet.*

COASTING WITHOUT SNOW.

Most boys are very fond of coasting, but there are very few who have ever had an opportunity of coasting in summer. Many boys have looked longingly at steep, grassy hills, and have wished that Jack Frost would hasten on, so that they might enjoy the winter sport. They would like to learn how to slide downhill in summer on the grass without getting wet feet, frost-bitten fingers, and other discomforts of cold weather.

While on my vacation in the Berkshire Hills I made a sled on which I could slide down a tolerably steep hill on the grass as nicely and swiftly as on the snow in winter. I will describe it, so that others can enjoy the sport, and fine sport it is. It is in many respects superior to real coasting.



SLEDS FOR COASTING WITHOUT SNOW.

My sled is a very simple affair, being composed entirely of barrel staves. I made two kinds of grass sleds, single spring and double spring. The single spring is much the simpler, and requires only five staves, while the double spring requires nine.

In selecting the staves take those which are the widest and curve the most; also take those which will bend the least. If very strong staves cannot be had, a brace must be placed at the end of each runner, between the upper and lower staves. It is better to do without this block, if possible, as it interferes with the springiness of the sled. In making the single spring sled this block should be nailed on to the lower stave of the runner before the lower stave is fastened to the upper. Care should be taken in nailing the staves together not to get the nails too close to one another, as this is liable to split the wood. After being driven through, the nails should be clinched. For this purpose wrought nails are the best. The seat and board on which the feet are placed should be nailed to the upper staves before these staves are fastened to the lower.

COASTING WITHOUT SNOW.

In making the double spring sled the advantage is that it is much more springy, and therefore rides more easily. The seats should be fastened on as on the single spring sled. Each stave should be nailed to another before the couples of staves are fastened together. In fastening the seats a solid support introduced between the staves as they are nailed together will prevent them from springing under the hammer.

In sliding down the hill, in order to steer, a short stick should be taken in each hand and dug into the ground on the side toward which you wish to go.

GEO. BARDWELL.

The Deepest Well in the World.

The McGuigan gas well, the light from which can be plainly seen from the top of Wheeling Hill, is the pioneer gas well of this vicinity. It led to all of the others now making such a turmoil in this valley. It was sunk for oil, not gas, and the great gaseous reservoir was tapped unawares. Just three miles nearer us the Buchanan well was sunk, and is now the deepest well in the world, having reached 4,300 feet, and is still going down. When a depth of about 3,000 feet was reached the tools broke and were left there, and for some time the well was deserted. Then a new concern took hold of it, and is now vigorously drilling for the greasy fluid. The rope broke in March, and the cable, between 4,000 and 5,000 feet in length, and weighing several tons, parted seven hundred feet from the top, and all efforts to catch hold of it and draw it out with the great iron shaft or drill at the lower end failed. The workmen were then discharged and the public supposed the well abandoned. Superintendent Crocker had no thought of quitting the work. Additional tools were procured, and at a recent date work was resumed. The well, which was dry, was filled with water to assist in floating the cable, a proper instrument was inserted, and the rope was caught and lifted out. It was supposed that after getting the rope taut, a "sucker rod" would have to be sent down to loosen it from the drill at the bottom, as that was fast and could not be lifted with the weakened rope. Fortunately the rope cut itself off where it was attached to the shaft, and thus saved a great deal of trouble. The next thing to do was to remove the water from the well, and pumping was resorted to, when nearly a barrel of very fine crude oil was obtained. The well is cased to the depth of 1,200 or 1,400 feet and is dry. When the water is removed, which will be done in a day or two, a "spear" will be sent down after the drill, and no difficulty is anticipated in bringing it to the surface. When this is accomplished the work of deepening the well will be recommenced. Mr. Crocker states that the machinery he has on the ground will enable him to go 500 feet deeper, and by increasing its power he could go to the depth of 7,000 feet, but he hopes to reach oil in paying quantities at a small additional depth.—*Wheeling* (*W. Va.*) *Register.*

Croton Chloral in the Treatment of Whooping Cough.

W. C. Webb, M.D., of Bryantsville, Ky. (*American Practitioner*, August, 1883), has come to the conclusion, from the treatment of nearly two hundred cases of whooping cough, that croton chloral is by far the most valuable single remedy for its relief. He has found that it is well borne by children. To affect the disease it must be given in decided doses. A child twelve months old will bear one grain of the medicine every four hours throughout the twenty-four. During the first week not less than this should be given. Thereafter, the cough is usually so much relieved that few if any doses are required at night. If the drug be thus pushed to its full effect, there are few cases that may not be entirely controlled in a fortnight. The dose for children ten years old should be two grains every four hours; adults will bear only about four grain doses. The drug thus used does not derange digestion or affect the vital nervous centers. The first few doses may cause some irritation about the throat and fauces, but this soon ceases. The relief is so marked in some cases that patients fall asleep in their chairs.

Croton chloral, if pulverized, will dissolve readily in compound tincture of cardamom. The following is a good prescription: R. Croton chloral, ʒ i.; tinct. cardamo., glycerine, āā ℥ ij. M. Sig. One-half teaspoonful every four hours, for a child two years old and under. A less expensive and very useful mixture is as follows: R. Croton chloral, ʒ i.; tinct. belladonnæ, ʒ ij.; tinct. cardam. co., ℥ ij.; glycerine, ℥ iij. M. Sig. Dose, one-half teaspoonful. If the paroxysms of cough are exceedingly severe, and if there is extreme gastric irritability, the croton chloral should be preceded by a few whiffs of chloroform. The anæsthetic thus used produces the happiest effects, and it need not be repeated more than two or three times. The combination of bromides with the croton chloral is of doubtful utility. If any of them are to be used, the bromide of quinine should be preferred. Watchfulness should, of course, be exercised during the use of croton chloral, lest toxic symptoms should be manifested.

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Correspondence.

Hearing the Whistle.

To the Editor of the Scientific American:

I lived at one time about one and a half miles west from Havana, N. Y., at an elevation of about 600 feet above the valley at the head of Seneca Lake. I have frequently heard the locomotive whistle distinctly at Corning and at Elmira, N. Y., a distance of about eighteen miles from where I lived. The condition of the atmosphere at such times was looked upon as indicating an approaching storm.

BURR NOBLE.

San Francisco, Cal., October 11, 1883.

To the Editor of the Scientific American:

I have often heard locomotive whistles from Nevada, which is not less than nine miles on an air line. I have heard the mill whistle a few times from the same place. I have also heard the locomotive whistle a few times in favorable weather from Fort Scott, Kansas, which is a trifle over seventeen miles. I have heard the foundry whistle from the same place. This is not an every day occurrence, for the weather must be favorable to hear from any of these points.

D. K. HUBBS.

Mount Vernon County, Mo.

The English Skylark in America.

To the Editor of the Scientific American:

Under the above heading appeared in No. 12—September 22d, 1883—of the SCIENTIFIC AMERICAN, an account of the successful acclimation of the skylark in Bergen County, New Jersey.

Permit me, sir, to correct several errors in the notice referred to, viz.:

The skylarks were first brought to America for acclimation purposes in 1873 by the undersigned, then Secretary of the "Cincinnati Acclimatization Society," and set free in the spring of 1874 at Burnett Woods Park, near Cincinnati. They have since returned, or at least some of them, and every spring chosen as a place for abode a spot near the point where they first greeted the free American air, namely, a summit in the vicinity of the park before named.

Contrary to their habits in Europe, these skylarks have selected a hilly ground as their favorite place of abode, whereas in the old country the skylark generally inhabits meadows or a level country. The writer of the notice in question states that the skylark is *not* a migratory bird. In this he is, however, not in accord with the facts, for the skylark is a migratory bird; only in rare instances small numbers remain over winter in northern climates. Why, further, the same writer should use the term *English* skylark, I do not comprehend. Many also call the common sparrow in America *English* sparrow, but neither of these birds are of English origin, nor are they found solely in England.

ARMIN TENNER.

Berlin, Germany, October 6, 1883.

Hearing the Whistle.

To the Editor of the Scientific American:

I have been a reader of your paper for five years, and cannot do without it. It is worth $10 a year to me. I have read quite a number of articles in my paper about hearing locomotive whistles a long distance; so thought I would tell what I have heard many times: This village is twelve miles south of east from Blood's depot, on the Rochester division of the Erie Railroad; three valleys and four ranges of hills intervene. It is nothing uncommon, on quiet days preceding a storm, to hear the throbbing, rumbling sound of trains passing that place, and I have often followed them by the sound till they reached Kanona, a station twelve miles west of south from here, the whistles being very distinct at the intervening stations. I have heard this many times from a place one mile east of here, and have frequently listened and distinctly heard the whistle of trains as they approached a station (Wayland) four miles farther west of Blood's depot. I do not hesitate in saying that I have heard locomotive whistles *sixteen* miles away, and have hundreds of times heard the roar of passing trains twelve miles away. This statement can be vouched for by reliable men living here in this village.

F. M. M.

Prattsburgh, N. Y., October, 1883.

Nickel Plating on Zinc.

BY PROF. H. MEIDINGER.

Successful electroplating in general depends on three conditions: on the quality and properties of the metallic solution (the bath), on the strength of the current, and its relation to the surface of the pole, which determines the thickness of metal deposited in a unit of time (rapidity of precipitation), and on the nature of the surface of the pole on which the metal is to be deposited. If the pole is of metal and is to be inseparably united with the deposit, as is the case with silver plating, the surface must be perfectly clean and free from oxide or grease. If the surface is dirty, the precipitate peels off. It will not adhere at all to nonmetallic substances, but merely incloses it.

It is a fact worthy of attention that under otherwise similar conditions many metals do not take certain deposits well. In some cases the deposit is streaked, powdered, or of bad color, and in others it peels off afterward when polished. Iron in its different forms (steel, wrought iron, or cast iron), zinc, lead, and tin cannot be readily silvered or gilded in the cyanide bath, although it works first rate on copper and its alloys, and is generally used for that purpose. But of the copper alloys German silver causes more difficulty than brass. Copper, brass, and iron are easily plated in the nickel bath; zinc, on the contrary, is not. In some of these cases the metal to be plated acts directly on the solution itself, as, for example, zinc acts on silver and nickel solutions, and this circumstance may affect the properties of the whole deposit; this does not happen with iron.

If a metal cannot be nicely plated in a bath, it is customary to cover it first with some other metal of better quality in this respect. Thus iron, zinc, and tin are easy to silver and gold plate after they have been copper plated, and zinc can also be nickel plated under these conditions.

To unite the deposit as firmly as possible with the object, it has been found in many cases advantageous to slightly amalgamate the surface of the metal to be plated, especially in giving a thick coating of silver to instruments. The method is extremely simple, for it is only necessary to dip the articles for a short time into a mercurial solution and then rinse them with water.

The quantity of mercury used is insignificant, in fact a heavy amalgamation must be avoided, as it would make the metal brittle. A mercurial solution serviceable for this purpose is made with the commercial mercuric nitrate or chloride (corrosive sublimate). The solution must be very dilute, about one, five, or at most ten parts of the dry salt in a thousand parts of water; to this solution some sulphuric or chlorhydric acid is to be added until the liquid is perfectly clear. The stronger solution gives up more mercury in a given time than a weaker one, and this must be taken into account in amalgamating. With practice it is easy to tell from the change of color when enough mercury has been deposited. Iron does not alloy, or only very badly, with mercury, and hence it cannot be subjected to the process just described.

Within the last decade nickel plating has reached an extraordinary development. At first it was limited to iron, then it was gradually extended to brass and German silver, and now is increasing in favor for coating zinc. As this metal takes the nickel from ordinary baths very badly, it has been proposed to copperplate it in the cyanide bath. But this is a nuisance. The use of the poisonous cyanide bath should be avoided as far as possible, and limited to cases where it cannot be dispensed with; in nickel plating, cyanides are not absolutely necessary, even if an intermediate layer of copper is desirable in thick nickel plating. The cyanide of copper (and likewise brass) bath has a disagreeable property of only working when certain conditions are exactly observed; it also decomposes easily. As the nickel wears off by use the red shines through, which is worse than if the white zinc itself were laid bare. Experience also showed that coppered zinc, when it came into the nickel bath, at once turned black and could not be plated.

There is not yet any literature on amalgamating zinc for the purpose of nickeling it. On many sides objections are heard against the deficiencies of the customary process of nickel plating, and it seemed to me worth while to make some experiments in this direction. The experiments were satisfactory. I amalgamated a sheet of zinc and then had it nickel plated by Schwerd in Carlsruhe. The nickel adhered well, united perfectly, and took a fine polish. I think it is not improbable that the nickeled sheet-zinc of commerce is prepared in a similar manner. This supposition receives support from one of the properties of this zinc to which my attention was called by Beuttenmüller, who has used a good deal of it in his factory.

It is rather brittle in comparison with pure sheet-zinc. I cannot explain this brittleness in any other way than due to amalgamation. The alloys of mercury with solid metals, called amalgams, exhibit this property, that the mercury dissolves off small quantities of the metals to form a thicker liquid; with a larger excess of the solid metals the alloys are solid, but fragile and brittle. This character remains, but grows gradually less. When a sheet of metal is amalgamated, it depends on the quantity of mercury combined with it and the depth to which it penetrates, whether it will cause a perceptible change in the strength of the metal.

Copper must remain in contact with mercury for a long time until it has penetrated a considerable depth; with zinc this takes place very rapidly. A sheet of zinc one millimeter in thickness, thoroughly cleansed in acid, only needs to have metallic mercury poured over it so that it forms a bright mirror to make it so brittle that it will not stand bending. Zinc carries this peculiarity into its alloys with copper, so that brass and German silver are much more sensitive to mercury than copper. If zinc is immersed in a mercurial solution, it will depend upon the time it stays in whether the mercury will be merely deposited upon the surface or will penetrate more deeply into the zinc. A concentrated mercurial solution will make a sheet of zinc one millimeter thick brittle in a few minutes.

The quantity of mercury necessary for nickel plating will have an imperceptible influence on its strength if the zinc is thick; but if it is thin it may show a perceptible difference, which makes it difficult to work the zinc. Special care must be taken to prevent too much mercury being deposited on the zinc by leaving it in the solution too long. The exact quantity can only be determined by experiments that are simple and easily carried out

When one metal is deposited on another by the galvanic current, we cannot speak of them as alloys if they are inseparable, for they are only held together by adhesion. Hence there can be no change in the characters of the two metals; neither a harder nor a more brittle product results from electroplating. If the latter is observed even in a slight degree, it is easy to conclude that there is mercury in it.

Pure zinc has a different action on nickel solutions from amalgamated zinc. The former soon turns yellow and brown, and the deposit can be rubbed off with a piece of paper. If a feeble current is employed this chemical action preponderates, and hence we obtain a poor deposit. If the current is very strong, the zinc will be more rapidly coated with nickel by electrical action than it would by the chemical action of zinc on the solution, and a good deposit can be obtained. It is only by observing these precautions that it is possible to nickel plate zinc directly, and yet this is frequently inconvenient. If amalgamated zinc is dipped into a nickel solution, after a long time feeble action will begin. The mercury, although there is so little of it, protects the zinc against the action of the liquid, like zinc in its alloys with copper, brass, etc., is protected against the attacks of different liquids, copper sulphate, sulphuric acid, etc. Yet in all these cases the protection is incomplete; after a while a slight action is observed. In nickel plating zinc, slight amalgamation will suffice to secure a good deposit with a feeble current.

It has been observed that some kinds of German silver take nickel badly; previous amalgamation may, perhaps, be an advantage here, too.—*Badische Gewerbe Zeitung.*

Coloring Amber.

For coloring amber it is necessary to find a liquid in which the amber can be heated, and this liquid must fulfill, says Prof. Ed. Hanausek, the following conditions. Its boiling point must lie above 150° C. (302° Fahr.), and it is better if it boils above 200° (392° Fahr.). The amber must not be attacked by the hot liquid nor must its physical characters be changed. The liquid must be able to dissolve dyes and not decompose them, or at least not rapidly. It should also be mentioned that the dyestuffs employed must not decompose at 150° or 200° C. Many of the fatty or essential oils, and also solid fats and hydrocarbons which melt below 150°, may fulfill these conditions. The attempt to impart different shades of color to amber were made with linseed oil. The following pigments dissolve in it without being entirely decomposed at 200° C., viz., dragon's blood, alizarine, purpurine, and indigo. Of the aniline colors, fuchsin, aniline violet, methyl green, and alkali blue, all refuse to dissolve in pure linseed oil. In carrying out the experiment a weighed quantity was stirred into linseed oil, and the piece of amber to be colored suspended therein, and slowly heated to 190° or 200° C. The liquid was then kept for some minutes at the temperature of 180° or 200°, after which the source of heat was removed and the hot liquid allowed to cool gradually. After taking the amber out of the oil and cleansing it, it was found to be dyed.

Different colors can be obtained with the above mentioned dyes, and various shades can be produced according to the relative proportions of dye and oil.

A light or dark reddish brown can be made with dragon's blood, bright yellow with alizarine, an orange yellow with purpurine, light or dark green, dark blue, and black from indigo. The proportions of indigo that must be taken to obtain the shades mentioned are given as follows: For light green, one-fourth of a part of indigo to a hundred parts of oil; for dark green, half a part to a hundred; for dark blue, one part of indigo to a hundred; and finally for black, four or five parts of indigo to a hundred of oil; on heating the oil, the indigo dissolves in it and imparts to it a very beautiful reddish purple.

By frequently heating these mixtures to 200° C., both the indigo and the linseed oil suffer some change. The oil gets thicker and turns brown, and when heated it no longer assumes such a fine purple color. A mixture that has undergone this change from heating, colors amber brownish; hence when it is desired to obtain pure shades of green and blue, it is necessary to frequently change the dye baths or renew them. In dyeing black this is not so necessary, yet it has also been observed that in this case, too, the operation succeeds better by using fresh dye baths, or at least adding a little unused indigo to the bath after each heating. In dyeing black it is not necessary to suspend the amber in the liquid, for it is colored more quickly when it lies on the bottom in immediate contact with any undissolved indigo.

If finely pulverized asphalt is put in linseed oil, and the oil heated until it almost boils, a portion of the asphalt will dissolve, forming a brownish liquid and have a distinct green fluorescence. Amber that has been heated in this liquid for a long time to 200° C. acquires a brownish color and has a slight greenish fluorescence. This fluorescence is, however, much more distinct and striking if the amber is subsequently heated in a mixture of one part of indigo in a thousand of oil.

Asphalt is not the only substance that can be employed to impart this fluorescence to amber, as all hydrocarbons which are fluorescent themselves can impart this quality to amber.

Coloring amber is of practical interest in as far as it is a fact that this crude material can have the color changed in every way.

If it is found possible to give to any amber the color and shade of the finest quality, great results may be expected. Moreover, the method of dyeing low priced amber is so simple, that it can very easily be changed to black amber, for example, which is capable of being used for certain purposes.

Rendering amber fluorescent may be of considerable importance.—*Neueste Erfindungen und Erfahrungen.*

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The New English Patent Law.

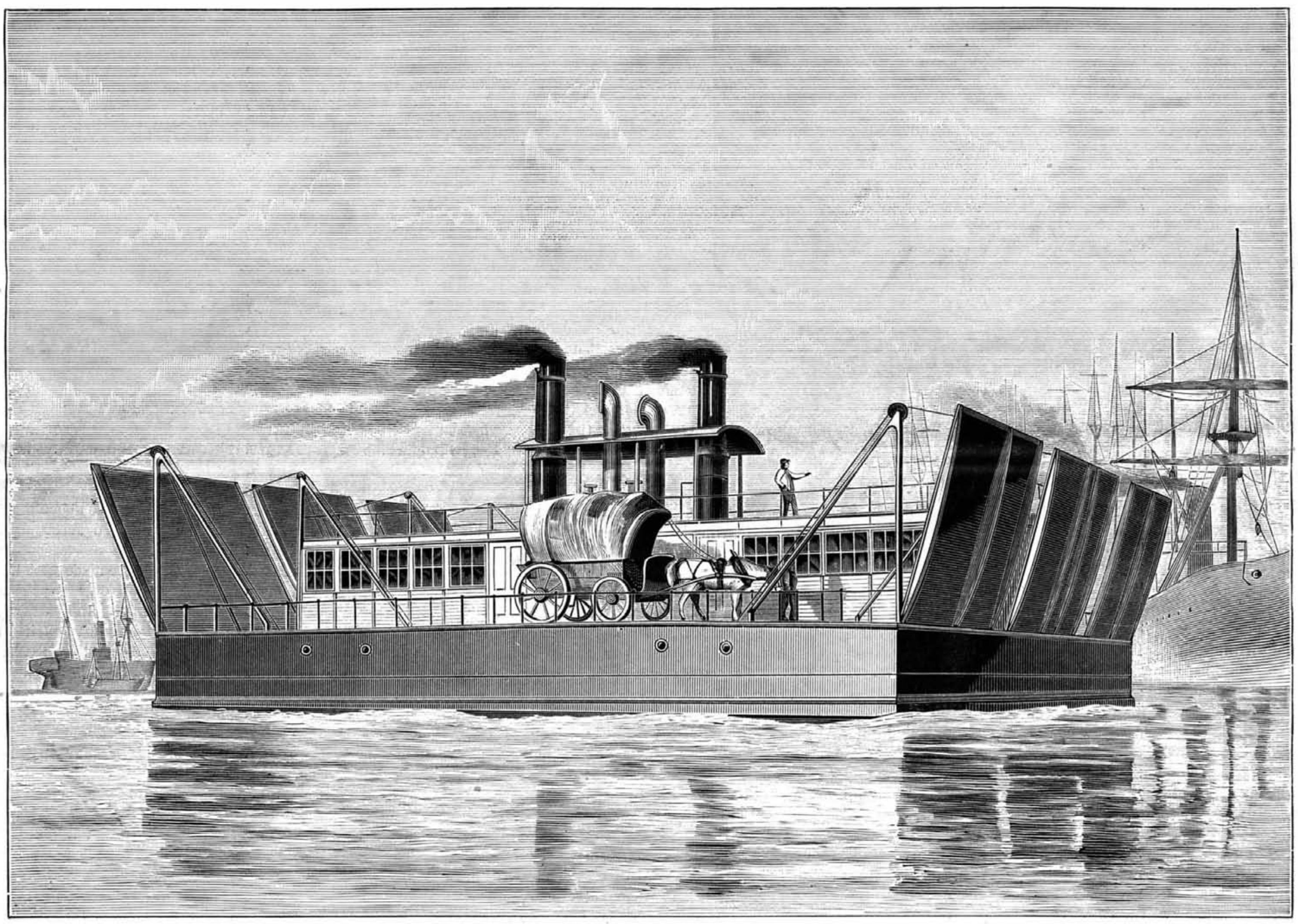
Writing upon the subject of the Patent Act, Mr. James J. Aston, Q.C.—perhaps the best legal authority on the matter—expresses the opinion that inventors have much cause to be grateful to the Government for passing the new act. Mr. Aston draws particular attention to one feature of the new law which has hitherto escaped notice, and which, in his opinion, constitutes an important benefit for inventors. Under the existing law a patent is granted upon the "express condition" that the nature of the invention, and in what manner the same is to be performed, shall have been described and ascertained by the inventor in his complete specification. This regulation throws the burden of proof upon the inventor, who has frequently been surprised to find that a description which he may have drawn up to the best of his ability has been held to be insufficient by the courts. Where this is the case the patent is voided. Under the new act, however, this condition is altogether omitted from the patent as draughted, and the complete specification will be filed before the granting of the patent, and will be approved by a competent officer before it is accepted and published. The new patent will further recite "that the inventor hath, by and in his complete specification, particularly described the nature of his invention." Hence it would seem to follow, as Mr. Aston says, that the official acceptance of the specification carries the guarantee of its sufficiency; wherefore, in future, patents granted in the prescribed form cannot be rendered void on this account. Mr. Aston writes in this case as an inventor; and, as such, he feels thankful for and greatly relieved by this change. Thus it would appear that the modified kind of inspection hereafter to be performed by the officials will be a greater protection to the inventor than was expected. We are not aware that Mr. Aston ever asked for an official guarantee of novelty, as did some fervid admirers of inventive genius; but protection against loss by inadvertence or ignorance of the necessities of accurate description is not too much to ask of the Patent Office. It must not be forgotten, however, that this conclusion is only the opinion of one lawyer (although an experienced one), and awaits confirmation by the court which first decides a disputed case of the nature indicated.—*Journal of Gas Lighting.*

Nearsightedness.

The points which should be insisted upon for the prevention of myopia, or for its arrest when it has commenced, are the following: 1. Work should always be done in a good light, and so far as may be possible by daylight; hence late hours, reading in bed, by twilight, and by firelight, should be discountenanced. 2. The type of the books in common use should be good. If two editions are printed, one with large and the other with small type, the former should be chosen. A few chapters may be detached and bound separately, so as to make a light book, easily held in the hand. 3. In order that the head may be kept up and the child prevented from poring over his books, a raised desk and a form well adapted to his height should be provided. 4. The hours of work should be moderate; none should be done before breakfast. School hours should not be longer than from nine till twelve and from two till four, with perhaps an hour in the evening for preparation. 5. Active out door games—lawn tennis, fives, football, and cricket—should be encouraged. 6. The diet should be abundant and varied. 7. The bowels should be kept in order, and constipation avoided. 8. Appropriate glasses should be provided for viewing distant objects, and especially for following instruction on the blackboard, which many children wholly lose; but if the selection of glasses is not placed in the hands of an ophthalmic surgeon, it will be well to remember that in moderate myopia no glasses are required for near work, and that the feeblest glasses which give good vision for distance should be used.—*Henry Power, M.D.*

AN AUSTRALIAN STEAM FERRY BOAT.

The increase of traffic between the north and south banks of the Yarra, at Melbourne, has now assumed such dimensions that the ordinary convenience afforded by the Falls bridge and the several ferry boats is entirely inadequate. From time to time the Harbor Trust has been urged to establish a steam ferry, and it now appears probable that the much needed reform will be accomplished. At the foot of Spencer Street men are now engaged cutting out a miniature dock, from which the ferry will start, and on the other side of the river a similar excavation is in progress. The ferry, which will be square, both stem and stern, will be driven by powerful machinery, and will be of such beam that several loaded carts and wagons, irrespective of passengers, can be conveyed at once. The arrangements for entering and debarking will be such that horses will have no more difficulty than in crossing a bridge, and a wonderful convenience will thus be afforded to the public.—*Illustrated Adelaide News.*



STEAM FERRY AT SPENCER STREET, MELBOURNE, AUSTRALIA.

New Metallurgical Discovery.

At a recent meeting of the British Association, Professor Chandler Roberts described some most suggestive experiments on the mobility of gold and silver in molten lead. Graham first ascertained the rate of diffusion of salts in solution; Dr. Guthrie has recently studied the diffusion in alloys; and Professor Roberts is now testing metals at temperatures above their melting points. If a lump of a gold-lead alloy with 30 per cent of gold, covered with lead, is heated in a crucible, the gold appears at the surface the very moment when perfect fusion has been attained; the diffusion also takes place rapidly if the gold alloy is put in a small crucible, and this one placed within another crucible containing lead. By melting in a cylinder, 200 millimeters high, a solid cylinder of lead with a small piece of the gold alloy fused to its bottom, or, better still, by placing the gold at the top of one limb of a U-shaped crucible, withdrawing test portions from the top end of the other limb, Mr. Chandler Roberts arrived at the diffusion rate, 300 millimeters in five minutes for silver, this rate being probably a little higher than that of gold.

Sir William Thomson characterized this as a great discovery. The rate of diffusion of gold in lead, he said, appeared to be immensely greater than the rate of diffusion of liquids. The fact was, it was a subject of which we understood very little indeed, but which would probably prove of great value in metallurgy, where one example of it, the rapid mixture of spiegeleisen with iron, was well known. If the experiments were repeated with salt and water substituted for the gold and lead, it would take years, twenty years at least, to produce the result now attained in forty minutes, and which took place not much less rapidly than the diffusion of oxygen through hydrogen, or the transmission of heat through iron.

Bone Black Superphosphate

Prof. F. Farsky's conclusions are that superphosphate goes back in the soil the more rapidly the more calcium carbonate is present. The more water circulates in the soil, the less is the reversion. Superphosphate of a coarse texture is less liable to reversion than that of a fine grain. As most seeds complete their germination in the soil in seven to fourteen days, it appears that in lime soils plants obtain the phosphoric acid of their nourishment chiefly, if not entirely, from the calcium phosphate soluble in ammonium citrate. In an experimental field fine grained superphosphate gave a less advantageous result than coarser qualities. Kladno phosphate gave in three cases a better result than superphosphate, except with potatoes. Precipitated phosphate did not act as well as the other phosphates.—*Biedermann's Centrablatt.*

The Dimensions of Atoms.

In a recent lecture at the Royal Institution, by Sir William Thomson, on the size of atoms, the speaker, through a series of learned considerations which cannot be given here, reached the following conclusions: It is very probable that in an ordinary liquid, or a transparent or semi-opaque solid body, the mean distance between the centers of two contiguous molecules is less than one five-millionth of a centimeter and more than one-billionth of a centimeter. To obtain an idea of the grain and of the corresponding relative sizes, let us imagine a globe of glass or of water of the size of a croquet ball (16 centimeters in diameter), and let us increase it in imagination until it becomes as large as the earth, each molecule being increased in the same proportion. Then the structure of this mass thus increased would be more granular than that of a pile of musket balls, but certainly less so than that of a pile of croquet balls.—*La Nature.*

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Irrigation in India.

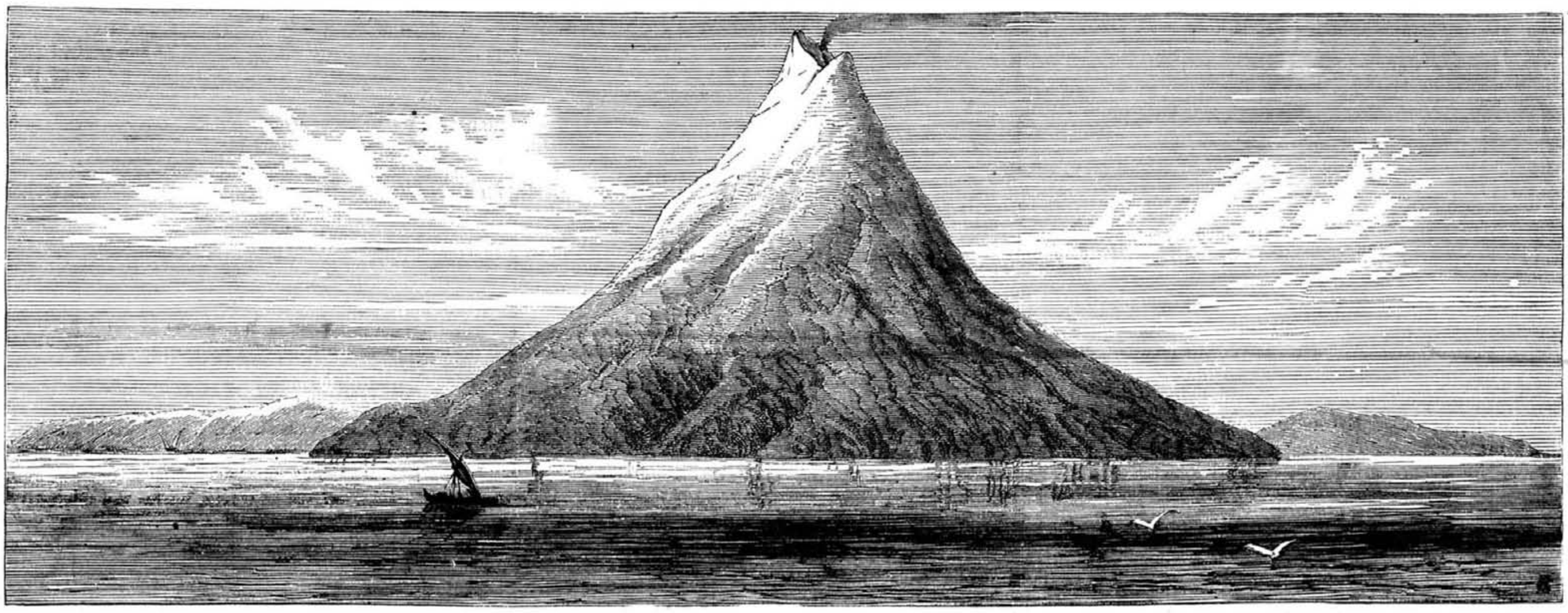
The system of irrigation now in use in the Madras Presidency is on a vast scale, a record, though imperfect, of the tanks in 14 cultivated districts showing them to amount to 43,000 in repair and 10,000 out of repair, or 53,000 in all. The length of embankment required for each may be estimated on a moderate calculation at half a mile, and the number of masonry works in irrigation sluices, waste weirs, and the like may be taken to be at least six. The embankments alone for all these tanks would extend over 30,000 miles, while the total number of separate masonry works are at least 300,000. The most remarkable feature about this gigantic system is that it is entirely of native origin, not one new tank having been made by Europeans; and, according to all accounts, there must be a good many equally fine works which have been allowed to fall into decay. According to the *Tropical Agriculturist*, the revenue dependent on existing works is roughly estimated at 150 lakhs.

Sulphur—Phosphorescent.

K. Heumann raises the question whether sulphur, selenium, arsenic, etc., are not, under suitable circumstances, capable of phosphorescing like phosphorus. He finds that when sulphur is heated on a metal or porcelain plate in the dark, the vapors suddenly become phosphorescent, burn with a bluish-gray flame, perfectly distinct from the ordinary fine blue flame of sulphur. The odor given off is not that of sulphurous acid, but resembles that of hydrogen persulphide, camphor, and ozone. The product of the combustion is doubtless a stage of oxidation lower than sulphurous anhydride.

KRAKATOA.

We give herewith a sketch of the island of Krakatoa, in the Straits of Sunda, near the island of Java, which suddenly disappeared during the terrible earthquakes of August 25th and 26th last. A large area of habitable territory was submerged during this extraordinary convulsion of nature. One hundred thousand people lost their lives, most of them being overtaken by the great waves which came from the sea, and swept inland for several miles. Our engraving is from the *Illustrated London News*.



THE ISLAND OF KRAKATOA, FORMERLY IN THE STRAITS OF SUNDA, SUBMERGED DURING THE LATE VOLCANIC ERUPTION IN JAVA.

Death from Passion.

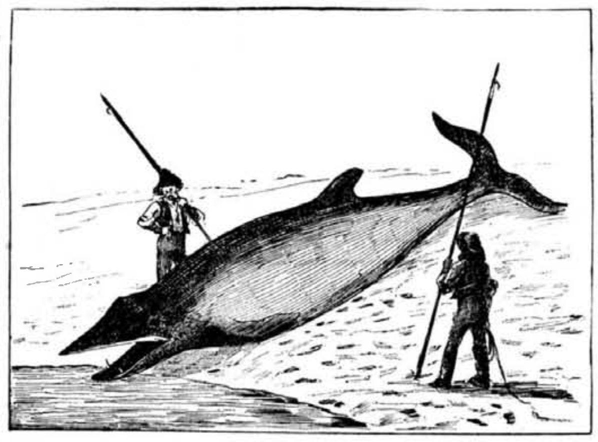
Cases in which death results from the physical excitement consequent on mental passion are, according to the *Lancet*, not uncommon. A recent instance has again called attention to the matter. Unfortunately, those persons who are prone to sudden and overwhelming outbursts of ill temper do not, as a rule, recognize their propensity or realize the perils to which it exposes them; while the stupid idea that such deaths as occur in passion, and which are directly caused by it, ought to be ascribed to "the visitation of God," tends to divert attention from the common sense lesson which such deaths should teach. It is most unwise to allow the mind to excite the brain and body to such extent as to endanger life itself. We do not sufficiently appreciate the need and value of mental discipline as a corrective of bad habits and a preventive of disturbances by which happiness, and life itself, are too often jeopardized.

A Whale Hunt in Shetland.

At West Voe, Dunrossness, on September 20, early in the morning, a number of six oared boats were proceeding to the fishing, when they observed a shoal of whales (twenty-eight in number) disporting themselves close to Sumburgh Head. They immediately gave chase, and succeeded in driving them all ashore. The scene of slaughter was wild in the extreme. Along the head of the Voe were spread the whales, lashing the water into foam in their death struggles, while in the midst of the blood and foam the men, wading waist deep in water, were going from fish to fish and plunging lances into the monsters' sides. One big fellow, managing to get his head seaward, went away at a great rate, sometimes below and sometimes on the surface; but he had been wounded mortally, and he was easily brought ashore again.—*Pall Mall Gazette.*

THE BOTTLE-NOSED WHALE.

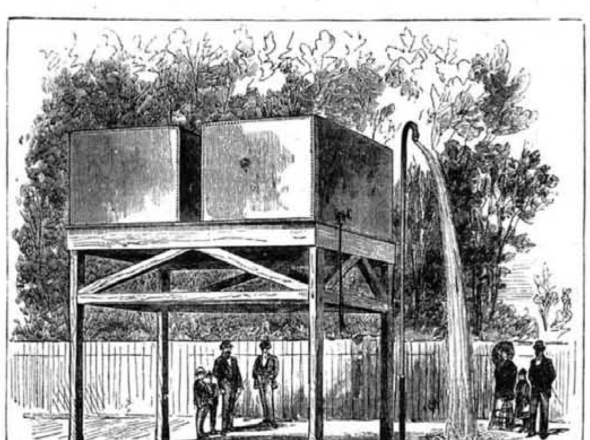
A rare specimen of the Mesoplodon, or bottle-nosed whale, of which a picture can be seen on this page, was recently washed ashore near Long Branch. Professor True and Mr. Palmer of the Smithsonian Institution have taken a plaster cast and removed the bones to Washington. This is said to be the second specimen ever prepared. The only one now known is in the Paris Museum. The body is nineteen feet and four inches long and will probably weigh two tons. —*Graphic.*



THE BOTTLE-NOSED WHALE.

ARTESIAN WELLS, AUSTRALIA.

There are two artesian wells at Sale, known respectively as the Borough and the Cunningham Street well. On the 15th of April, 1880, a contract to bore 300 feet, or until the water flowed over the surface, was taken by a German called Niemann, the borough council of Sale, after considerable discussion, having voted a sum of £200 for the purpose. Water which rose 3 feet above the ground was struck on June 17, at a depth of 190 feet; and on sinking some 40 feet deeper, a stream of black water, with a most disagreeable smell, suddenly rushed up the pipe, rising to a height of 43 feet above the surface. This left a heavy deposit, as it passed down the street, of dark gray sand, dead leaves, decayed wood, and nodules of iron. In a few days it became perfectly clear. In boring this well, an iron tube 4 inches in diameter was put down to a depth of about 100 feet, and inside this, gas pipes 2 inches in diameter were put down to the required depth. The uniform outflow of this well (the Borough well), shown in our cut, is 43,000 gallons daily, the whole of the cost of which, including tanks at which water carters can fill their casks, troughs for watering of horses and cattle, pipes for channels, etc., was only £280 16s., whereas the estimated cost of supplying Sale with water from a higher level of the river, by gravitation, was estimated at £36,000.



ARTESIAN WELL SALE, AUSTRALIA.

The following is the analysis of the water made by Mr. Cosmo Newbery. It is bright, colorless, and tasteless; it contains an amount of solid matter in solution equal to 30·7 grains per gallon.

An analysis of this gave:

Chloride of sodium	36·44
" " potassium	trace.
" " calcium	"
" " magnesium	0·46
Carbonate	0·40
" of calcium	trace.
" " silica	0·80
Organic matter	1·60
Total	39·70

In one million parts it contains free ammonia, 0·75; albuminoid ammonia, none; nitrates and nitrites, none. The water is of excellent quality for all domestic purposes, and it is remarkably free from nitrogenous bodies.

Most of the ground bored through was soft; samples of the various strata passed through were religiously preserved and placed in their order, in a long box with a glass front, and were thus sent to the Mining Court of the Melbourne Exhibition.

Water was struck in the Cunningham Street well, which is the property of a private company, on the 25th August, 1882. Two water bearing strata have been tapped here, one at the depth of 190 feet with a 6 inch pipe, the other at 284 feet with a 4½ inch pipe, placed inside the former. The supply of water from the 190 foot level is 250,000 gallons, and that from the 284 foot level 150,000 gallons a day, making in all the immense outflow, rising 40 feet above the surface, of 400,000 gallons a day, of which at present about 380,000 gallons are wasted. This runs through the street into Wishart's Morass, thence into Flooding Creek, and and thence into the Heart Morass, where it floods a lot of selections for a distance of over six miles. It is, however, anticipated that at some future period this water will be used as a motive power. The water from the lower level is kept back by means of cocks The cost of this well was £1,250; during the process of boring, several accidents in connection with the machinery occurred, usually causing the operation to end in failure.

According to Mr. Johnson, Government Analyst, the water from the above well shows only six grains of salt to the gallon, as against 36 grains in that of the Borough well, not a quarter of a mile distant. The water from this latter is said to have proved unsuitable for reticulation purposes, as it not only rots the pipes, but also stops them up with sesquioxide of iron, so that they have to be taken up and cleaned at short intervals; that from the Cunningham Street well, on the other hand, so far from being injurious to iron, is actually said to be improving the boilers of the locomotives in which it is used, and to have been running through 1 inch and 1½ inch pipes for the last four or five months without any sign of injury. The borough council of Sale is talking of reticulating the town, but has not yet decided whether to use the Cunningham Street well or to risk putting down another.—*Town and Country.*

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Organisms Living in the Atmosphere.

Dr. P. Miquel, chief of the micrographic service at Montsouris Observatory, has published a volume on this subject, from which are taken the following points, which we translate from the *Bulletin de la Societe Francaise de Hygiene.*

Miquel divides these minute beings into four groups: micrococci, bacteria, bacilli, and vibrios and spiral microbes. Each group or genus can be subdivided into species and varieties, the characteristics of which are unfortunately not well marked.

The *micrococci* usually present the form of globular cells, without the power of spontaneous movement. They vary in size from five ten-millionths to three-millionths of a millimeter in diameter. Their appearance varies with their age, from little cells filled with a protoplasm of very slight refractory power, to brilliant granulations surrounded by a very distinct black circle. They are met with united into groups or chains.

It is generally easy to distinguish micrococci from other bacteria; but it sometimes requires considerable attention to distinguish micrococci from bacteria on the borders of each.

Bacteria have the form of short movable club (batonnet), either single or joined in groups of two, three, or four, seldom more. They are usually longer than they are wide; but they are also found spherical in form, imitating micrococci; at other times they are found larger at the extremity than in the center. One bacterium that was cultivated long enough by Miquel possessed the singular property of transforming a gramme (15½ grains) of sulphur into sulphydric acid within 48 hours in an infusion of tartrate of ammonia in 4 liters of boiling water containing excess of sulphur.

The number of bacteria of a pathological nature is very large. We may mention one only found by Pasteur in the potable waters of Paris that has the power of producing the metastatic abscesses of a purulent nature when injected into the jugular veins of animals. This pus producing microbe demands more complete study.

Bacteria, which approach micrococci very closely at the one extreme, come at least quite as near to the bacilli at the other extreme.

Bacilli are formed of cells arranged in rigid filaments of uncertain length, either movable or immovable, and varying in width from two to five millionths of a millimeter.

Common bacilli have two modes of reproduction—by division and by brilliant seeds or spores. If they are cultivated where the oxygen of the air has free access, the bacillus uniformly obstructs it, and becomes active and relatively short; division takes place without hinderance.

If the oxygen has difficulty in reaching the surface of the liquid, the latter is quickly saturated with carbonic acid; the bacilli come to the surface to get air to breathe; there they continue to increase immoderately without stirring and form an impenetrable network, which subdivides and throws out brilliant spores. It is nevertheless doubtful whether all the aerial bacilli have this power of throwing off spores. On the boundaries of the group it is very difficult to distinguish the varieties of this species from those of the preceding group. The bacteridie of charbon is remarkable type of motionless bacilli; the bacillus subtilis, which is aerial, and butyric ferment, which is not, on the other hand belong to a class of very active bacilli.

The *vibrios* and *spirilles,* both of which are placed by Miquel in one group, ought, it would seem, to form two distinct groups, if they are frequently met with in the dust of the air.

The former are filamentary mossy organisms that grow in the cultivating liquid in the form of needles. Air, rain water, condensed steam, rarely contain germs of these organisms. The others (spirilles) have long filaments, not stretched out, but wound up into helices. They are either very long and then vibrate like the vibrios; or very short, and then are always stiff, having the appearance of a collection of numerous short screws crowded together. Spirilles are frequently found in anatomical macerations and putrefying vegetable infusions; they are rarely met with in dust of the air.

Without following out Miquel's enumeration of bacteria, which will be found given in full in his book, we will briefly give some of his results. The mean number of bacteria that he found in a liter of rain water was 16,000, divided in the following proportion:

	Micro-cocci.	Ba-cilli.	Bac-teria.	Total.
Rain water	28	63	9	100
Air of Montsouris Park	73	19	8	100

The total number of bacteria in a liter of water was found to be distributed in 200,000 liters of air from the park about. This last number, of course, varies with the season, the state of the weather, and direction of the wind on Montsouris. The mean number for each season, deduced from observations extending over three years, were as follows per cubic meter:

Winter, December to February	44
Spring, March to May	76
Summer, June to August	76
Autumn, September to November	134

In autumn they are most abundant, and this season is most exposed to epidemics. Rain cleanses the air of its bacteria as well as of spores; but, on the other hand, humidity is an obstacle to the diffusion of bacteria in air, while prolonged dry weather favors it, and it is only after a long drought that the spores of the air get old and lose in part the power of reproduction in the liquids employed for their cultivation.

The effect of the wind at Montsouris is partially due to this cause and also the position of the observatory on the south side of the city. The numbers were as follow:

Winds from N. and N. E.	138
" " E. and S. E.	102
" " E. and S. W.	50
" " W. and N. W.	92

Just in proportion as we penetrate into Paris the number of bacteria increased enormously, without exactly following the variations noticed at Montsouris. There were found in the Rue de Rivoli, at the height of one of the first story windows of the Mairie of the IV. Arrondissement, the following numbers:

Winter	373
Spring	850
Summer	888
Autumn	888

The effect of private houses was found to be very appreciable; they are very rich in bacteria, and the more so the poorer the ventilation. This is shown by an example of air taken from Hospital de la Pitie, the number per cubic meter being as follows:

	Salle Michon for men.	Salle Lisfranc for women.
Winter	17·720	17·600
Spring	10·740	8·000
Summer	5·280	6·400
Autumn	12·630	12·200

As soon as the season allowed the windows to be opened, the number of microbes indoors decreased, but increased on the street.

It is indeed Paris itself, her inhabitants and her animals, that are the origin of these microbes, because if we examine the air that hovers over the city even at the height of the lantern on the Pantheon, we will find but very few microbes in it.

Top of Pantheon	28
Montsouris Park	45
Mairie of IV. Arrond	462

If we examine the dry dust that falls on the furniture of the rooms, we notice the same increase from the circumference of Paris toward its center.

Bacteria in 1 gramme of dust at the Observatory Montsouris, 750,000. In apartments in Rue de Rennes, 1,300,000. In apartments in Rue Monge, 2,100,000.

The proportions of each kind also vary at the same time.

	Micrococci.	Bacilli.	Bacteria.
At Montsouris	187,500	525,000	13,000
In Rue de Rennes	780,000	442,000	78,000
In Rue Monge	1,575,000	378,000	147,000

The number of bacilli decrease, while the micrococci and bacteria increase.

In spite of the minute size of the microgerms and the facility with which they are transported by the wind, their diffusion through the air can only be perceived through short distances. Whatever it may be that is the center of emanations, its germs are very soon drowned in such a mass of air, and they are rarefied to such an extent, that the most formidable of them are no longer to be dreaded. It is not so with dust transported with whatever has been deposited on it; their activity can be preserved a long time and transmitted almost any distance if there are no special circumstances that destroy them on the way.

In the same city the necessary intercourse of the inhabitants exposes each one of them to the action of noxious germs, and all those which present a suitable soil for their cultivation may feel their influence. Fortunately the greater part of these innumerable microbes of the air are not only inoffensive, but they are powerful auxiliaries in this sense, that they relieve us of organic detritus of every sort, that, without them, would accumulate on the soil and render all fresh life impossible. And yet it is easy to see that in Paris, where all these microgerms spring up and multiply, increased mortality follows at an average distance of eight or ten days; the increase corresponding to the number of bacteria found in the air of Montsouris and Rue de Rivoli. In this total number the noxious microgerms are produced by epidemic batches; but circumstances favorable to the generality of microbes are equally favorable to these.

The bacteria collected in the air of sewers are much less numerous than in the majority of dwellings; but the moisture that prevails there keeps them young and vigorous: they invade and taint the less sensitive infusions in a few days. The bacteria are very numerous, and many of them are anaerobes, those which contribute to the putridity of the fermentations which produce them. Injected into rabbits, Miquel showed that they were perfectly harmless, which does not always take place with house microbes.

The following is a summary of the qualitative composition of the atmosphere in places where Miquel estimated the number of microbes, in percentages of each kind:

	Micrococci.	Bacilli.	Bacteria.
Air of Rue de Rivoli	93	5	2
Air of Montsouris	73	19	8
Air of hospital	86	9	5
Air of Paris dwellings	84	10	6
Air of laboratory, Montsouris	81	16	3
Air of inhabited rooms	54	47	1
Air of sewers	60	14	26
Dry dust, Montsouris	25	70	5
Dry dust, Rue de Rennes	60	34	6
Dry dust, Rue de Monge	75	18	7

We may add that in the park of Montsouris the number of microbes that fell with the dust on a square meter within 24 hours was 23,000. In the micrographic laboratory this number reached 2,400,000. It ought to be still greater in the interior of the hospitals and certain dwellings.

In the presence of these legions of microbes it would be desirable to know how they would act in the presence of substances called antiseptic or disinfectant. This has also been studied by Miquel.

He places oxygenized water, H_2O_2, at the head of the list of bactericides; 5 centigrammes to a liter of bouillon stopped all fermentation. The other agents have much less effect as shown by the following figures taken from a larger table given by Miquel.

The smallest quantity of each substance capable of preventing fermentation completely in one liter of bouillon was as follows:

Oxygenized water	0·05	gramme.
Iodine	0·25	"
Bromine	0·60	"
Chloride zinc	1·90	"
Carbolic acid	3·20	"
Permanganate potash	3·50	"
Boracic acid	7·50	"
Salicylate soda	10·00	"
Borate soda	70·00	"
Anhydrous alcohol	95·00	"

If to this we add the almost absolute harmlessness of oxygenated water derived from baryta, we can understand what a role this reagent is called upon to play in surgical and obstetrical operations.

M. Miquel has just commenced the second part of his work, viz., a study of the microscopic composition of the waters of Paris and its vicinity; but this a much larger operation, the study of these microbes not in their totality, but taken successively and individually.

Asser's Photo-Lithographic Transfer Process.

Unsized paper, as it is habitually used by lithograph printers, must be employed.

It has to be of the best quality and rather thick. It would be better if it were made on purpose by a paper manufacturer. The smooth side is covered with a layer of starch. In order to avoid different kinds of starch, of which one ignores the different peculiar qualities, it is better to use an invariable substance. Experience shows that cooked wheat flour is most suitable for that purpose. It must be rather concentrated, but nevertheless liquid enough, not to prevent regular running off. This starch is poured into a square pit and the smooth side of the paper is carefully placed upon it, so that bubbles are avoided. After that it is laid to dry horizontally on the other side. In a dark room the unstarched side of the paper is laid above a rather concentrated solution of bichromate of potash, till by its porosity the paper is entirely pervaded by the liquid.

Then it is hung on a pin in the dark, left to dry, and transferred on a polished stone in the lithographic press, the starch side toward the stone.

In order to give to the paper a smooth surface, the scraper is pulled several times over it. By this operation light must be avoided.

In this state it is placed as usual under a negative in a photographic chassis, exposed to the light till the enlightened parts present a picture of a strong brown color. Then the paper is taken from the chassis and left in various baths of water till all unaffected parts are of a clear white, and the enlightened ones of a light green tint.

If this result is not obtained by cold water, hot water may be employed to destroy any traces of the dissolvable bichromate of potash. Then it is again hung to dry, on a pin. Sunshine or a moderate fire well contribute greatly to the acquirement of a clear image. In order to transfer the copy, the thus prepared paper is laid on the back side upon water only warmed a little in winter. Then it is placed upon a stone or a glass after the superfluous water is removed by blotting paper. The transfer ink consists of common lithographic printing ink only mixed with a convenient part of oleëne.

Before blackening the image a layer of mastic dissolved in absolute alcohol is conveyed to the paper and spread regularly over it with a little cotton till it is dry.

The above described ink spread upon a stone is put on a wooden roller, covered first with cloth or flannel, and thereupon with cotton or silk velvet.

The liquid that has remained in the paper is sufficient to preserve from ink the places which must not be blackened. If there might still remain some impurity, as frequently happens, it may be removed by using the roller very lightly and finally by taking it off with a wet soft sponge. Afterward the water is again removed by blotting paper.

The velvet of the roller has to be renewed frequently.

After the last preparation the blackened paper is transferred upon a lithographic stone or upon zinc, and handled in the usual manner.

E. T. ASSER.

Amsterdam, 1883.

A Home-made Fountain Pen.

Take two ordinary steel pens of the same pattern and insert them in the common holder. The inner pen will be the writing pen. Between this and the outer pen will be held a supply of ink, when they are once dipped into the inkstand, that will last to write several pages of manuscript. It is not necessary that the points of the two pens should be very near together, but if the flow of ink is not rapid enough the points may be brought nearer by a bit of thread or a minute rubber band.

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Autumn Glories.

It is now, in mid-October, that the rural landscape is in its glory. The leaves of the deciduous trees are ripe and resplendent in color; that is, the trees whose leaves fall in autumn. The leaves of these trees ripen as the fruits do. It is the same result from the same cause in both leaves and fruit. Every one who walks along the country roads or lanes, or rides or drives, or takes a railway trip where there is a skirting of woodland, has had sight of the beauty of the foliage with its almost infinite variety of color. Some, of course, have not enjoyed opportunities for strolls, drives, or journeys within eyeshot of these scenes since the glories have been put on; but all who can should do so. It is not every season that the colors are so brilliant or so varied as they are this fall. Sometimes the late summer and early autumn weeks are too dry, the flow of sap ceases prematurely, and the foliage dries up and withers rather than ripens. Then there is but little bright color. But the weather has been highly favorable this season, and the woods, especially on the Jersey side of the Delaware, are aglow to an unusual degree.

It does not require that a long journey should be made to see these beauties. Almost any bit of landscape with a copse or grove or stretch of young timber will show the perfection of autumn leaf coloring at this time, if there are swamp maples, sugar maples, sumac, sweet gum, dogwood, oaks, and sassafras well interspersed among the pines, cedars, spruces and other trees of our neighborhood. Where all these are plentiful, together with climbing vines, the effect is, of course, the more beautiful, especially if the trees are on a hillside. The effect is grandest of all on the flank of a mountain, where the colors are in mass; and, where viewed from a distance, the rounded outlines of the rising banks of trees look like cumulus clouds lighted up by a sunset of crimson purple and gold. The perfect scene is where there is a considerable proportion of evergreen trees—pine, spruce, hemlock, cedar—to make a background and to occupy the interspaces between the trees with colored foliage. Then, there is every color of the spectrum and every shade of blended hue, not even excepting the blues, which in some conditions of the air and of the light are observable in charming tints, among the greens in the distance. From the umbers and buffs and russets to rich orange and golden yellow, from the deep purples, maroons, and bronzes to crimsons and scarlets, with every variety of green—all the intermediate colors can be found in any strip of woods that contains the trees above named, or a majority of them.

But some of the colored maples surpass all other trees in their splendor, as their leaves pass from the golden and orange yellows in the lower branches to the flaming tints on their crowns. The sweet gum is next in varied brilliancy, but these trees are far less numerous hereabouts than maples. They abound, however, in the near counties in South Jersey. The sumacs and dogwoods show handsomely in the distance, but their leaves do not bear close inspection like those of the maple and sweet gum. Some of the oaks, too, are exceedingly beautiful in their variegated leaves of green and red. When you go to look at these roadside or mountain pictures, try to see them in the sunlight. An hour after sunrise or an hour or two before sunset are the choice times; but at all times of the day they are beautiful.—*Philadelphia Ledger.*

Hard-Headed Practice.

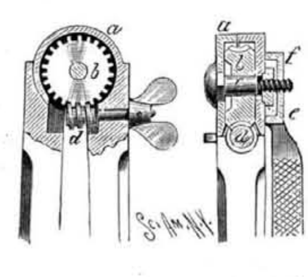
Dr. Walker, President of the Boston Institute of Technology, will have the country much beholden to him if he continue the good work he has so admirably begun of leading youths into useful and practical channels of study. He finds the tendency of the young is toward a professional calling, and as his elder experience proves these avocations to be dangerously overcrowded, he is striving to correct the fanciful disposition to a common-sense regard of the demands of life. He is inducing many of the boys of that city to pursue mechanics as a study, and is by that means fitting them for paths in life that are not already choked up with futile toilers after fame and fortune. The fact is, this country needs more industrial institutions and fewer colleges of law and medicine. We want more common sense and less ideality, more hard-headed practice and less theory, more workers and fewer puddlers. Success in the workshop is infinitely preferable to and more honorable than failure in a profession, and the mere matter of name has come to make but little difference with the estimate of men's worth nowadays. Technical education is what is wanted in our manufactories, and in them is our life.—*Chicago Journal.*

The Signal Service Clock.

A clock of peculiar construction has been manufactured for the United States Signal Service Bureau at Washington. The case is of brass, and allows the swing of a pendulum 39 inches long; it is air tight, and admits of the air being exhausted, and the movement run in a vacuum, thus obviating any possibility of variation due to atmospheric changes. An electrical attachment is connected with the movements, by means of which the clock is wound as it runs, so that there is not the usual liability to variation arising from the differing conditions of the mainspring. This is accomplished by alternately breaking and closing an electric current. The motion thus obtained and the power of the current are used to rewind the spring by means of a worm and other mechanism. The winding keeps exact pace with the running, and the slightest deviation from this standard is shown on an indicator. The train is jeweled, and is therefore little affected by friction.

CALIPERS AND DIVIDERS.

The pair of calipers or dividers herewith illustrated is provided in the joint with a disk having a worm-threaded edge with which a screw pintle engages, which is held loosely in one of the legs, thus permitting the points to be adjusted accurately by turning the screw after the legs have been adjusted in the usual manner. One of the cuts is a longitudinal sectional elevation, and the other is an enlarged detail cross sectional elevation. The disk, *b*, is provided with one flat surface and also with a recessed surface, so that the friction on one will be greater than on the other, so that the disk will be held on the cap of one leg by friction while adjusting the points. The upper end of each leg is provided with a disk having an annular flange, *a*, forming a cap. One of these disks is provided with a circular and the other with a square aperture. Passing through the two disks and through the worm-threaded disk is a bolt, *c*, provided with a head, and having a squared part fitting in one of the disks. The bolt has a tapering shank, the free end of which is screw-threaded. A nut, *e*, holds these parts together. A screw key, *f*, then screws on the threaded end of the bolt, *c*. A pintle, *d*, is held loosely on one of the legs directly below the disk, and on the outer end is provided with wings, and on the inner end, which is enlarged, is a screw thread engaging with the worm thread of the disk, *b*. If the dividers are to be opened or closed, the nut, *f*, is unscrewed, when the legs can be moved as desired. When the legs are moved by hand, the flat surface of the disk, *b*, will slide on the surface of the disk, *a*. When the legs are moved by turning the wings, the disk, *b*, will remain stationary in regard to one disk, and the sliding will take place on the other disk.



This invention has been patented by Mr. William H. Mitchell, Lebanon, N. H.

COMBINATION TOOL.

A novel combination tool recently invented by Mr. I. T. Torrey, of Beeton, Ontario, Canada, is especially intended for the use of railroad men for cutting the wires and tin clips used in sealing freight cars, and combines shears, tack hammer, claw for pulling tacks, and a screw driver. The blades are formed with bows similar to those of an ordinary pair of shears. One bow is formed with a hammer head, and the other with a claw so situated that the part of the bow just in front of the claw will furnish a fulcrum when the tool is used for drawing tacks. The two cutting edges are made on a line with the pivot, so that a firm and powerful grip is furnished for cutting wire or tin.

The cutting portion of one blade is made very short, while that of the other blade is made somewhat longer, and is reduced in width at its extremity, so as to form the screw driver blade. The construction of the tool will be readily understood from the engraving.

TORREY'S COMBINATION TOOL.

Melted Wool.

M. Heddebault has discovered a method of preparing soluble wool from tissues in which wool and cotton are combined. When subjected to a current of superheated steam, under a pressure of five atmospheres, the wool melts and falls to the bottom of the pan, leaving the cotton, linen, and other vegetable fibers clean and in a condition suitable for paper making. The melted wool is afterward evaporated to dryness, when it becomes completely soluble in water, and is called azotine. The increased value of the rags is sufficient to cover the whole cost of the operation, so that the azotine is produced without cost. It contains all its nitrogen in a soluble condition, and can, therefore, be compared to dried blood, which is worth 2·50 francs per kilogramme of nitrogen. M. Ladureau regards this discovery as one of great interest for agriculture and mechanical industry.—*Soc. Industr. du Nord.*

Waterproofing Fabrics.

Formerly some preparation of India rubber or gutta-percha was generally employed for rendering textile fabrics waterproof, but since that time many other and cheaper materials have been pressed into this service. Some of the processes are thus described in the *Polytechnisches Notizblatt,* No. 12.

Dujardin's process makes use of alum and sugar of lead. It is applicable to cordage and fabrics as well as to wood, leather, and paper. He takes of pulverized potash alum and crushed acetate of lead, each 20 parts, bicarbonate of potassium and Glauber's salt, each 12 parts, and pours over this mixture 3,000 parts of soft water, all by weight. He also dissolves separately in an equal quantity of water 9 parts of oleine soap, and then mixes both solutions. The articles are left in this solution until thoroughly saturated, allowed to drain, dried, brushed, and finally pressed.

For linen, leather, and wood he also adds margarine, 6 parts, and for cotton or paper some gelatine, 3 parts, and resin, 6 parts. Impregnation with this preparation, it is claimed, does not injure the colors. Alum and sugar of lead alone, or alum and caoutchouc, can be used for the same purpose.

To waterproof linen, the *Pharmaceutische Zeitung* recommends a solution of sulphate of alumina in ten times its weight of water, and a soap bath of the following composition: One part of light colored resin and one part of crystallized soda (sal soda) are boiled in ten parts of water until dissolved. The resin soap is precipitated with half part of table salt, and is subsequently dissolved along with one part of white curd soap in thirty parts of hot water. It should be put in wooden tubs for use. On made up articles the two solutions can be applied with a brush and then rinsed off.

According to Stenhouse, paraffine is excellent for waterproofing hempen hose and other things. The article to be treated is tightly stretched and heated over a hot plate of iron, and then rubbed as evenly as possible with a piece of paraffine. It is then pressed with a hot iron or between rollers, so that it will penetrate it thoroughly. Instead of using a piece of paraffine, the paraffine may be cast in a cylinder with a wooden core (like a printer's roller), and the goods drawn over it, pressing them down sufficiently. Or the paraffine can be rubbed on cold and then a hot iron passed over it. Paper can be saturated with melted paraffine on a warm plate of iron, the goods wrapped in it, and the whole pressed between hot iron plates or metallic rolls. Where long pieces of goods are to be treated, the process can be made continuous by passing the stuff over one, or more warm rollers that are kept covered with paraffine by running in a bath of melted paraffine. The excess of paraffine is removed by a scraper, a brush, or hot rollers.

When paraffine is employed in solution, the goods must be previously well and thoroughly dried, or the moisture will prevent the solution from penetrating within the goods and repel it.

A Great Loss from Spontaneous Combustion.

The origin of the disastrous conflagration which destroyed in a few minutes the other day the buildings of the Pittsburg Exposition, with all their contents, has been explained by a theory which is, to say the least, very plausible. It seems that Mr. Warner, the aeronaut, having an ascension to make, spent the day before the fire in repairing his balloon, and in revarnishing the canvas of which it was made with boiled linseed oil. As the most convenient place for his work, he chose the boiler room, and after the varnishing was complete, the balloon was rolled up and put by to dry. A more reckless operation than this it would be difficult to conceive, the warmth of the room, the rolling together of the canvas, and the boiling of the oil all conspiring to make the spontaneous combustion of the inflammable mass almost inevitable, and the opinion of the Pittsburg Fire Marshal will be concurred in by every builder, architect, insurance agent, and painter's apprentice, that the result was simply what ought to have been expected under the circumstances. The only thing that could have made the canvas more certain to take fire than simple saturation with linseed oil would have been to sprinkle it with water before rolling up, but this is by no means essential to the effect. It is, however, a very common factor in the cases of spontaneous combustion which occur every week or so. Some uninstructed person, having been engaged in painting or polishing woodwork, undertakes to save the cotton rag which he has been using by washing out the oil or paint, but after one or two trials, finding this a rather difficult operation, abandons the attempt, and rolls up the rag in a knot, and throws it into some corner, where the oil and water speedily react upon each other to set the whole in a blaze.—*American Architect.*

Electric Light Carbons.

M. Jacquelain has endeavored to prepare a pure carbon for electric purposes that should be as hard and as conductive as gas carbon. He first takes gas carbon, which he submits to four processes: (1) treatment with dry chlorine at a red heat for thirty hours; (2) treatment with hot alkali for about three hours; (3) immersion in hydrofluoric acid (1 to 2 of water) at a temperature of 15° to 25°; (4) carbonized by heating strongly in the vapor of a high-boiling hydrocarbon, for commercial purposes gas tar will do well. All these operations may be performed after the carbon has been cut into sticks. By these processes the impurities have been reduced to a minimum and a good, pure carbon obtained.

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ENGINEERING INVENTIONS.

A patent has recently been issued to Mr. J. B. Hunter, of Ashley, Ill., for an improved motor constructed with sprocket wheels, cog wheels, a driving chain, and two independent fly wheels, of which one is rotated directly from the shaft to which power is applied, and the other is rotated from one of the axles on which the wheels are mounted, whereby the power will be equalized and balanced in the motor.

An improved automatic car coupling has been patented by Messrs. Joseph Rigby and S. S. McHugh, of Ottawa, Kas. In this improved coupling the drawhead is provided with a very large mouth, and the link is held in position to enter the opposite drawhead. The drawhead is provided with a hole passing through it longitudinally, a slotted sliding block being located in this, and actuated by a spring for pressing against the link as held by the pin, so that the link will be held out suitably for entering the drawhead of the other car.

MECHANICAL INVENTIONS.

A new and improved machine for fastening buttons to garments and other articles is the invention of Mr. Albert Hall, of Cypress Hill, N. Y. The invention is very simple in its construction, inexpensive to make, and can be operated by an unskilled person.

Mr. Squire Raymond, of East Venice, N. Y., has recently patented a simple weight power arranged for transmitting rotary and reciprocating motion, and is intended more especially for operating small machinery, such as wood turning lathes, churns, fanning mills, pumps, etc.

Mr. Ephraim R. Kugler, of Kingwood, N. J., has patented an improved turning lathe, which is especially adapted for turning out telegraph pins and brackets. Not only is the entire shaping of the head or bracket accomplished by this machine, but a screw thread of the desired depth and width is cut upon the head of the pin.

A simple and effective jack for use in laying flooring or applying sheathing boards has been recently patented by Mr. J. H. Williams, of East Craftsbury, Vt. The screw is elevated at such an angle as to bring the handle above the floor timbers or studding, so as to enable the operator to force together his floor boards with greater ease to himself than it has been possible to do heretofore.

An improved machine for cleaning fur robes has been patented by Mr. Ferdinand Hosch, of Brooklyn, N. Y. The fur is brought in contact with the rotating brushes by being carried over two rotating feed rollers, and a hood is arranged over these rollers and brushes to carry away the dust and dirt up through a chimney connected with it. The draught which serves to carry away the particles of dust is caused by the rotation of the brushes, and if this is not sufficient fan blowers may be employed.

Mr. Charles Daniel, of Butler, Mo., has patented an improved gate hanger. This invention consists of an improved device for gates which open by both sliding and swinging, and the improvement consists in a bracket for the roller on which the gate slides, reversible for right or left hand attachment. It has guide roller studs for supporting friction rollers to guide the sides of the gate bars, the bracket being a simple device contrived in such form that it may be moulded and cast without the use of cores.

Messrs. R. Cartmell, of Middlebury, Vt., and Albert Ball, of Claremont, N. H., have recently patented improvements in machinery for grinding the wood in the manufacture of pulp. The improvement relates especially to the class of machines shown in the letters patent granted to Mr. Cartmell, in May, 1882, in which the cylindrical casing carrying the grinding cylinder or wheel is provided with radiating chutes or hoppers. The invention further consists in certain features of construction and arrangement for facilitating the setting up of the machine and its convenient operation.

Mr. David F. Pratt, of Gardner, Mass., has patented a guide for rattan splitting machines, which belong to that class of splitting machine which employs a sectional guide, arranged with suitable springs in such manner that it will firmly clamp or grasp the rattan while being forced against the knife, and will always properly center the rattan with respect to the knife, whether the rattan be large or small. The invention further consists in adapting the guide so that both the lateral and vertical adjustment bring the guide orifice into exact alignment with the passage through the knife.

Mr. G. W. Pittman, of Keokuk, Iowa, has patented a wrench having a stock or handle recessed centrally to receive the shank of the movable jaw, and also at its end for the reception of grip devices for holding the movable jaw. The device consists of a pivoted lever having a cam head to gripe one edge of the shank, and acting by its free end upon an angle lever carrying ratchet teeth for engagement with serrations of the opposite edge of the shank. The invention includes, also, a system of movable grip blocks or bits in either the fixed or movable jaw or both jaws of the wrench, for hold upon round objects. These bits work by rollers upon inclines tangent to the seats of the blocks in the jaws of the wrench, so that any slip of the shank of the movable jaw from its lower cam and ratchet grip connections in the handle will be compensated for by the movement of the bit blocks.

AGRICULTURAL INVENTIONS.

An improved potato digger and picker has recently been patented by Mr. Squire Raymond, of East Venice, N. Y. In this machine two plows are arranged in the fore part to throw the soil from the sides of the hills, while a single plow passes beneath and raises the potatoes and the soil in which they are embedded, and the shaker separates the potatoes from the soil, delivering them at the rear while the soil falls through the shaker to the ground.

A cultivator of unique pattern and design—ed to accomplish a great amount of work with the smallest amount of power is the subject of a patent recently granted to Mr. David Wise, of Cottondale, Tex.

Mr. W. P. Triggs, of East Portland, Ore., is the patentee of an improvement in harrows. The implement is suspended from a truck frame which is mounted on wheels, so as to be easily transferred from one field to another. By an ingenious arrangement of levers the harrow is raised from the ground at the will of the operator, and when it is wanted for use it is readily dropped to the ground, and the harrow commences its work.

MISCELLANEOUS INVENTIONS.

Mr. J. B. Freeman, of White Hart Lane, Tottenham, England, has patented an improved process of making white pigments from oxide of zinc and sulphate of lead. The process consists in first grinding the oxide of zinc and sulphate of lead together, and then grinding them with oil.

Messrs. Jesse Wasson and Richard T. Hitt, of La Porte City, Iowa, have patented an improved machine for working butter. The object of the invention is to provide a machine or table which will greatly facilitate and expedite the operation of working butter during its preparation for market.

Mr. John D. Blakeman, of Smith's Grove, Ky., has obtained a patent for an improved trace detacher. This invention consists in a whiffletree hook which is adapted to be operated by the driver to detach the traces and thus separate the horse from the vehicle in case the former runs away.

Mr. C. O. Tinker, of Ashtabula, O., has recently received letters patent for improvements for a simple roller die for making auger and bit blanks, the object of which is to improve and cheapen their manufacture, which this invention seems to accomplish in an effective manner.

A two wheeled vehicle has recently been patented by Mr. L. S. Clark, of Doylestown, Ohio. The invention consists of an improved contrivance for applying combined coiled wire and rubber springs to two and four wheeled spring carriages, and an improved joint connection of the shaft of a two wheeled vehicle to relieve the body from the motions of the horse.

An improved stopper for wire rope, etc., has been patented by Messrs. E. M. Stoddard and J. N. Johnson, of Norfolk, Va. The object of this invention is to provide a stop which shall act automatically to prevent a bar, rod, or rope from moving in but one direction, allowing it at same time to move freely in the other.

Mr. Ezekiel Holman, of Sandy, Utah Ter., has obtained a patent for an improved construction of roasting and smelting furnace for the reduction of silver, lead, and other ores. With this construction of furnace coke and other high priced fuels may be dispensed with, as ordinary coal can be used with good results.

An improved roof for railroad cars has been patented by Mr. John Walter, of Nashville, Tenn. The object of the invention is to provide a readily detachable or portable roof which may be quickly applied in part or whole to the top of the car. This roof also affords greater security to the brakeman in running along the top of the car than the old construction of roof, and provides an efficient means for ventilating the car.

Mr. S. W. Sykes, of Passaic, N. J., has patented recently an improved sweep strap connection for picker sticks of looms, consisting of a jointed metal hanger having a rocking connection with the sweep strap, also in special means for uniting the strap with the pivot or cross bolt of the rocking connection, whereby the durability of both the hanger and the sweep strap is greatly increased.

Mr. W. J. Moore, of Weatherford, Texas, has recently obtained a patent for a light, durable, and strong basket, made of wire, and designed for handling cotton and farm produce. The invention consists in any arrangement of a series of wires, whereby great strength is attained. Diagonal wires or braces connect the top and bottom hoops, and are twisted or wrapped around the upright wires intermediately of their length.

An improvement in suspenders has been patented by Mr. William B. Pratt, of Rahway, N. J. The buckle of the suspenders is provided with a cup-shaped slotted plate, and the ends of the suspenders are provided with a T-shaped shank which serves to unite the ends of the suspender to the buckle. Thus it is seen that the ends may be readily detached from the buckle, and the clothing will not be torn nor the suspenders worn as rapidly as at present.

Messrs. R. H. Dimock and J. A. Robinson, of New Haven, Conn., have recently patented an oil burner suitable for the use of any suitable volatile inflammable liquid, including naphtha, benzine, gasolene, camphene, petroleum, and other like liquids, for producing light and heat, and in which the liquid, that may be supplied under a head or pressure, is conveyed for volatilization and combustion through a block or blocks of non-inflammable absorbent material and burned upon the exposed surface.

Mr. Benj. F. Perry, of West Andover, O., has obtained a patent for an improved fence. This fence is of the style known as zigzag or worm fence, and the great advantage is that rails from old or worn out fences may be used in the construction of the new fence and serve a very good purpose. The rails of the different sections are alternately placed one above the other and are bound in place by wires, the ends of which are secured to posts in the ground. A barbed wire is also proposed to be extended along the top of the fence over the top rail.

Mr. C. L. Dalton, of West Elkton, O., has patented a novel thill coupling spring having an attached latch with a removable and specially constructed joint pin, by which the pole or shaft is united with the coupling, and with which the latch engages; also, in a coupling jaw provided with a tightening screw bolt to prevent its spreading, likewise in a shaft strap provided with a loop or hook that engages with the screw bolt, and in means for holding the thill coupling spring back when it is required to detach or adjust the shafts or pole of a vehicle.

The Harvey W. Peace Company, of Brooklyn, N. Y., by assignment from Mr. Alexander Sloan, of Newark, N. J., are the patentees of an improvement in cross cut saw handles. The saw handle is provided with a countersunk socket having exterior ribs to prevent it from turning, an interior screw thread to receive the split screw, which is made in two parts, having a hook upon the lower end of one part to pass through a hole in the saw plate, and a recess in the end of the other part to receive the hook of the first part. The connection between the saw plate and handle is provided with a washer placed upon the split screw, between the handle and saw plate, and grooved to receive the edge of the said saw plate. By this invention the plates of cross cut saws are securely held by the handle and may be readily detached therefrom.

An improved incandescent electric lamp is the subject of a patent recently granted in the United States to Mr. Desmond Gerald Fitzgerald, of Brixton, County of Surrey, England. The invention has for its object to produce a more complete vacuum in electric incandescent lamps by effecting the removal of residual oxygen, and, in some cases, residual nitrogen. To this end is employed a supplementary carbon filament, or a wire which may itself be made of oxidizable metal—such as iron or zinc—or be covered with an oxidizable metal—such as magnesium or other suitable substance placed within the bulb—and capable of being temporarily thrown into circuit, so that by the passage of the current, after more or less complete exhaustion by the pump, the carbon filament or oxidizable wire will be heated, and thereby effect the absorption of the residual oxygen, and when magnesium is employed the residual nitrogen contained in the bulb.

Mr. Edward K. Warren, of Three Oaks, Mich., has patented a new stiffening material for corsets, ladies' dresses, and like purposes. The invention has for its object the utilization as a rib or stiffener for corsets and other articles of dress or fabrics of the stalks, stems, or quill portions of feathers after they have been stripped—as for instance, the feathers of turkeys, geese, chickens, and other fowls—which kind of stock have heretofore had little commercial value. The growing scarcity and increased cost of whalebone for the above and other purposes has led to the employment of various substitutes, including bones, horn, rubber, steel, and rattan, but the use of split quills of fowls is believed by the patentee to be the best substitute for whalebone that has been devised for the above named purposes, and for some kinds of surgical appliances. The same inventor has obtained a patent for making whips out of whole or split quills made up in similar manner to the material described for stiffening corsets, etc. The splints are arranged to overlap and break joints, and when bound together form a tapering elastic rod which may be covered in the ordinary way.

NEW BOOKS AND PUBLICATIONS.

Mechanical Drawing Self-Taught. By Joshua Rose, M. E. Illustrated by 330 engravings. Henry Carey Baird & Company, 810 Walnut Street, Philadelphia. Price $4.00.

The aim of the book is to enable the beginner to learn to make simple mechanical drawings without the aid of an instructor. The two first chapters are devoted to descriptions of and instructions in the use of instruments. The remainder of the book is taken up with explanations of simple geometrical terms, showing their practical application, shadow lines, and line shading, and examples in drawing bolts, nuts, screws, gear wheels, engine work, plotting mechanical motions, drawing for line shaded engravings, shading, and coloring. The illustrations are well executed, and although all the lines necessary are used, there is not that profusion sometimes seen in works of this character, and which confuses instead of instructs the student. The matter is systematically arranged, that part which teaches the principles preceding and imperceptibly leading up to that part showing their practical application.

The Elasticity and Resistance of the Materials of Engineering. By Wm. H. Burr. William Howard Hart Professor of Rational and Technical Mechanics at Rensselaer Polytechnic Institute. John Wiley & Sons, New York.

The author states in his preface that the work is the outgrowth of lectures to students on the elasticity and resistance of materials, elaborated and extended so as to cover many details not included in the ordinary technical course of study. The book is divided into two parts, "rational" and "technical," the first being intended to furnish an analytical or rational basis for the second, or practical development. Part I. considers the general theory of elasticity in amorphous solid bodies, thick, hollow cylinders, and spheres and torsion, the energy of elasticity, and the theory of flexure. Part II., in which the mathematical results obtained in Part I. are subjected to the test of experiment, discusses tension, compression, compression of long columns, shearing and torsion, bending or flexure connections, working stresses and safety factors, the fatigue of metals, the flow of solids, and miscellaneous problems. The plan of the book is admirable, as by the aid of experimental results in a great variety of material, coefficients are established which involve the varied and complicated circumstances of material in actual use, and formulæ, which otherwise express ideal conditions only, are thus rendered of the greatest practical value. The experimental results given are very numerous, the author aiming to show variations in products of different mills, and also of the same mill; to show the variations due to difference in size, shape, relative dimensions, and condition of specimens; and to show that specimens apparently identically the same may give different results. The direction in which further investigations may be most profitably pursued is indicated.

Business and Personal.

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Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 80 to 88 Market St., Chicago, Ill.

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Steam Pumps. See adv. Smith, Vaile & Co., p. 237.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv. page 269.

Bradley's Road Card, Syracuse, N. Y. See p. 270.

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Notes & Queries

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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) J. M. K. writes: Would you kindly inform me the process used in taking the yellow color out of raw paraffine so as to make it white and almost transparent? A. Different solvents are used. Sometimes bisulphide of carbon, benzine, etc. Hübner treats it with sulphuric acid, and then distills the tar, first separated from the acid, mixing the tar in the retort with quicklime. This product is then pressed and treated with benzine.

(2) C. E. W. writes: In this part many farmers are making underground (tile) ditches. Some of these men place smaller tile at the outlet than at the head or throughout the length of the ditch, claiming that more water will flow out than if the outlet is the same size or larger than the main part of the ditch. Is it not merely a smaller stream at a higher speed, and not more water that flows out? A. It is only a smaller stream at a higher velocity. 2. Are lazy tongs a suitable means for doubling the throw of a crank, or had they better be avoided in heavy machinery? A. "Lazy tongs" had better be avoided in all arrangements for conveying power.

(3) J. De W. C. writes: In my business it is sometimes necessary to ascertain the number of gallons in square tanks or cisterns, and in circular. What do you consider a convenient rule for determination of contents in gallons? And what species of gallon is understood? I am confused by certain tables in my possession, which state that "the wine gallon must contain 231 cubic inches" and in another place a gallon is said to contain "277¼ cubic inches," although the bushel in same table is put down at "2,150½ cubic inches," and again at "2150·42 cubic inches." A. The United States legal gallon contains 231 cubic inches. To compute contents in gallons of round tanks: Square diameter in feet, multiply by 0.7855, and again by the depth in feet, and multiply by 7.48, this latter being the number of gallons in one cubic foot. For tanks of square or rectangular outline, multiply together the length in feet of both sides and multiply result by depth of tank in feet and again, as above, by 7·48.

(4) D. M. R. writes: 1. If I take nickel plated articles from an electro-nickel bath and place them in an electro-silver bath and silver plate them, is there any amalgamation between the two metals, or would there be with any other two metals? A. No amalgamation will take place. The silver would be simply superposed. 2. What is plating by the Parker process? A. We do not know the Parker process by that name. 3. What is pyro-plating? A. Plating by the aid of heat, the old method before electro plating was introduced.

(5) N. W. H.—A copying ink that may be used without press or water, and will yield one or two fair, neat copies, is made by mixing 3 parts jet black writing ink and one part of glycerine. This ink dries very slowly and must be used on glazed paper. The writing also must be fine.

(6) A. F. R. writes: Please inform me where the best gas engine is made. I want 30 horse power or thereabouts. And can you say if sulphur gas (natural gas) will drive such an engine? A. Gas engines are not made of more than 5 horse power. Sulphurous gas would, we think, not work well in a gas engine. The products of combustion would contain sulphuric acid, which would corrode the cylinder and piston.

(7) A. C. P. asks: 1. How thick should the carbon pencil be made in the simple electric light described in SUPPLEMENT, No. 162? A. ⅛ to ¼ inch in diameter. It should be pointed. 2. Would a piece of the carbon wire taken from a broken Edison incandescent lamp work well? A. No. 3. How many cells would be needed of the easily made bichromate battery described in SUPPLEMENT, No. 159? A. 10 or 12.

(8) W. W. T. writes: I am building a wind mill 10 ft. diameter; please give me the angle with the plane of motion that the sails should set. Should the sails be set at right angle with the axis, or pitched against the wind a little? A. Rule given by Smeaton is: "The radius is supposed to be divided into 6 parts, and ⅙, reckoning from the center, is called No. 1, and the extremity (of the radius) No. 6. Nos. 1, 2, 3, 4, 5, 6, angles ~~with the axis, 72°, 71½°, 72°, 74°, 77½°,~~ and 83°."

(9) H. M. asks: How can I create a vacuum in a hollow ball six inches in diameter, without the aid of an air pump? A. The best vacuum you can possibly get without a pump of some kind may be obtained by placing a small quantity of water in the ball and heat the ball and steam the air out. Continue the heat until the steam is also all out, or nearly ceases to be discharged; then seal the ball with a plug or by any means you may see fit.

(10) H. S. M. writes: 1. On the hub of a wagon wheel is a fly and on the felloe is a bee; which of the two rides the farther, the wagon being driven straight ahead for a period of 15 minutes? The bee beats the fly by the difference in the length of the two cycloidal curves which their positions give by the revolutions of the wheel. 2. Does any part of said wheel move backward during said time or trip? A. It does not. 3. Which part of a fly wheel of an engine moves the fastest, the rim or hub? Engine running at same speed for both calculations. A. The rim moves the fastest.

(11) W. & W. ask: Can you inform us if glass sewer pipe has been manufactured anywhere in the United States? If yes, at what place, and has it proved a success? A. We do not know that glass sewer pipe has been used. It certainly cannot be sold for a price that will make it a success. There is no doubt as to its durability and sanitary value, as its smooth, hard surface offers no lodgment for germs or filth.

(12) D. R. C. asks: Is there any difference between an injector and an inspirator for steam boilers? If so, what is the difference? A. Inspirator is only a special name. They are both injectors.

(13) A. M. H. writes: I have a practical treatise on heat, by Thomas Box, and on pages 130 and 131, the statement is made that a cast iron flue dissipates 3·35 times as much heat as a sheet iron one under the same conditions. On page 148 it says the loss of heat by contact of cold air is independent of the nature of the surface. Page 146, by table of radiating power of bodies, the radiant power of sheet iron is given as 0·56620 and the radiant power of cast iron is given as 0·64800. This gives cast iron less than ⅐ more than sheet iron; which is nearest to the truth? Under the same conditions, which gives off the most heat by radiation, cast iron, plain or galvanized, or lacquered, and in what proportions? Can you give me any other cheap method of preparing the surface of cast iron (without polishing) to prevent much radiation from it, at 200° to 500° Fahr.? A. The figures given in Box's treatise are not altogether reliable, for the reason that he does not state the condition of the surfaces, whether smooth or rough, and the color of the radiating surface. This is a material point in the relative value of the radiation from different metals or materials. When the surfaces of sheet and cast iron are exactly in the same condition as to smoothness and color, the radiant power is in favor of the sheet iron. The roughness of cast iron by increasing its surface may give it an artificial advantage as a radiant body. For preventing radiation there is nothing better than a smooth, polished surface. The next best is a good coat of lime (whitewash).

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

G. D. C.—No. 1 is common mica in feldspar. No. 2 is a black micaceous schist containing garnets; the red spots being the garnets.—H. S.—Specimen No. 1 is a black slaty serpentine. No. 2 is quartz with calcite (limestone), and No. 3 is a quartz.—J. L. T.—The mineral is pyrite (iron sulphide) of no value.

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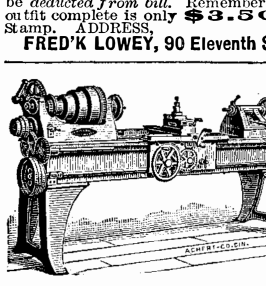

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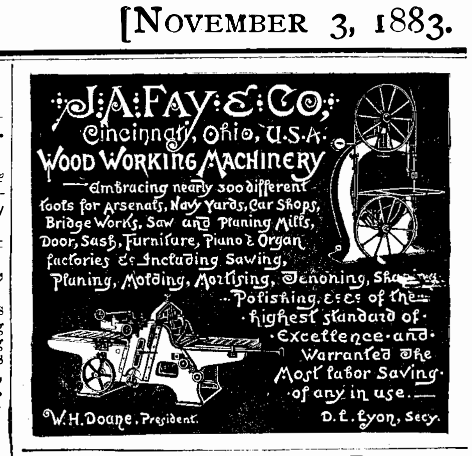

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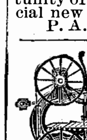

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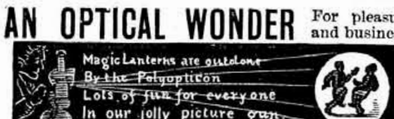

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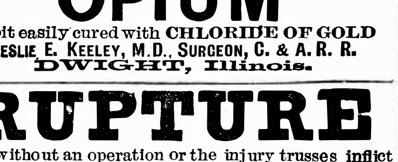

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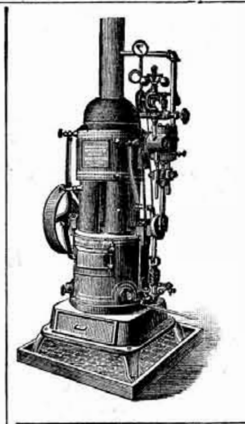

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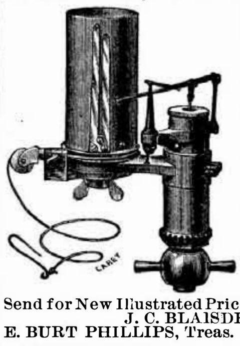

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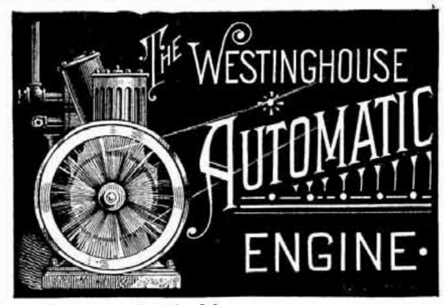

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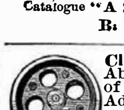

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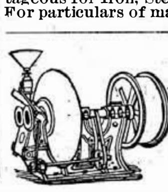

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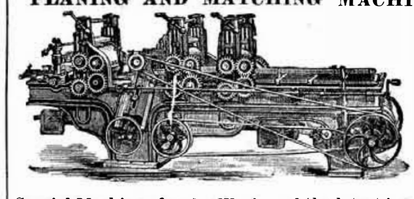

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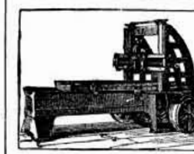

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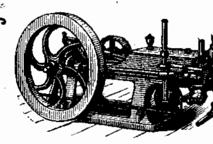

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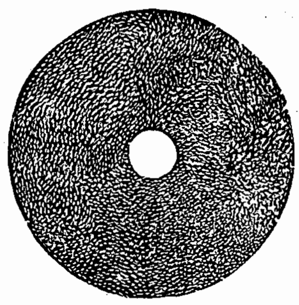

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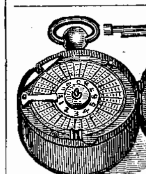

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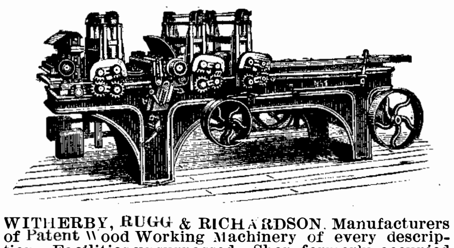

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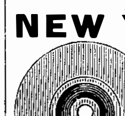

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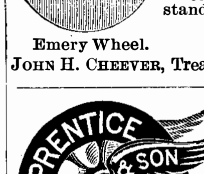

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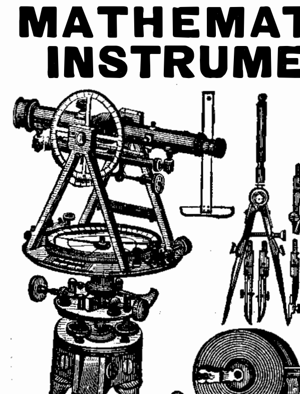

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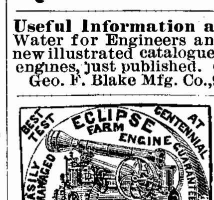

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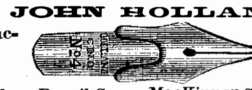

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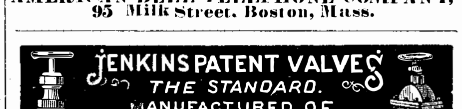

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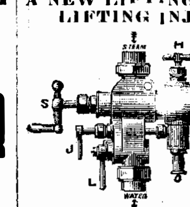

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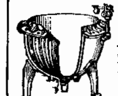

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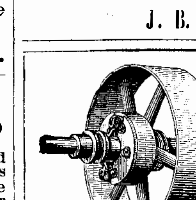

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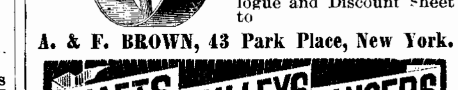

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