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THE NEW YORK APPROACH TO THE EAST RIVER BRIDGE.

It will not be difficult for any reader who has visited the offices of the SCIENTIFIC AMERICAN to locate clearly the scene depicted in the illustrations presented herewith. Nassau street and Park row converge at the northerly end of the block on which our establishment stands, entering the wide triangular space known as Printing House Square. From this Chatham street proceeds northerly, and may be thus taken as a prolongation of either of the two thoroughfares above mentioned. The large hotel on the extreme right of Figs. 2 and 3 marks the beginning of Chatham street, and

Fig. 2.—THE SITE OF THE APPROACH AS AT PRESENT.

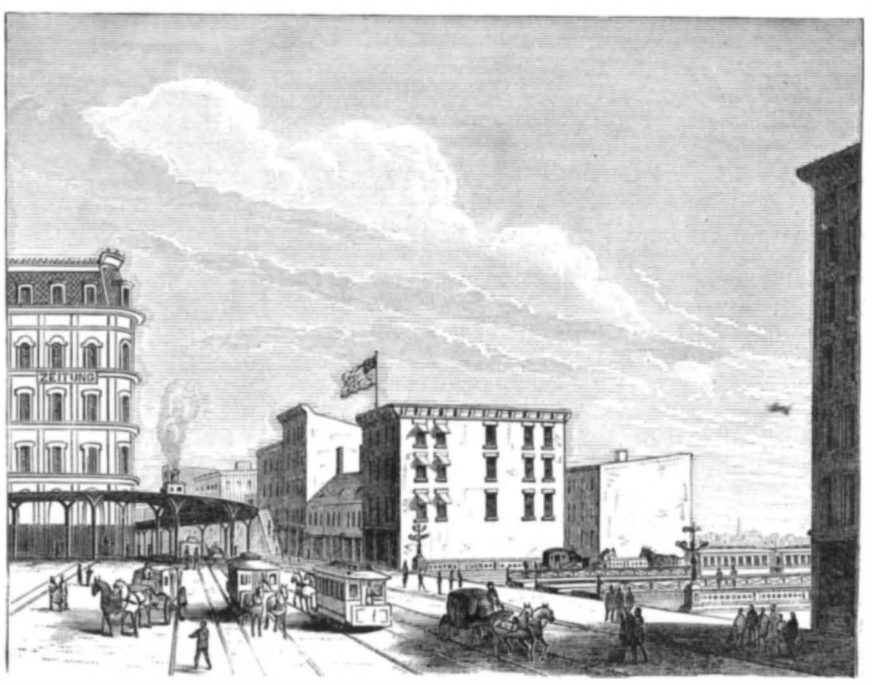

Fig. 3.—THE APPROACH ENTRANCE

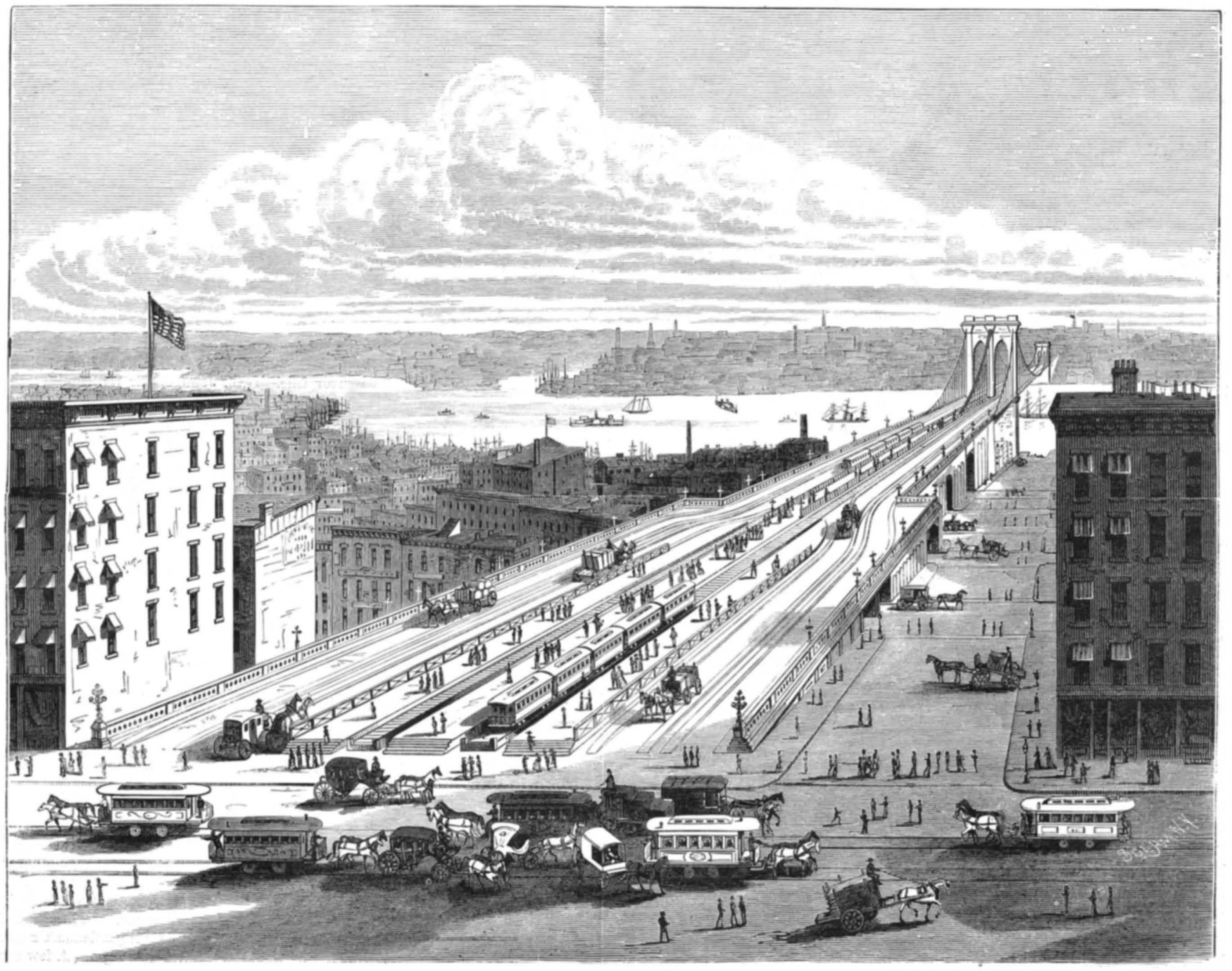

Fig. 1.—THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN. THE BRIDGE ENTRANCE, NEW YORK SIDE.

on the left in the background is shown the fine building of the *Staats Zeitung* newspaper, which stands at the angle made by the junction of Chatham and Center streets. Around this building sweeps the elevated railroad, which as usual defaces the fine facade of the contiguous structure and aids in obstructing a street already too narrow for the traffic which passes through it.

The northernmost of the two tall edifices in the middle of Fig. 2, previous page, is the *Daily News* office, the other is the iron structure formerly used by the *Staats Zeitung*. At a point about eighteen inches north of the north wall of the first mentioned building, and consequently in the small house adjacent thereto, falls the center line of the Great East River Bridge, and at this point is the junction of both this line and a line drawn, with a slope of 3¼ feet per 100, from the top of the New York anchorage. Here, then, is the starting place of the immense inclined plane of masonry which forms the approach to the bridge. On each side of the center line for a distance of 55 feet the buildings will be demolished, and in lieu thereof will appear the entrance to the grand aërial avenue. The change thus effected is represented in Fig. 3, and in Fig. 1 the reader is supposed to be looking up the magnificent perspective which will be visible from City Hall Park. The length of the approach from entrance to summit of the anchorage is 1,562½ feet. The latter, it will be remembered, is an immense pile of masonry, located on Water street, in which are imbedded the iron anchors and chains to which the cables are attached. From anchorage to pier the distance is 940 feet. Then comes the span of 1,595 feet crossing the river, another stretch of 940 feet from pier to anchorage, and lastly the Brooklyn approach, which will be but 836 feet long, or somewhat more than half the length of that on the New York side; so that the whole length of the bridge will be nearly 6,000 feet. The great piers rise to a height of 268 feet above high water, and at the water line measure 134 feet in length by 56 feet in breadth. The cables enter the anchorage walls at an elevation of nearly 80 feet above high water.

From our large illustration it will be seen that the width of the approach is not uniformly maintained. Beginning at 100 feet—the extra 10 feet of ground being taken for convenience in construction—it continues at this width for a distance of 600 feet; then it narrows to 85 feet, and this is the uniform width until the roadway is once more broadened on the Brooklyn approach. The space afforded at the 100 feet section is partitioned off into four carriage ways, three footways, and two railways for rapid transit. A pair of carriage roads are arranged at each side, the other thoroughfares being placed intermediately. The narrowing is effected by omitting two footpaths. The rapid transit roads will be provided with endless ropes connected with powerful engines at the termini. To these cables the cars will be attached by ingenious clutching devices, and in this manner they will be drawn over the bridge. The carriage ways may be used either for street cars or for carriages. Upon them are to be laid iron and steel trams, some fourteen inches in width, to accommodate wheels of any width apart. These are also so made that they will serve as tracks for the street cars.

The roadway of the approach rests upon a series of semicircular arches, supported by piers of granite and brick. In these piers openings or cells are left in the masonry to economize material. On the north side the exterior of the approach will be closely contiguous to the adjacent buildings. On the south side there will be a street of varying width, in some places reaching 100 feet. It is possible that the three small buildings on the south side of the approach may also be removed, as indicated in Fig. 3, in which case there will be a fine broad thoroughfare running parallel with the approach. This subject is, however, still under consideration. The facade of the structure wherever visible is of dressed granite of two colors. The spaces within the arches will be devoted to warehouse purposes. In each will be two floors, the loftiest being from 30 to 37 feet above the ground. These will be rented for any business use not likely to prove injurious to the structure, and will doubtless prove a remunerative source of revenue.

The arch construction of the approach is varied where streets are to be crossed. At Franklin Square there is an iron truss skew bridge of 210 and 170 feet span. At Cliff street, there is a stone and brick structure of 51 feet 8 inches span, and at Vandewater street one of 40 feet. The other bridges are to be simple box girders.

The entire approach will be so ornamented as to present an imposing appearance. A pierced parapet will crown the edges; the girder bridges are of a unique design that is very tasteful; and at intervals along the roadway handsome gas lamps will be placed. In all probability this splendid structure will be completed within the next two years.

PROGRESS OF BRITISH TORPEDOES.—The laboratory torpedo is as far ahead of the Whitehead as the latter was in advance of its rivals. The new torpedo, it is said, can travel at a speed of thirty miles an hour, and can be adjusted with more certainty than its rival. The authorities at Woolwich now decline to show distinguished foreigners all that they are doing.

TESTING THE TAY BRIDGE.—The great Tay bridge was lately tested by running six engines (each weighing 72 tons), at first singly, and subsequently coupled together, over the whole of the spans. That weight is more than double the greatest possible working load, and the extreme deflection was found to be only 1¼ inch.

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NEW YORK, SATURDAY, APRIL 6, 1878.

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(Illustrated articles are marked with an asterisk.)

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CITY PARKS AS GARDEN SCHOOLS.

It is scarcely a reproach to be considered too philanthropic, but after carefully reading Dr. Edward Seguin's proposal for the conversion of our city parks into garden schools, we are inclined to think that his desire to benefit the people is in excess of the advantages possible under his scheme. His idea is to convert the parks into species of museums; to introduce plants so classified and arranged that whoever examines them will involuntarily absorb botanical knowledge; to exhibit the appliances for "artificial hatching, breeding, and fattening poultry, raising the silk worm, etc.; to make the ponds lively with the appliances of hydraulics . . miniatures of great American water falls . . . shells, fishes, and the wonders of fish culture; to render the rocks and caves geological specimens," and so on, the motive being to facilitate education, or, in other words, to enable children to become educated through the medium of play.

There is a wide gulf between Dr. Seguin's plan and the outrageous proposal on the part of the city politicians to grab one of our largest and finest parks for the benefit of the young men who find pleasure in tricking themselves out in gaudy clothes and playing at soldier; but it is only necessary to remember that the parks are meant to be places of recreation for all classes of people, to perceive that a project which adds to the restrictions which must be cast around their use is only in degree less objectionable than one which prevents their enjoyment altogether. The main difficulty in our American mode of life now is that we are constantly tending to obliterate the distinction between work and play, by crowding work into hours which ought to be devoted to perfect relaxation of mind and body. If work must be done unremittingly the practice should be confined to the strongest years of life, and the preparation for such an existence manifestly is not an anticipation of it in childhood. The acquirement of knowledge is work, depending upon the nature of the individual, easy or difficult as the mind is receptive or the reverse. As a rule school hours are intelligently adjusted with a view to taxing the young brain to a safe limit; and to put any more upon it, by compelling children, voluntarily or involuntarily, to absorb more knowledge of the kind which should be, if it is not, taught in school, and this during their play hours, is simply continuing work. Besides play that is of any value as play has in its very essence freedom. The parks even now are sufficiently restricted, and if to "Don't walk on the grass," "Don't pick flowers," "Don't break trees," we are to add, "Don't meddle with the machines," "Don't carry off the specimens," "Don't step on the beds," "Don't paddle in the fish pond," and a score of other "don'ts," we might as well close the ground to the children at once.

Again, this project of Dr. Seguin's (which by the way by no means lacks eminent support, for we find it indorsed by Professors Newberry and Eggleston, the late Dr. Peaslee, and other well known citizens and scientists) does not take into account the fact that the immense majority of those who enjoy our parks are the poorer classes, who, in the breathing spaces which have been niggardly enough dealt out, find a welcome relief from the cramped quarters of the tenement, and as affording such relief it can hardly be contended that converting the parks into schools will enhance their value.

DISRESPECT OF INVENTORS' RIGHTS.

English literary journals are not remarkable for their appreciation of inventors' rights. Indeed, it is only too common with them to side with the aristocratic element of society in regarding inventors as, for the most part, poor devils who put themselves and their betters to no end of trouble by interfering with vested rights and established interests; that is to say, inventors who have not inherited or achieved distinction or title. If Sir John or Sir William invents anything, it redounds immensely to his credit and the credit of the British name. But if the unknown mechanic Jack or Bill does the same, and expects to be paid for his invention, it is quite another affair.

Accordingly a little plain talk from a paper like the London *Examiner*, touching the honesty of respecting the rights of inventors, seems decidedly encouraging. Somebody writes to the *Times* that Mr. Graham Bell certainly deserves the highest honor for his wonderful invention, the telephone, and then proceeds to say that the price of the instrument need not prevent any one from possessing a pair. The materials for making them can be purchased for a few shillings, and it is an easy matter to put them together. He himself had made a pair of excellent quality, at a cost of only fifteen shillings; and he goes on to show how others may do the same, unconscious that he is confessing peculation to the amount of about £24 5*s.*, and that he is instructing the public how to deprive the author of "this latest and most wonderful invention" of the reward of his labors.

Whereupon the *Examiner* remarks that the principles of common honesty are not so well understood as they ought to be; at all events there is a sad indisposition to give inventors and patentees the benefit of them:

"We presume that this gentleman would scorn to take £24 5*s.* from the pocket of a person who had earned his money by gambling, or on the stock exchange—that would be stealing. But Mr. Graham Bell happens to ask to be rewarded for rare ingenuity, patience, and scientific knowledge, and he is therefore fair game. 'Those that have brains should have no money' is this gentleman's new reading of the claimant's celebrated apothegm. A few complimentary phrases should satisfy them."

The disposition to invade inventors' rights, and to reward their services with empty compliments, may be less prevalent here than in England; nevertheless it is well now and then to look at it from the standpoint of simple honesty. Stealing is stealing, whether the theft is of material property or non-material.

A WORKING MAN.

Genius has been defined as a capacity for hard, steady, and long-continued work; the ability to "toil terribly," as one man of genius has expressed it. The definition may be accepted as a reasonably fair one, with the single addition that genius implies also the gift of working wisely. It is the direction that genius gives to toil, not less than the amount of it, that makes that toil so beneficial to mankind. In whatever way a modern man achieves true eminence he must work for it; and the work done by many of our really great men is positively appalling to men of less power and capacity for endurance.

There are few living men who have made their personal influence for good more variedly felt than Sir John Lubbock. In each of half a dozen different departments of useful activity he has done enough (had he done nothing else) to give him an honorable rank as an original observer, a sterling contributor to the world's progress; and the fertility of his mind seems not more wonderful than its scope and well directed energy. All owing to favorable opportunity, do you say? To inherited position, wealth, schooling, and the like? Hardly, as the history of his life will show. He owes much to such advantages; yet thousands of men have all these and more, but, lacking the disposition and the capacity for hard work, they make no permanent mark.

In his education, Lubbock illustrates what is almost a law with respect to the evolution of men of genius; his early home influences were good and liberal, and he subsequently escaped having his natural force and originality ground out of him by a formal course of university teaching. Before he was fifteen years of age the death of two of the partners of his father's banking house compelled him to leap the gulf between Eaton College and Lombard Street. From that day to this the business of his life has been banking; the investigations which have made him so widely known as naturalist and man of science have been his recreations.

The duties of his desk necessarily occupied the business hours of his youthful years; yet he found opportunity to continue his interrupted studies, and to gratify a taste for natural history which had been early fostered by an intelligent father, and subsequently stimulated by the example of Darwin, who at this time was a near neighbor of the Lubbock family.

The results of his labors in this department began to show themselves in technical journals before he was of age. At twenty-three he contributed to the "Philosophical Transactions" of the Royal Society, and to the entomological and other scientific journals. Since then his yearly contributions show at least a habit of steady application to this sort of original investigation. His recent papers on the intelligence and life habits of bees, ants, and other insects, and their service in fertilizing flowers, are familiar to all readers of the SCIENTIFIC AMERICAN.

In 1865, on the death of his father, he succeeded to the baronetcy and became Sir John Lubbock. Soon after he was induced by the Liberals of West Kent to stand for Parliament, but was beaten. In 1868 he retired in favor of Mr. Lowe, after nomination for the representation of the University of London by a committee of men of the highest scientific eminence. After another unsuccessful attempt for West Kent, he was elected for the borough of Maidstone in 1870. In the meantime he had entered into the discussion of the primitive condition of man, publishing first his "Prehistoric Times," and subsequently a work on the "Origin of Civilization," ably defending his position throughout the controversy in numerous scientific and other periodicals.

As statesman, Sir John has been as hard and successful a worker as in the domain of nature and early man. He has been a conspicuous representative of many and important interests, and has had the honor of piloting through the House of Commons several bills of signal importance to industry, commerce, and science. As the head of a great banking house he has made his influence felt in many ways. One of his most important services to bankers was the organization of the London Clearing House, with the introduction of a system of clearing checks, which extended to country banks the system followed by the London bankers. He represents in Parliament the London Association of Bankers; was a member of the International Coinage Commission, and has contributed not a little to financial literature. As a political writer he has also attracted attention, notably in his paper on the "Imperial Policy of Great Britain," published about a year ago.

In addition to all this labor as banker, Member of Parliament, and scientist, he has found time to serve as Vice Chancellor of the University of London, as member of the Public Schools Commission, and of the Royal Commission for the Advancement of Science; he has lectured before the British Association, the Royal Institution, and many scientific societies in the chief towns of England. He has been Vice President of the British Association, of the Royal Society, and of the Linnæan Society; also President of the Ethnological Society and of the Entomological Society. He is a fellow of all the societies above named, and of the Geographical Society, the Geological Society, the Society of Antiquaries, and other scientific bodies at home and abroad. He is also a magistrate, and withal a clever hand at mechanical work. It is said that his daily manual work would entitle him to a fair return on the wages of an artisan.

Would-be representatives of the working man—like Citizen Swinton, or Schwab the beer seller, or Kearney the cab man—would probably call Sir John a pampered aristocrat, and dispute his right to the title of working man; but the real workers, whether manual or intellectual, or both combined, cannot but honor him as a real worker, a useful worker, an uncommonly hard worker.

THE TELEPHONE A SENSITIVE ELECTROSCOPE.

The law first discovered by Faraday more than 40 years ago, that intermittent electric currents will induce other currents in neighboring conductors, was applied to advantage in various forms of small machines with double and triple coils, mostly used for medical purposes, and culminated in that powerful modern apparatus now found in most all physical cabinets, the Ruhmkorff coil.

The experiments proving that such currents are also generated when the wires are not close together are well known to electricians. But when the wires are several feet distant it requires delicate galvanometers or other electroscopic appliances to demonstrate their presence.

As the telephone is an instrument adapted to be acted upon by very weak electric currents, and to manifest their audible effects, it may be anticipated that it is very well adapted to test the presence of currents incidentally induced by other currents passing through neighboring wires, and the observation of such phenomena has caused the most intense surprise among those not acquainted with the law of electric induction, making them wonder how the current passes from one wire to another through several feet of intervening air. From the first time the telephone was used many strange sounds were heard, which often interfered with the successful use of the instrument, especially when the return currents went through the ground; but even while using two wires extraneous sounds were noticed, and finally it was found that the click of the Morse telegraph was transmitted through the telephone when its conducting wires were suspended on the same poles as those conducting the telegraphic messages. Finally, when the separate wires of several telephones are carried together by the same poles, or only in proximity to each other even for a short distance, the sound of every telephone was found to be transmitted to the others. The latest instance we find recorded in a late number of the Rochester *Evening Express*. It mentions that a strange fact not on the programme was developed in recent experiments. While Professor Johnson was, during the afternoon, preparing the instruments so as to transmit the singing from Buffalo to Rochester, by means of the Western Union telegraph wire, the sound was also distinctly heard through a telephone in another locality (Mannel's store), which had no other connection with the Western Union wire than that. The wire connecting it with Buffalo ran parallel and near to the Western Union wire, but nowhere touched it. It is further reported that a similar state of things took place during the concert, when the cornet solo and singing in Buffalo were also heard in a third telephone in Amsden's office, the wire of which at no point approached nearer to the Western Union wire than a distance of ten feet.

It had before been noticed that sounds were heard in Amsden's office when the telephones of the Vacuum Oil Company were used, the wires of which were parallel, but did not approach each other at any point within several feet. The Rochester editor adds: "This we regard as one of the most wonderful developments yet of this mysterious force of electricity, but perhaps the electricians will be able to give some explanation of the fact, which is well attested."

It will be seen from what we said in the beginning of this article that not only is there an explanation, but that it is founded on one of the best known and established laws of electricity, and that even the whole phenomenon was anticipated; however, it must be confessed that no one did anticipate such a perfection of detail as practical experience shows to be attainable, and it proves the telephone to be one of the most sensitive electroscopes for detecting the presence of induced currents.

NICKEL PLATING.

The plant necessary to commence nickel plating consists of a battery, preferably of the Smee type, with carbon negative; a well bolted oblong wooden tank, of a size to suit the articles to be plated, coated on the inside with good asphalt, and nearly filled with the nickel solution; nickel plates for anodes, and brass rods to suspend the plates and work in the bath; suitable vessels for an alkali, an acid, and soft water for cleaning the work before placing it in the nickel bath; polishing and buffing lathes, rouge, crocus, etc. The bath may be composed either of the chloride of nickel and ammonia or the corresponding sulphate, dissolved in pure water. If the latter is used, the solution must be kept neutral and up to about six degrees of hydrometer. It is prepared by dissolving ¾ lb. of the salt in each gallon of water. This salt is generally considered the best for nickel plating, and costs only $1.30 per pound. From this bath the nickel can be profitably deposited at $2 a pound. The chloride bath requires about four ounces of the salt per gallon, and works better with a slight acid reaction, the tendency in working being toward alkalinity, even with great exposure of anode. The intensity of battery current must be proportioned to the bath, and remain constant. Large baths offer less resistance to the electric current than those of smaller dimensions, and can therefore be worked with a current of somewhat less tension. For a bath of 10 gallons or less, the tension of the current should be equal to that of from 2 to 3 Smee cells (carbon and zinc) in series. The exposed surface of the nickel anodes should in no case be less than the surface to be coated, but may with advantage be greater. The amount of battery power for a given amount of work should be in zinc surface equal to the surface to be coated, with care to preserve the normal tension of the current. If the current is too intense the coating will present a dull white or frosted appearance. The anodes must be in connection with the negative plate (carbon) of the battery. Damage is not infrequently done to the bath and work by misconnection.

The work should be scrupulously clean when entered to the bath, and should be carefully moved about after entering to free it from any adhering air bubbles. If the finished work is to have a smooth polishing surface it must present such a surface before entering the bath. Nickel is hard and cannot well be burnished. Traces of oil and grease are removed by a hot soda solution. After dipping in clean water the surface is freed from films of oxide by an acid bath. If the work is of iron the acid may be hydrochloric diluted with three or four volumes of water; if of copper or brass, of nitric acid diluted with about twenty parts of water. Brighten the work in the acid dip, then immerse momentarily in water; go over it with a clean stiff brush and very fine sand; again dip in the acid, then quickly in soft water, and place immediately in circuit. The hand must not come in contact with the surface of the work after removal from the alkali, as the slightest touch may spoil all. On removal of the work from the plating bath it should be immediately dipped in cold water and transferred to hot water, which will cause it when taken out to dry quickly and perfectly. The bath should be covered when not in use, to keep out dust and prevent as much as possible its evaporation.

By a little practice and proper attention to these simple rules the nickel bath may be worked continuously, month after month, and the metal deposited smoothly and with certainty. Magneto-electric machines, such as those of Gramme and Weston, are now gradually replacing galvanic batteries in large electro-plating establishments.

THE WORKING WOMEN'S HOTEL.

The fine building on Fourth Avenue, Thirty-second and Thirty-third Streets, designed by the late A. T. Stewart as a home for the working women of New York city, is being rapidly put in order for the reception of its guests. The exterior work was long since finished, but until recently much remained to be done to complete the interior arrangements. The plans of the building were made by Mr. John Kellum, and were evidently well considered. The result is far in advance of any similar enterprise of the kind, every detail being especially adapted to the purposes of the structure.

There are 502 sleeping rooms of various sizes, together with eight reception rooms and extensive parlors and dining rooms. A library of nearly 3,000 volumes is one of the best features, and it is furnished with suitable desks and conveniences for writing. The carpets, upholstery, etc., were designed and made for this especial purpose, and the general decorative effect is artistic, the tints and forms being harmonious. The mechanical arrangements of the house are excellent. There are five elevators, besides stairways. Water is supplied by steam pumps from an artesian well on the premises, and the gas burned will be made in the building. This independence with regard to water and gas will effect a considerable saving, and will allow of a more liberal use. Steam heat will be introduced.

Within the building is a large court containing a fountain; and this, as well as the imposing entrance, shows an intention to make the hotel something more than merely comfortable.

The *Tribune* states that the minimum charge for those living at the hotel will be $6 per week, and from that amount up to $10 per week. These rates will be too high for the great number of working girls in New York, who are paid from $3 to $7 per week. But it is expected that a large class of women will find a home at this place. The artists, writers, teachers, students, telegraph operators, actresses, and the majority of women engaged in the finer mechanical and commercial pursuits, are believed to be numerous enough to fill many such hotels.

Practical Utility of Lubricators.

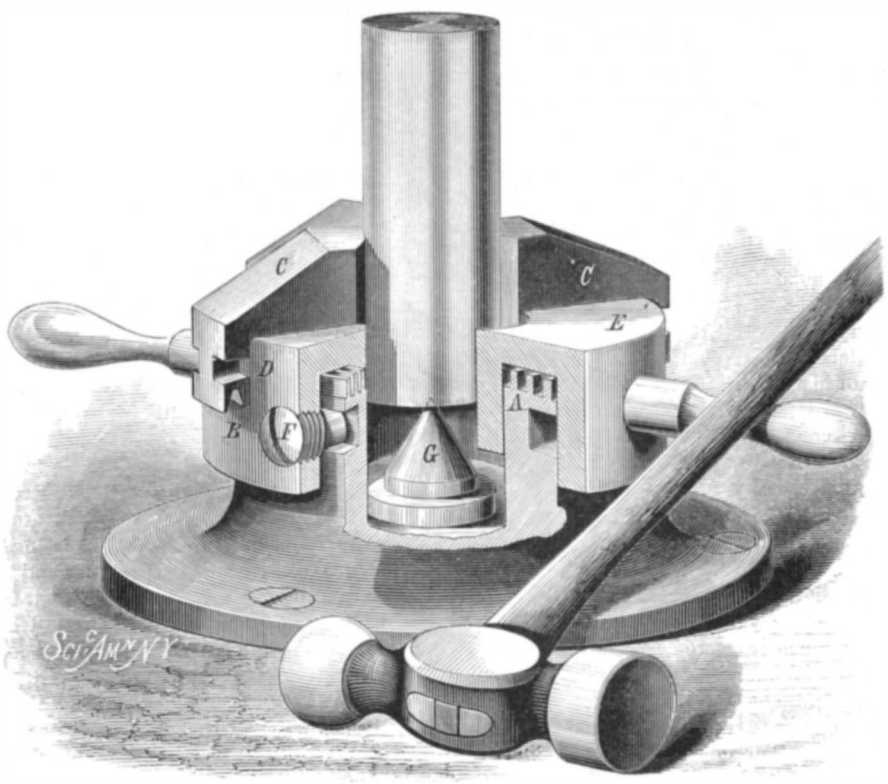
Dr. Joule, of Manchester, England, one of the most distinguished chemists of the day, has made a thorough investigation of the subject of friction and heat; and it is now not only well known that the loss of heat is loss of power, but the value of the power lost can be estimated almost to a fraction. "We may gather from this knowledge," says Mr. W.H. Bailey, "when we apply it to workshop economy, that if a pedestal or bearing becomes so hot through friction as to cause one pound of water to be raised one degree Fahrenheit in temperature in one minute, heat has been lost equal to that which would be created by a weight of one pound falling through a space of 772 feet. We are told that if we apply this conversely, heat has been lost which would lift one pound weight 772 feet; and if we apply these illustrations still further, and imagine forty-two pedestals or bearings losing heat by friction in a similar manner, we may inform ourselves that we are losing nearly one horse power, because they represent 32,424 foot-pounds of force; and if we know from our books what our coal costs, it will take very little trouble to give us the exact cash value of this friction and destructive action."

IMPROVED CENTERING CHUCK.

The annexed engraving represents an improved chuck for centering work before adjusting it on the lathe. The construction is strong and exceedingly simple, and the device generally is well calculated to save time and trouble. The lower portion or standard is rigidly attached by screws to a suitable bed. On its upper face are spirally disposed projections, A, in which engage recesses, B, on the lower surface of the jaws, C. Said jaws have side recesses which receive projections, D, on inner side of the mortises in the upper revolving portion, E, in which mortises said jaws work radially. Through said upper portion, E, pass the screws, F, their inner ends entering a groove on the standard, thus retaining the part, E, in place while allowing it to revolve.

It will be evident that when said portion, E, is rotated by the handles shown, the jaws will, by the spiral projections on the standard, be caused to move uniformly and simultaneously toward or from the center. In using the device the work is placed between the jaws, as represented in our illustration, and the latter are tightened. The object is thus adjusted so that its center rests directly upon the metal cone, G. It only remains to strike the work from above with the hammer, and the point of the cone makes the necessary indentation.

For further information address Mr. A. F. Cushman, Hartford, Conn.



IMPROVED CENTERING CHUCK.

Patented through the Scientific American Patent Agency July 14, 1874. Further particulars may be obtained by addressing Hinckley & Son, Dallas, Texas.

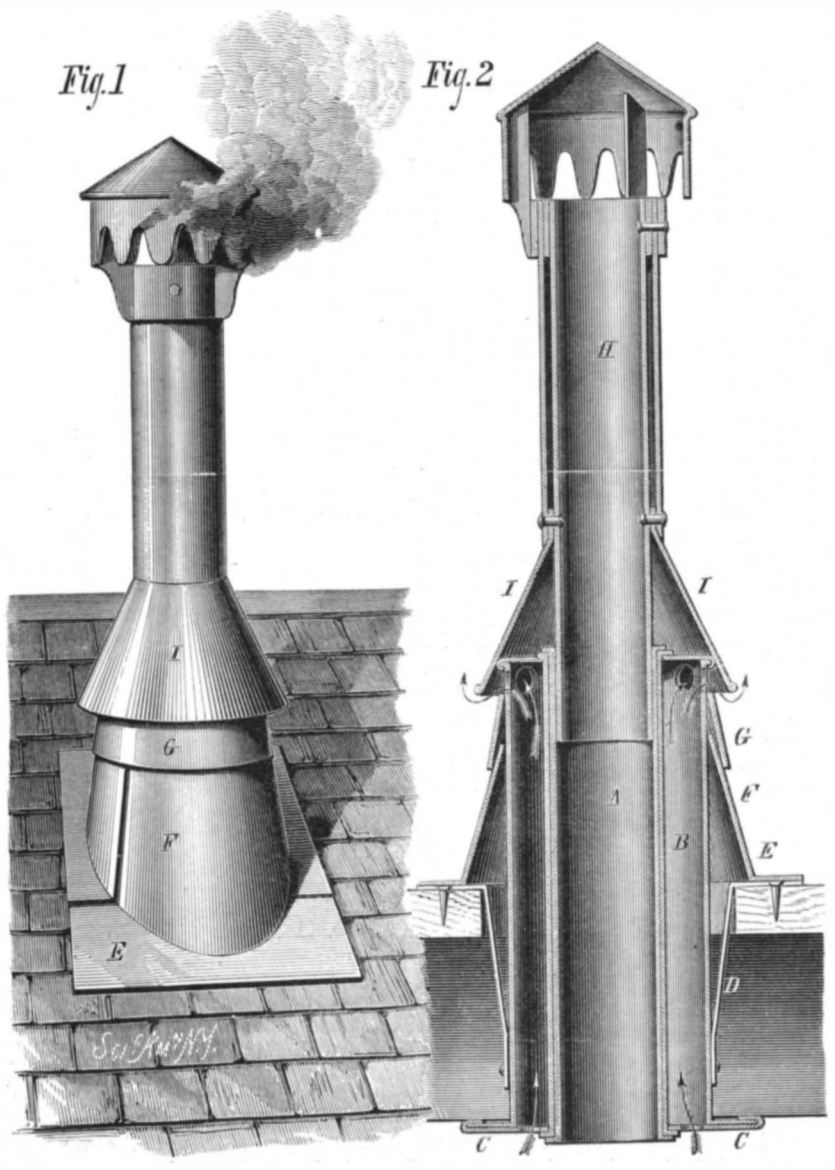
A New and Powerful Explosive.

We learn that M. Nobel, the inventor of dynamite, has recently discovered a new explosive substance still more powerful than that. He has given it the name of "explosive gelatine," on account of its aspect, which closely resembles gelatine. The substance is composed of 94 to 95 per cent of nitro-glycerine, and 6 or 5 per cent of collodion, mixed together. It is viscous, but can be easily cut with aknife or with scissors, and placed in cartridges or shells. Dynamite, it is known, has the disadvantage of being alterable by water—when it is moist the nitro-glycerine separates from the absorbent. The new substance, on the contrary, does not give the least symptom of exudation; it is impermeable to water, which does not at all affect its explosive properties. It is inflamed in the same way as dynamite, and its power is at least 50 per cent greater. Italy and Russia have, it is said, adopted this substance for charging bombs, torpedoes, etc.

COMBINED VENTILATOR AND CHIMNEY.

The accompanying illustrations represent a combined ventilator and chimney, which, we are informed, has been found economical, safe, suitable for light structures, and capable of being easily put up by any one. Fig. 1 is a perspective and Fig. 2 a sectional view; in the latter A represents the chimney flue, which is made preferably of tin lined with No. 24 sheet iron, the same being riveted through wherever the joints may lap. An outer casing, B, is suitably attached by a flange, C, to the ceiling, while the body and whole support of the chimney is held by supporting straps, D, firmly riveted to the outer casing, B, and fastened to the timbers or sheeting of the roof.

The water-proof connection of the casing, B, with the roof at the point of its passage through the aperture of the same, is made of two sheet metal plates, E, so constructed that they shall clasp the outer casing, B, from opposite sides. The upper plate laps over the lower one, and each is provided with its half of a collar, F, so cut and fitted to the same by soldering as to make a perfect water-tight connection independent of any soldering to the outer casing, B. The upper edge of the halves of the collar is secured by a close-fitting ring, G, or by any other suitable means. A chimney extension or tube, H, is fitted into or otherwise firmly attached to the upper end of chimney, A, and protected against the rain at its upper end by a cap or shed. Lower down on the same a second cap, I, is formed by the flaring out of an outer casing, so as to extend around and protect from rain the upper end of casing, B, and also the collars of the water-proof plates, E. The heat of the smoke and gases of combustion, passing up through the chimney flue, produces the heating of the air in the ventilating space around the same, so as to cause, by the rising of the air to the outside, a draught from the room, and thereby a ventilation of the same. The sheet iron chimney, A, having a tin casing next to the ventilating space, the corroding action of the air upon the outer surface of the same is prevented, and, being riveted together wherever the joints of either may lap, one strengthens the other, and a greater durability is attained thereby. The outer air casing surrounds the chimney complete, and not being dependent upon solder in any of its connections, the liability of accident by burning out of the chimney from the accumulation of soot is claimed to be rendered impossible. There being no contact of the inner flue with the wooden parts of the building, the danger of fire from the chimney is avoided.



COMBINED VENTILATOR AND CHIMNEY.

Water Supply of Cities.

The Prince of Wales has addressed a letter to the Society of Arts, suggesting an open discussion on this question, with a view to the consideration of some comprehensive scheme of a national character, by which the vast natural water resources of the kingdom might be turned to account for the benefit, not merely of a few large centers of population, but for the advantage of the general body of the nation.

Early History of the Steam Engine.

John W. Hackworth, who witnessed the trial of the "Royal George" locomotive in 1828, writes as follows to the London *Miller:*

M. Cugnot, a French mechanic, first produced a self-moving steam carriage in 1769, and the following year (under Government auspices) constructed a second, which conveyed artillery and passengers. William Murdock, of Redruth, Cornwall, made a working model machine of this class in 1785. In 1786 Oliver Evans, a native of Newport, Delaware, was granted by the Legislature of Maryland the exclusive right in that State of using steam carriages on common roads, and shortly after constructed one. Richard Trevithick—who had repeatedly examined Murdock's model—made a machine of this kind at Camborne, Cornwall, in 1802. Timothy Hackworth's "Royal George" locomotive, constructed for the Stockton and Darlington Railway Company, was started in September, 1827. It was the first that exceeded the efficiency of horse power, and frequently traveled more than twenty miles an hour. The following experiment with the "Royal George" was witnessed by Robert Stephenson, Joseph Lock, Timothy Hackworth, and myself, early in 1828, and was, at the special request of Robert Stephenson, inserted in Rastrick and Walker's printed report, which they laid before the directors of the Liverpool and Manchester Railway Company on March 7, 1829. Report, p. 17: "Hackworth's engine took forty-eight and three quarter tons at eleven and two tenth miles per hour on a level, and the steam was blowing off when the experiment ended." Remarks by Rastrick and Walker in said report: "We state the preceding as it has been given to us. Hackworth's engine is undoubtedly the most powerful that has yet been made, as the amount of tons conveyed by it compared with the other engines proves." Comparing the date of the "Royal George" (namely, September, 1827) with that of Sir Goldsworthy Gurney's common road engine (namely, July, 1829), it will be seen that nearly two years before the latter appeared the railway locomotive was an accomplished fact. Hence, had Sir Goldsworthy Gurney never lived, not one single detail of the railway locomotive would have been wanting, nor less perfect, nor its advent delayed five minutes.

New Mechanical Inventions.

An improved Rotary Valve for Steam Engines has been invented by Mr. D. W. Jones, of Pocahontas, Ark. It has an arrangement of steam passages in the valve, and ports and passages in the valve casing, by means of which the pressure on the valve is equalized or counterbalanced, so as to relieve the latter from friction.

A machine for Trussing Barrels has been patented by Mr. H. W. King, of Alden, N. Y. The object is to furnish means of rapidly applying truss hoops to barrels, and also for confining barrels during the process of heating. The machine has an annular head carrying a truss hoop, between which and a form on the head the upper ends of the staves are placed. A movable frame carries a hollow cone for driving down the truss hoops and giving form to the upper end of the barrel. There is a separable bed having a conical cavity, at the sides of which grooves are formed for receiving the hoops to be placed on the lower end of the barrel. The lower ends of the staves are contracted by a suitable device after the upper ends are secured. There is also a bed carrying a hollow cone for confining the barrel during the process of heating.

Improvements in Gigging Machines for Napping Cloth have been patented by Messrs. Christian Woelfel and James Massey, of Chester, Pa. The guide rolls of reciprocating napping cards are combined with adjustable bracket plates guided in recesses of the main frame and set by suitable screw gear, while the napping cards are reciprocated at right angles, or any other lateral angle of inclination, to the cloth by means of eccentrics and vertical shafts. These are improvements on patent No. 172,991.

Mr. A. S. Hickley, of London, England, has secured a United States patent for a new Electric Fire Alarm and Signaling Apparatus, in which the warning is given by a compound thermometric spring set to the required degree, making connection and sending an electric current to an ordinary clockwork alarm bell, when the temperature of the surroundings is raised by fire. The principle is not a new one, but is applied in a novel manner.

An improved Gang Wood Saw, making

two cuts at the same time, has been invented by Mr. T. F. Osburn, of Jerseyville, Ill. Two reciprocating saws work in a frame by means of slide rods driven by eccentric gearing. The piece of wood to be sawn is held in position by suitable holding and adjusting rods.

A new Coal Drill has been patented by Messrs. J. J. Rigney and William Hemingray, of Shamokin, Pa. It consists of a tapering and toothed cylinder, which is screwed into the coal by means of a wrench, and which carries the boring auger, the latter working by screw threads in a removable nut.

Mr. Cyrus Hunter, of Stonewall, Va., has invented a Steam Engine, in which the essential feature is a cylinder with closed heads and broken-out middle part, by which in reality two cylinders are formed, in which two separate pistons, with a single connecting rod and cross head, work. The valves are put in motion by the pistons, and are coupled together. The inventor claims a more perfect alignment by this arrangement, and freedom from the leakage and friction of the stuffing box of ordinary engines, none being required by the piston rod, as it does not pass through a cylinder head, partition, or abutment.

An improved Gas Lighter and Automatic Extinguisher, invented by Mr. G. S. Dunbar, of Pittsfield, Mass., is operated by an ingenious system of clock work, designed to work with regularity and effectiveness.

BROWNHILL'S BRICK MACHINE.

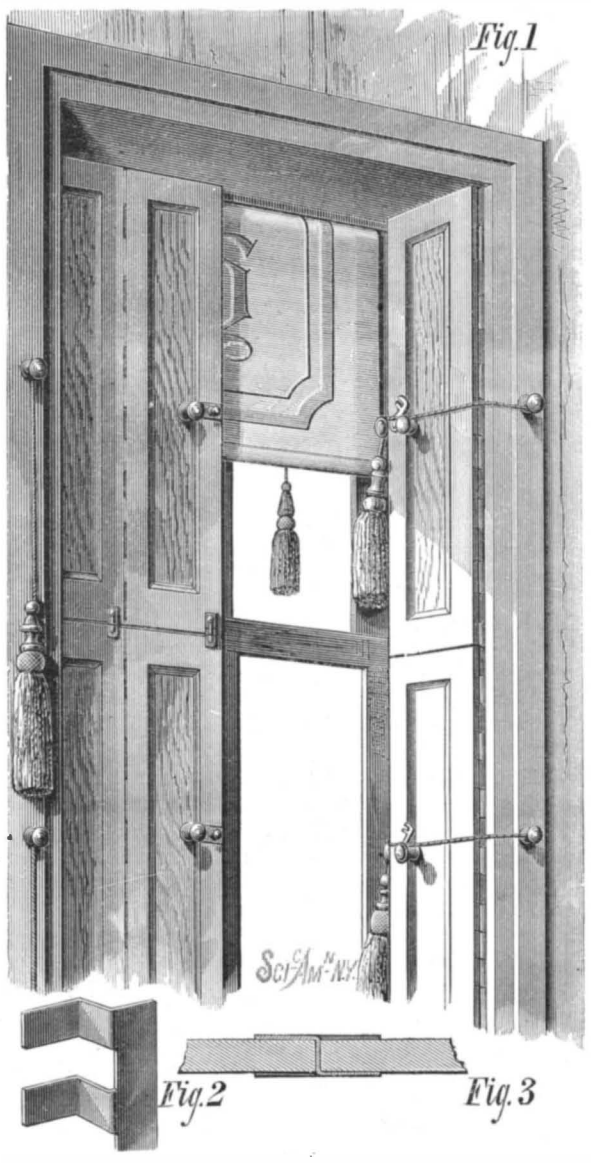
The machine shown in the accompanying illustration is the invention of Mr. R. W. Brownhill, of Walsall, England. Its most striking feature is the large margin of strength allowed in its construction, the dimensions of all working parts being so increased as to provide against great or unusual strain. Having thus provided for strength and durability, the inventor claims that the machine is capable of operating upon all kinds of brick earth in any condition, rough, ground, disintegrated, wet, dry, or semi-dry. Of course the quality of the bricks made ultimately depends upon the character of the material used; but, so far as the machine itself is concerned, the avoidance of the breakages and interruptions, so frequent with machinery of this class, is an essential point gained.

Referring to the engraving, B is a strong cast iron frame, with moulding box, S, cast on it. C C are slide boxes to guide the pistons, *e e*, which form two sides of the brick. The pistons are fitted with strong friction rollers. The pulleys, C *e*, and the chains and weights, G G, are to keep the pistons close to the cams cast upon the main shafts during their irregular motion. The hammer to drive the clay into the mould, S, works on the slides, A A, connected at the top by the cap, N; it falls during every revolution, and supplies and consolidates the clay through the hopper, E, into the moulding box, S, and between the piston pallets, *e e*. The hammer is operated by the helve, Q T, which works upon a reeler, R, turning upon a gudgeon, *g*. At the lower end of the helve, T, is fitted a friction roller to work upon the spiral, U, which is connected to the large spur wheel. By this means the hammer is raised and then dropped with the force of its own weight. The pallets, *e e*, deliver the bricks upon the band, P, which is worked by a small band pulley lifted at the moment when each brick comes out of the mould.

The operation of the machine is as follows: Clay is fed into the hopper, W. The screw revolving at the bottom of this hopper carries an adjustable quantity of clay into the hopper proper, E. Under this hopper the distance is regulated between the pallets for a regular quantity of feed, and it in reality becomes the mould. Just at the moment the pistons are in position the hammer falls, and forces the material into the mould. The motion of the cams causes one piston to retire while the other advances, and presses the brick. The retiring piston then entirely leaves the mould, and the advancing piston forces the brick out of the mould, to be taken away by the band before described, and thus completes one brick. The machine is adjustable in all its motions.

IMPROVED PAPER SHUTTER FOR WINDOWS.

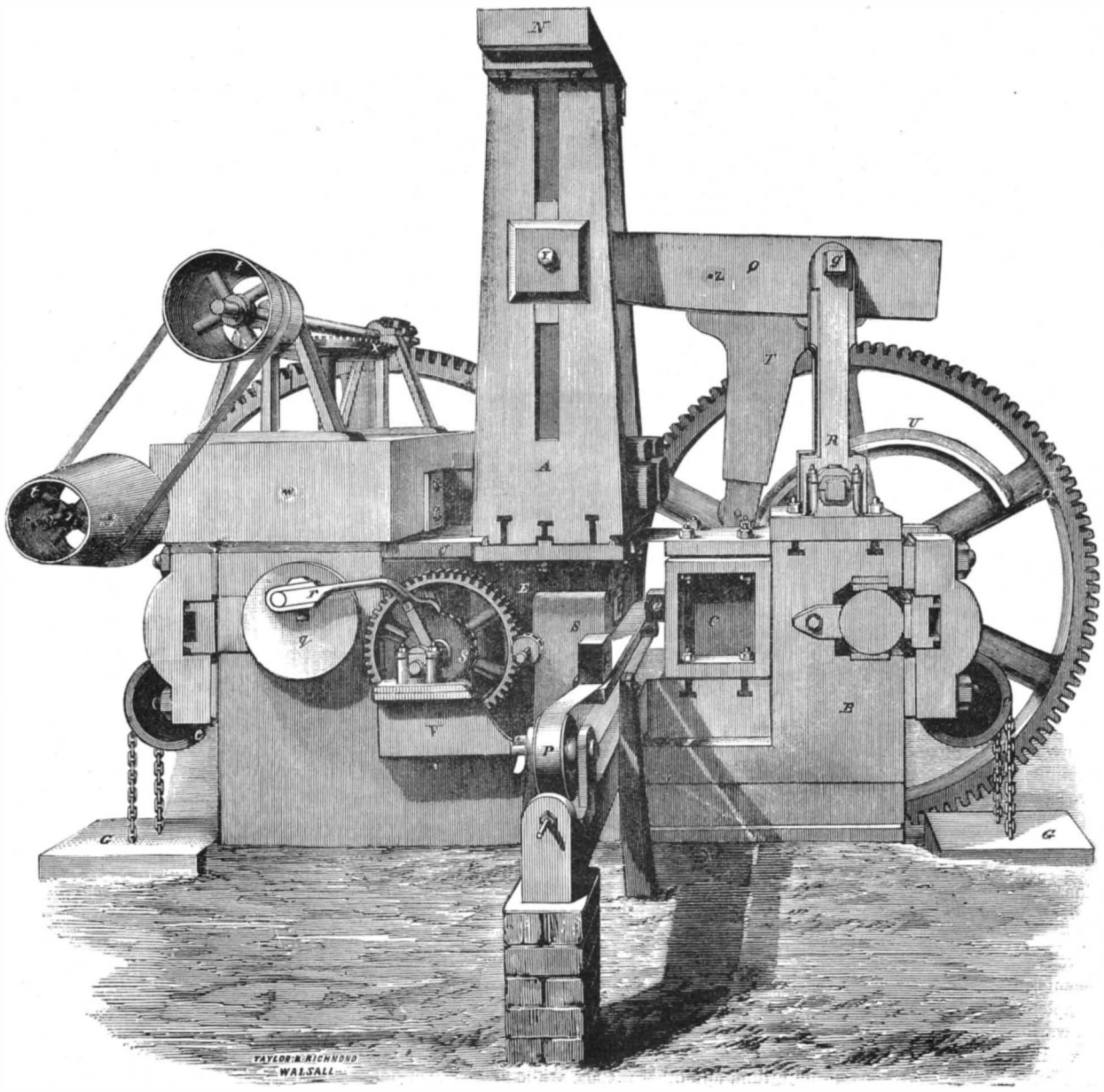
Our engraving illustrates a new adaptation of paper to building purposes, the same being the manufacture of the material into inside blinds or shutters for windows. A shutter composed of paper is claimed not to be so liable to be affected by shrinkage and expansion, and therefore is free from the disadvantages of binding or open joints. It is lighter and cheaper than wood, and it may be attached where wooden shutters cannot be. It admits of every variety of painting or ornamentation in set patterns ready for the trade, renewable at any time in similar manner to wall paper.



PAPER SHUTTER FOR WINDOWS.

The shutter parts are composed of panels or sections united by flexible joint hinges of cloth, as shown in Figs. 2 and 3. The strip of fabric is cut as shown with tongues, two strips being glued one on each side of the same section, and the tongues of each strip lapping on the opposite sides of the adjacent section. These hinge strips extend from top to bottom, as shown in Fig. 1. The panels thus joined are similarly hinged to jamb pieces for attachment to the jambs, which pieces are wide or narrow to suit different styles of windows, and are constructed with reference to the folding of the shutters. At the point of junction of the shutter parts, in the center line of the window, they are provided with rabbets to close the joint and shut out the view, and to prevent the shutter from springing or warping. The jamb pieces can also be applied upon the surface of the architrave, where the jamb is too shallow to receive the wooden shutter now in use. This is claimed to be an important advantage, as it permits of the application of inside shutters to any house without alteration of the windows.

Patented January 15, 1878. For further information address Messrs. Hipkins & Meek, Bellaire, Belmont county, Ohio.



THE BROWNHILL BRICK-MAKING MACHINE.

Japanese Textile Fabrics.

Calling attention to a fine display of Japanese woven and embroidered stuffs—the spoils of a temple and palace in the center of Dia-Nippon—exposed for sale in this city, Mr. Frederic Vors gives, in the *Tribune*, an interesting account of this branch of ancient Japanese manufacture. He says:

"Numerous articles have been written about the fictile, metal, and enamel productions of Japan, but little, until now, has been said of the proficiency of the Japanese as weavers and manufacturers of textile fabrics. For years past we have been familiar with Japanese silks, such as were offered for sale in drygoods stores, especially made for the European and American markets; but what has been excessively scarce and almost unknown until now are the woven stuffs, brocaded dresses, and embroideries that were worn by the princes and daimios of a period at which the most remarkable manufactures were made, like Sèvres porcelain, only for presentation pieces, or for the use of crowned heads.

"For the artist and the collector the study of such stuffs affords an unusual interest, for it shows even to better advantage that subtile quality of ornamentation which makes Oriental art so interesting. The first impression received on seeing these superb textures is one of exquisite delight at the perfect harmony of design and color, but, as the eye wanders over the stuff, new details appear in every spot. The color of the groundwork changes, and so does that of the ornamental pattern, but on several yards of stuff the same juxtaposition of color between the ground and the ornament will not be repeated, thus affording great interest to the observer. The robes of the princes were of large dimensions—which seems singular when we think how low in stature the Japanese race is—and cut square, for their artistic sensibility is so acute that they could not have the heart to cut 'bias' through a beautiful pattern. This detail is not without interest, for we can take the dresses apart and use the wide bands of stuffs for decorative purposes. The lining used for each dress is always in perfect harmony with the outside hues of the garment, which offer the most striking variety even in one single piece. The dresses of musicians, jesters, priests, and lords, though cut in the same shape, are ornamented with suggestions of the occupations of the wearers. Some are so heavy with gold brocade that their weight is nearly sufficient to bear a man down, but in all cases that most exquisite harmony of color, which is such a relief to us after all the dogmatic art we have suffered under so long, is carried out in the most delightful

fashion. These people, who live in abodes that are more like tents than houses, and who, thanks to the glorious climate of their country, are always out of doors, seem to imbibe the influence of the magnificent coloring of nature by which they are always surrounded. Japanese art is true art in the fullest acceptation of the term; that is, a simple rendering of nature without any effort of the brain. When imagination comes in play, then it introduces those terrible though gracefully curved monsters which astonish us and set us thinking, for their magnificent grotesqueness does not interfere with the general composition of the design, but only enhances its beauty by strong contrast.

"The metallic threads used in their brocades are always made of paper, gilt or silvered, for the Japanese are masters in paper manufacture. This has a two-fold utility; while it makes the stuff more rigid, it does away with the hard cracks which occur in pieces in which gold thread of inferior quality is used, for real gold thread is too costly to be used except in church ornamental work, and even then only for pieces used on the altar. In some of the finest embroidery, such as was made for the hangings of temples, the gold work on the dragons is heavy enough to introduce glass eyes and metal claws, which help very much in making the monsters terrible. In embroidering on crape—such as is known in the trade as *crêpe de chine*—they are without rivals. They use a peculiar method of reserving certain parts by painting them over with a chemical which prevents spots thus prepared from taking the dye. In this way, when the stuff comes out of the dye vat, an important part of the ornamental design is already indicated by white masses and lines. Plaids produced by lines of different colors and thickness intersecting at right angles seem to have been used by them long before they became identified with Scotch fabrics."

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Owing to insufficient appropriations many very valuable clerks were recently dismissed from the Patent Office, and complaints have already begun to be made of the interruption of business resulting therefrom. The Commissioner, however, says that the discharge was unavoidable, as funds had run short, and that the allotment for salaries, etc., had even been exceeded. This should be remedied at once by Congress. It is not as if the Patent Office were an expense to the Government, as in that case there might possibly be some excuse for the parsimony which Congress exhibits; but when it is considered that over $120,000 more was received for fees than was paid out for expenses last year, and that over $1,100,000 lies to the credit of the Patent Office in the Treasury, a good reason is shown for more liberal dealings toward the office.

There is another matter where Congress is also derelict in its duty: it has suffered the Patent Office to remain for months without a decent roof, and has taken no steps toward repairing the injuries done by the fire. The inventors of the country have a right to demand that the edifice should be put in order again with the least possible delay, so that the model museum may be again ready for the convenient arrangement and storage of the models, as they pay fees enough to entitle them to sufficient accommodation.

THE PROPOSED PATENT COURT.

Mr. Vance has introduced into the House a bill to establish a Court of Patents, with three judges at a salary of $5,000 each. It allows appeals from the Commissioner to the court, and the decision of the court is to be conclusive, but not to the extent of preventing any person from testing the validity of a patent in any court of law or equity. The clerks and messengers of the court are to be assigned by the Commissioner of Patents from his force, and the rooms to be occupied by the court are to be in the Patent Office building. The board of examiners in chief is to be abolished, and all statutes applicable to it are to be made to apply to the Court of Patents. We have already pointed out the objectionable nature of this project.

REMOVING BARS IN THE MISSISSIPPI.

Captain Eads, having succeeded in his great enterprise at the mouth of the Mississippi, is looking around for more worlds to conquer, and now proposes to apply his jetty system to the removal of the bars wherever they occur between St. Louis and the Mississippi's mouth. He claims that by his method of operating a channel 25 feet deep can be secured between those points, and, moreover, that by making the width of the stream uniform the velocity of the water will equalize the bed of the river through the movement of the sediment, thereby rendering levees unnecessary.

In view of the success of Captain Eads, where it was doubted by many of our prominent engineers, his proposition, notwithstanding the enormous expense involved, is worthy of a careful consideration. The importance of the Mississippi as a national commercial channel cannot be exaggerated, and it consequently has strong claims for a large share of the money which Congress may see proper to appropriate for internal improvements. The money which it would require to construct a complete system of levees is so enormous as to stagger even the warmest friends of a liberal policy in regard to such matters. If it is believed on investigation that the plans of Captain Eads are practical, the expense of improving the Mississippi, and confining it within bounds, would be so greatly reduced that Congress would not be likely to hesitate about granting all the aid necessary for that purpose.

AMERICAN BUTTER IN ENGLAND.

The last report from our Consul at Newcastle-upon-Tyne gives some facts relative to American butter, which it seems desirable that the producers of that article should know. Complaint is made that the butter is too salt and packed in roughly finished red oak tubs. If made with less salt, but of the best quality, and packed in neat firkins or kegs of white oak, ash, or white cedar, and sent across the Atlantic in refrigerator steamers, it would command a good sale at remunerative prices. Danish butter has the preference on the east coast of England and in Edinburgh, the price being as high at present as from $38.44 to $38.93 per hundred. In London, Liverpool, Manchester, and Glasgow the American sixty pound tubs give satisfaction.

NORTH CAROLINA GOLD MINES.

A memorial from the Sixth Congressional District of North Carolina asks the appointment of a commission to visit the mineral regions of that district and to make a report thereon. From a pamphlet accompanying the memorial it appears that the gold producing area of North Carolina covers about 12,000 square miles, containing 140 mines already developed, besides large coal, iron, and copper areas. The yield of gold from these mines up to June 30, 1877, was $10,370,492.

OCCASIONAL.

Washington, D. C.

Correlation between Gravity and Electricity.

To the Editor of the Scientific American:

The experiment of Professor Pirani, described on page 80 of the SCIENTIFIC AMERICAN of February 9, 1878, and intended to demonstrate that electric currents are subject to the influence of gravity, does by no means prove what it purports to do. The influence of gravity upon a column of liquid is its hydrostatic pressure on the lower end, and this must necessarily affect the condition of the surface of the electrode which is exposed to this pressure, and make a difference with that which is at the top of the column not exposed to the same pressure. This difference of condition is sufficient to generate a weak current, perceptible by a sensitive galvanometer; this is sufficiently illustrated by the currents developed by two plates of the same metal attached to the ends of the coil of a delicate galvanometer, and plunged in the same solution; the least difference in the condition of their surfaces, or plunging one plate deeper in than the other, will cause a current to be produced.

To this must be added that liquids are very different from gases in respect to uniformity of the mass, which, by the nature of the molecular motion of gas particles and the consequent law of interpenetration, remains perfectly homogeneous throughout the whole mass, while in liquid solutions there is a tendency to greater concentration at the bottom of a column, when not mechanically agitated. I think, therefore, that this experiment may be dismissed as proving nothing in regard to the direct action of gravity upon electric currents; the more so, as from our present knowledge of the nature of these currents, and the overwhelming proofs that no such thing as an electric fluid exists, it is obvious that gravity cannot act on a thing which has no existence. This experiment belongs to the same class as that which tends to prove that heat has a negative weight, by showing that a body when warm weighs less than when cold. In fact a delicate balance will easily show this; but the cause is that the warm body generates upward air currents, which carry up the side of the scale on which the body is situated. In a similar way gravitation causes a difference in the condition of the two ends of a liquid column, which change may generate an electric current.

On page 148 of the SCIENTIFIC AMERICAN of March 9, a comment on the above appears in a communication on "The Correlation of Magneto-Electricity and Gravitation," in which the writer makes several erroneous statements and shows that he has very obscure conceptions of the nature of these forces. He says: "First, gravitation acts upon all kinds of matter; Faraday proved the same of magnetism." The latter statement is incorrect; Faraday proved that most substances were either para- or dia-magnetic, but that magnetism does not act at all on some bodies. "Secondly, gravitation is attractive; so is magnetism." Again incorrect; magnetism attracts or repels, according to whether poles of different or similar kind act upon one another. "Third, gravitation is proportional to the mass; the force of magnets depends also upon the mass." Not so; light and thin steel bars can be better and more strongly magnetized than heavy, thick ones. "Fourth, gravitation acts in an inverse ratio to the square of the distance; so does magnetism." Again incorrect; in some instances, such as the magnetic attraction of wires through which an electric current is passing, magnetism acts in the inverse ratio of the distance and not as the square, as has been proved by Ampère. "Fifth, gravitation does not manifest polarity; magnetism is known not to do so." The latter is the most absurd of all the statements made. It is magnetism which has revealed to us what polarity is; it is the very force which taught the existence of polarity, and with electricity exhibits the only polar phenomena. "Sixth, gravitation acts independently of bodies affording a resistance to light and heat; so does magnetism." Again wrong; while neither light nor heat affect gravitation, light has lately been proved to affect the electric conductibility of selenium, tellurium, and other metals, while increase of temperature diminishes magnetic attraction, and a sufficiently high temperature destroys it altogether.

The true magnetic connection between sun and earth may be more plausibly explained by Barlow's hypothesis that the alternate heating of the different sides of the earth during its daily rotation generates electric currents, from east to west, on the principle of thermo-electricity, and that the compass needle, according to the law of Oersted, places itself at right angles to these currents.

As by irregularities in the earth's surface these currents run in most localities not exactly east and west, the needle does not point exactly north and south, except in the few places where the electric currents run exactly east and west. If by reason of the sun spots the amount of heat emitted from the sun fluctuates, the electric currents generated by that heat change; and this may account for the connection between sun spots, magnetic periods, and auroras, which are nothing but electric currents through the rarefied air above the clouds.

Your correspondent further states that "the isoclinal, isodynamic (of the magnetic), and isothermal lines run parallel." This is by no means the case; the only thing which can truthfully be stated in this regard is that there is a slight tendency that way, so that the point of greatest cold on our earth's surface inclines toward the magnetic pole.

Finally, P. M. C. asks some questions, which I will attempt to answer. "1. Will not the supposition that the sun is a huge magnet account for the production by that body of light, heat, etc.?" Answer: Only to those for whom the word magnetism is a mysterious agent which may explain everything; but for those who have studied magnetism and know what a magnet is, it will explain nothing of the sort. Second question: "Admitting this hypothesis, will it not explain why the light of the sun increases as a heavenly body approaches it?" Answer: It will not; the approach to a magnet of another body, whether magnetic or not, never increases its temperature. Third question: "Will any other theory explain this satisfactorily?" Answer: It will; the theory of gravitation teaches a disturbance or tidal wave caused in the solar atmosphere of incandescent vapors by the mutual attraction of gravitation on the approach of a heavenly body. Fourth suggestion: "No known force except magnetism can produce all the phenomena of comets." Answer: A gratuitous assertion, pleasing to those who consider magnetism a convenient word to use in place of a rational explanation. The phenomena of the dual appearance of Biela's comet, the multiplication and relative position of the tails, and their coruscations have been a subject of deep research among speculative astronomers, and the mere assertion that "magnetism is sufficient to produce these most wonderful and least understood features" is a loose statement, without sufficient foundation, and as such insufficient for a rational investigator.

The only road to progress in our knowledge of natural phenomena is by thorough investigation and legitimate deductions from correct premises, while wholesale assertions, especially when they are utterly untrue, can only retard progress by deluding us with a shadow, and even less than a shadow, while the substance remains unknown.

P. H. VANDER WEYDE.

New York, March 16, 1878.

Rating Steam Boilers.

To the Editor of the Scientific American:

The frequent effort to decide the horse power of a steam boiler by the caprice of law, or the impression made by unintelligent experts on an ignorant jury, shows the want of a standard of duty on this subject that would be acceptable to steam users, without entailing on boiler makers a burden "grievous to be borne."

I suggest as a boiler horse power the evaporation of the number of cubic inches of water, obtained by dividing Watt's inch pounds per hour, by the duty developed, when a cubic inch of water is expanded into steam at atmospheric pressure.

Thus boiler H. P. = $\frac{33{,}000\times60\times12''}{14{\cdot}7\times1{,}700}$ = 950 inches, which will make two horse power when a good engine is used, and I do not think a boiler maker should be required to furnish an amount of boiler which may be necessary to supply steam to develop a horse power on a bad engine.

T. J. LOVEGROVE.

3,326 N. Broad Street, Philadelphia, Pa.

Man's Place in Nature.

To the Editor of the Scientific American:

What is it that led Dr. J. W. Dawson some years ago to report Huxley as saying that the Engis skull might have contained the brains of a philosopher, without giving the remaining portion of the sentence quoted?

We could not of course expect anything different from the colossal misrepresenter Cook, and therefore are not astonished to find that he quotes the sentence in the same way; but when the President of the New York Academy of Sciences, Professor Newberry, gives the same mutilated quotation, we begin to suspect that there is a mutual understanding between these three, that they will all bear false witness in this matter.

Or is it more probable that Dawson quoted carelessly from memory, and that Cook found it convenient for his purposes to follow Dawson, and that Newberry has been reading the reports of Cook's lectures?

May I beg you to print the sentence from Huxley in italics, so that those who are too lazy to look up the book (which

may be found on every library shelf) may yet read the quotation correctly, and that those who are at all influenced by these orthodox tirades against Darwin may recognize one of the customary weapons used by this class, namely, misrepresentation? The following is the quotation from Professor T H. Huxley's work, entitled "Evidence as to Man's Place in Nature," page 181, lines 2, 3, and 4:

"*It is, in fact, a fair average human skull, which might have belonged to a philosopher, or might have contained the thoughtless brains of a savage.*" * * *

A Leech Barometer.

To the Editor of the Scientific American :

The following is a simple way of making a "leech barometer." Take an eight ounce phial, and put in it three gills of water and a healthy leech, changing the water in summer once a week, and in winter one a fortnight. If the weather is to be fine, the leech lies motionless at the bottom of the glass, and coiled together in a spiral form; if rain may be expected, it will creep up to the top of its lodgings, and remain there till the weather is settled; if we are to have wind, it will move through its habitation with amazing swiftness, and seldom goes to rest till a high wind begins; if a remarkable storm of thunder and rain is to succeed, the leech will remain for some days before almost continually out of water, and show great uneasiness in violent throes and convulsive-like motions. In frost, as in clear, summer-like weather, the leech lies constantly at the bottom; and in snow, as in rainy weather, it moves to the very mouth of the phial. The top should be covered over with a piece of muslin.

EDWIN S. CLOUTMAN.

South Boston, Mass.

The Status of Patent Medicines.

In a recent decision by the Assistant Commissioner of Patents the question of the patentability of medical compounds is discussed at considerable length, in reply to a doubt expressed by the primary examiner as to the patentability of this class of inventions. The Assistant Commissioner takes the following grounds: The old leading English cases of Boulton *vs.* Ball, 2 H. B. L., 482, and Rex *vs.* Wheeler, 2 B. A. L. D., 349, expressly mention medicines as being comprehended under the term "manufactures," and as proper subjects of patents. Our patent system having been derived from England, if it had been the intention of Congress to have excepted medical compounds from the list of inventions to be patented, such intention should have been expressed. This was not the case; but, on the contrary, the law ever since 1793 has expressly provided for the grant of patents for "any new and useful composition of matter," in distinction from and in addition to an art, machine, or manufacture.

The discovery of a principle in medicine or medicines, or the effects produced by a medical or mechanical agent, is not patentable; but when a certain composition of specified ingredients is found by reference to the state of the art to be new and useful, the law is perfectly clear in providing that a patent may be granted for it, and it will not do to refuse it upon the ground of policy or distaste.

The case of the Morton patent, in the 8th vol. of the Attorney General's opinions, is often cited against granting patents for medical compounds; but the cases are not parallel, as the patentees in that case attempted to uphold a patent for the discovery of an effect. "The effect discovered was produced by old means upon old subjects." No claim for a medical compound was therein made, involved, or discussed.

The objections to the granting of patents on medical compounds must be the same as those in alleged inventions in other classes, such as want of novelty, utility, etc. Mere professional skill in combining, in the form of prescriptions, ingredients well known to the *materia medica* may not evince invention any more than an arrangement of mechanical elements due to ordinary mechanical skill. Originality may be lacking in both cases. There are petty nostrums and quacks in mechanics as well as in medicine, and there are deserving inventors in both cases, all of whom should be treated with the consideration their cases merit, under the same law and rules of practice.

The decision from which the above is condensed would seem to settle, so far as the practice of the office is concerned, the question of the patentability of medical compounds—a question which has been argued by many able examiners and attorneys both *pro* and *con.*, but without, so far as we are aware, ever having received such an authoritative answer as is given by Mr. Doolittle's decision.

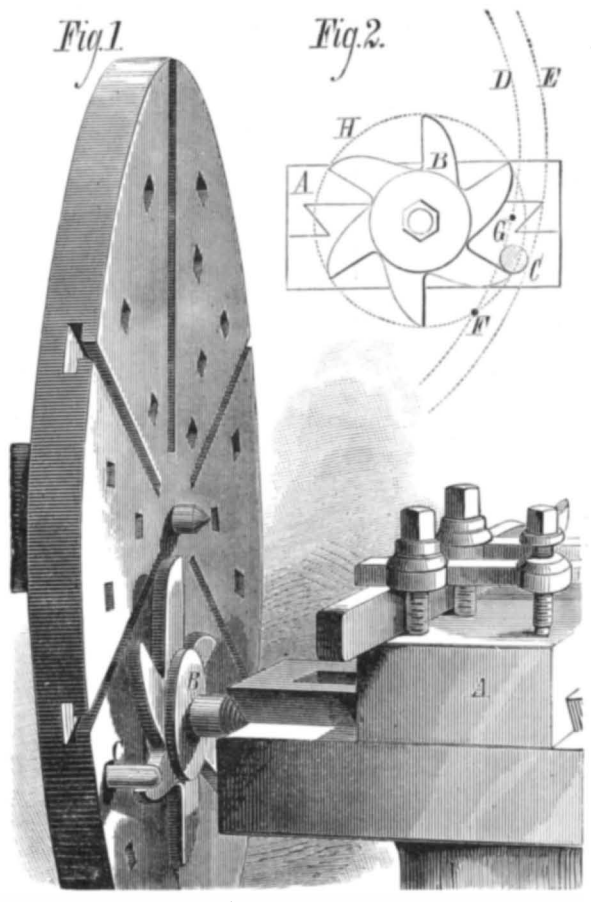
Fall of a Mountain Promontory.

Nearly every resident of Montana has either seen or heard of the famous Bear Tooth Mountain, the most prominent landmark in Northern Montana. It is visible from different points at distances ranging from 40 to 60 miles, and is in full view from Helena and the surrounding country. The mountain is distant 30 miles from Helena, and stands like a grim and mighty sentinel at the end of the cañon known as the Gate of the Mountains, through which flows the Missouri River. The Bear Tooth was fully described as a wonderful landmark of the early explorers Lewis and Clarke. In all photographs of the northern country the two tusks, rising black and grim hundreds of feet above the mountain, are the prominent objects. The main tusk remains, looking lonely and isolated in its grandeur. Recently a party of hunters who were chasing game, several miles north of the Bear Tooth, observed a rumbling sound and a quaking of the earth, and supposing it was an earthquake, and not noticing a repetition of it, they soon forgot the occurrence and continued their chase until they reached the Bear Tooth. Here they were astonished by the disappearance of the eastern tusk. This was a perpendicular mass of rock and earth, fully five hundred feet high, three hundred feet in circumference at its base, and about one hundred and fifty feet at the top. This immense mass had become dislodged, and coming down with the speed of an avalanche, had swept through a forest of large timber for a quarter of a mile, entirely leveling it. The country around is now covered with a great mass of broken trees and tons upon tons of rocks, many of them as large as an ordinary house.—*Montana Independent.*

THE STAR FEED.

A correspondent asks: "How can I feed a tool automatically on a lathe which has a slide rest, but has no feed motion? What is a star feed?"

A star feed is a device for improvising a feed motion to a slide rest which has no self-acting feed motion, or to a mechanical tool-holding device which cannot be actuated by the self-acting feed motion attached to the lathe or machine; as, for example, a boring bar. It is constructed as follows: Upon the outer end of the feed screw of the boring bar or slide rest, as the case may be, is fastened a piece of iron plate, which, from having the form in which stars are usually represented, is called the star. If the feed is for a slide rest a pin is fastened to the lathe face plate or other revolving part, in such a position that during the portion of the revolution in which it passes the star it will strike one



THE STAR FEED.

of the star wings, and move it around sufficiently to bring the next wing into position to be struck by the pin during its succeeding revolution. When the feed is applied to a revolving boring bar the construction is the same, but in this case the pin is stationary and the star revolves with the feed screw of the bar.

In Figs. 1 and 2 is shown a star feed applied to a slide rest. A is the slide rest, upon the end of the feed screw of which the star, B, is fitted. C is a pin attached to the face plate of the lathe, which, as it revolves, strikes one of the star wings, causing it to partly rotate, and thus move the feed screw. The amount of rotation of the feed screw will depend upon the size of the star and how far the circle described by the pin, C, intersects the circle described by the extreme points of the star wings. Thus the circles denoted by D E show the path of the pin, C; the circle, F H, the path of the star points, and the distance from F to G the amount which one intersects the other. It follows that at each revolution of C an arm or wing of the star will be carried from the point G to point F, which, in this case, is a sixth of a revolution. If more feed is required, we may move the pin, C, so that it may describe a smaller circle than D E, and cause it to intersect F H to a greater extent, in which case it will move the star through a greater portion of its revolution, striking every other wing and doubling the amount of feed.

It will be observed that the points F and G are both below the horizontal level of the slide rest feed screw, and therefore that the sliding motion of the pin, C, upon the face of the star wings will be from the center towards the points. This is better, because the motion is easier and involves less friction than would be the case if the pin contact first approached and then receded from the center, a remark which applies equally to all forms of gearing, for a star feed is only a form of gearing in which the star represents a tooth wheel, and the pin a tooth in a wheel or a rack according to whether its line of motion is a circle or a straight line.

It is obvious that in designing a star feed, the pitch of the feed screw is of primary importance. Suppose, for example, that the pitch of a slide rest feed screw is 4 to an inch, and we require to feed the tool an inch to every 24 lathe revolutions; then the star must have 6 wings, because each revolution of the screw will move the rest $\frac{1}{4}$ inch, while each revolution of the pin, C, will move the star $\frac{1}{6}$ of a revolution, and $4 \times 6 = 24$. To obtain a very coarse feed the star attachment would require to have two multiplying cogs placed between it and the feed screw, the smaller of the cogs being placed upon the feed screw.

Oiling Wheat.

The perverse ingenuity of mankind is, unfortunately, nearly quite as prominent a phenomenon in human history as that higher kind of ingenuity which, like mercy, blesseth both its possessor and its object. Corn and oil are admirable commodities, and in some parts of the world the latter enters quite as largely into human dietetics as the former. In our own country, however, except in combination with salad, and only then in a very modified degree, a strong prejudice exists, as a rule, with respect to oleaginous food, and an item of news which reaches us through the highly respectable channel of Messrs. Lange & Co., of Altona, is calculated to produce a somewhat disagreeable sensation in the average stomach. It is stated by those gentlemen, in the columns of a Hamburg paper, that for some time past a practice of manipulating wheat with oil has been adopted in that part of the world, for the double purpose of improving its appearance and increasing its specific gravity, upon which the sale value of the article in a great measure depends. Wheat, which in its natural condition would weigh 123 Dutch pounds, or about 75 kilos. per hectoliter, gains by the process of oiling about 6 Dutch pounds, or nearly 3 kilos. per hectoliter, and is thus made to appear from 10 to 12 per cent more than it really is. The money gain to the dishonest seller is 20s. to 25s. per ton, with an outlay for rape oil of about fourpence. The apparent increase in the specific gravity is caused by the smoothness imparted to the wheat by the oil, which makes a considerable number of "corns" go to the same bulk. The evil results, in addition to the direct money loss inflicted on the buyer, are, that thorough milling is impossible, and that the flour produced from the oiled wheat will never bake properly. The abominable practice is not confined to wheat alone, but has become common with almost all foreign seeds which are sold by specific gravity value, but in no other instance are the consequent evils so serious as that of wheat. Two tests are given, by which, it is said, this novel form of seed adulteration may be readily detected by the miller. One is to put the suspected wheat in a perfectly clean vessel, and shake through it a small quantity of turmeric powder. If the wheat is oiled the powder will adhere to the grains, especially about the beard and crease, while on unoiled wheat, even if it be damp, not a speck of the powder will be visible. The second method is to fill a clean glass with clean water, and then shake a little crystallized camphor dust on the surface of the water. The small particles of camphor will gradually melt, and while doing so a continuous lively rotary motion is caused. Now throw a few corns of the suspected grain in the water. If it has been oiled the rotary motion of the camphor will at once cease, and the latter will float motionless on the surface of the water. If the grain is unoiled the rotary motion of the camphor will continue as before.—*The Miller.*

Warning to American Workmen.

The United States Consul at Buenos Ayres, in a recent report, states: "I have been in receipt of frequent letters since I have been here, asking in regard to the conditions and prospects of labor in this country. I would not advise anybody to come here with a view to bettering his condition. They cannot expect to find employment of any kind. Every variety of manual and mechanical labor is suffering with the general depression of business, and establishments requiring skilled labor are reducing rather than increasing the number of their employés. If persons will come here in search of work, they should bring sufficient money with them to pay their return expenses. Every few days the consulate is visited by distressed Americans, who, having been induced to come out here, have been sadly disappointed upon their arrival to find no opportunity to earn a livelihood; thus, finding themselves without means either to live here or return home, they become objects of charity."

It would appear from the tenor of this, as well as from other similar communications from our consuls in different parts of the world, that our country is not the only one suffering from hard times, and that it is very little use for an American workingman to leave his country in the hopes of bettering his condition.

Rectification of Benzine.

In the examination of the products obtained in rectification of the benzine of gas manufactories, M. Vincent has found quite a number of interesting substances. Sulphide of carbon is very abundant. Ordinary alcohol is present also in notable quantity, and M. Vincent characterizes it by the preparation of sulphovinate of baryta, iodide of ethyl, and bromide of ethyl. Lastly, there is a considerable quantity of cyanides of methyl, the extraction of which, he thinks, might be made industrially profitable.

THE ECLIPSE STEAM ENGINE.

We illustrate herewith the well known "Eclipse" steam engine, as mounted on sills or skids, adapted for running saw mills, flouring mills, cotton gins, hoisting machines, ore washers, small steamboats, and for many other purposes, where economy of space and fuel is an object, and where a semi-portable steam engine can be used. These engines, since illustrated in the SCIENTIFIC AMERICAN of February 17, 1877, have been very much improved, making them, we are informed, still more durable, economical, and simple in construction. By the use of special tools and machinery, adapted to this class of work, these engines can now be constructed in large numbers. Accuracy and uniformity in workmanship are thus secured, and any part may be quickly and cheaply replaced. We are also informed that although these engines have been in the market less than five years, about 500 of them have already been sold, in all parts of the United States and in the East and West India Islands.

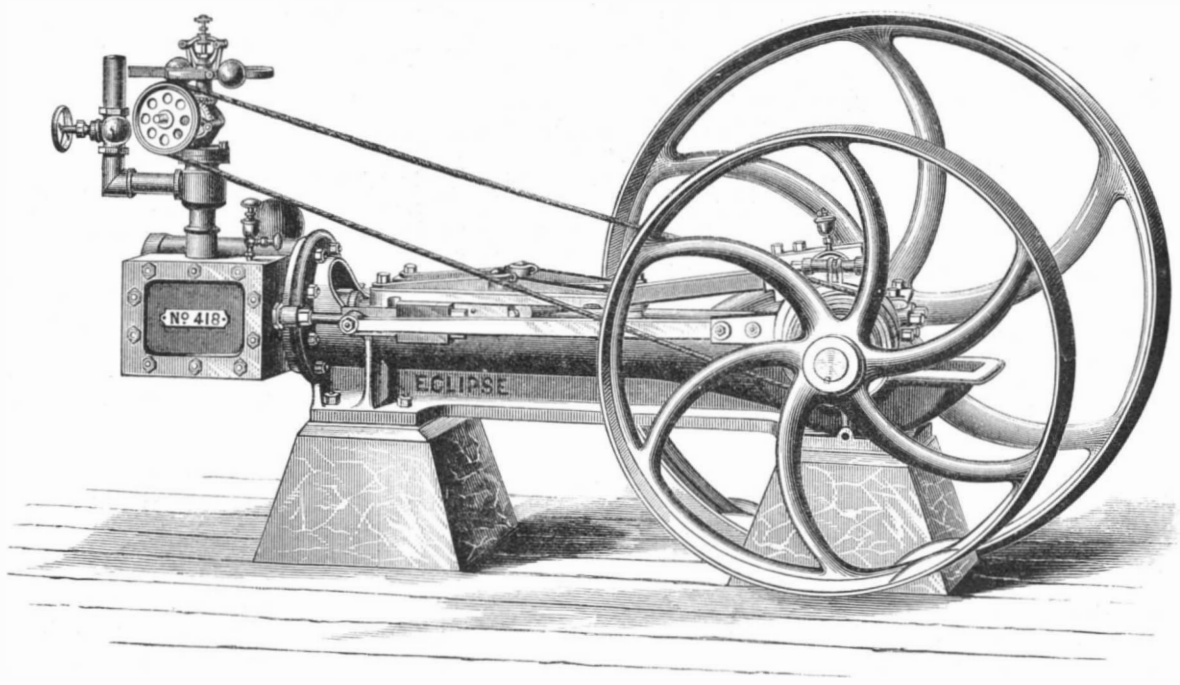


Fig. 1.—THE ECLIPSE STATIONARY ENGINE.

Fig. 2 shows the Eclipse semi-portable steam engine, which is of the horizontal style. The frame or bed comprises the one cylinder head, guides for cross head, and the two bearings for crank shaft, all in one solid casting, thereby making it impossible for the important working parts of the engine to get out of line.

The shape of this bed is the half of a hollow cylinder, except a small portion of one end, which is an entire hollow cylinder, with its one end closed by the formation of a flange or cylinder head, to which are bolted the cylinder and steam chest, which is also one solid casting. All the exposed parts of the cylinder are jacketed to prevent loss of heat by radiation. By this plan of constructing the bed plate the working strain is directly through the center of cylinder and pillow blocks, thereby making a very strong engine with the least amount of material. By this arrangement no strain from the working of the engine is thrown on the boiler; neither are there strains of any kind thrown on the boiler from unequal expansion, as there is an expansion joint between the engine and boiler. By making the bed plate as described, which is trough-shaped under the working parts, all the drippings from the stuffing boxes, bearings, etc., are kept from the boiler, thereby making it much easier to keep the boiler and engine clean.

The crank shaft is double, and is made of the best forged wrought iron, without weld or seam, and is balanced by means of cast iron counter-weights, so that the engine may be run at a high rate of speed without injury to any of its parts. The connecting rod is of the best forged wrought iron, and fitted with boxes made of the best copper and tin, and provided with all necessary arrangements for taking up all lost motion.

The crank shaft bearings are very large and long, and are lined with best quality of anti-friction metal, and provided with side brasses for taking up all lost motion.

The piston and valve rods are made of steel, and the piston has an improved self-adjusting metallic packing, which requires no adjusting until worn out.

The heater is formed by a separate cast iron pipe bolted near its one end to the steam cylinder, and supported at the other end by a bracket over the bed plate. The water pipe passes several times through this heater, and is of sufficient length to heat the water nearly to the boiling point before it enters the boiler. These engines are provided with all the necessary valves, cocks, etc., to make a complete outfit. The pump is so arranged that either of the valves can be removed and examined and repaired while the engine is in operation, and without disturbing the pipe connections.

The boiler is of the locomotive pattern, with the water space extending entirely around the bottom, forming a mud drum. The boiler front is made of cast iron in sections, and so arranged that the draught in passing to the furnace passes over the inside lining of the front, thereby keeping it cool and less liable to crack or burn out. This engine can very easily be dismounted from the boiler and used as a stationary engine, as shown in Fig. 1, which shows the engine on separate foundations. As will be seen no expensive foundations or separate wall are needed for carrying the end of the crank shaft, as both ends are supported on the bed plate, which makes it impossible to get out of line, no matter how poor the foundations may be or in what position the engine may be placed. By having all the parts combined as shown, they are more easily and quickly set up and operated. Ten sizes of these engines are manufactured, either as agricultural engines mounted on wheels for farm or plantation use, or mounted on sills or skids, and for stationary purposes, as may be wanted.

For further particulars of the Eclipse steam engines, and for illustrated and descriptive catalogues of stationary engines, boilers, and other machinery, address Frick & Co., Waynesboro, Franklin county, Pa.

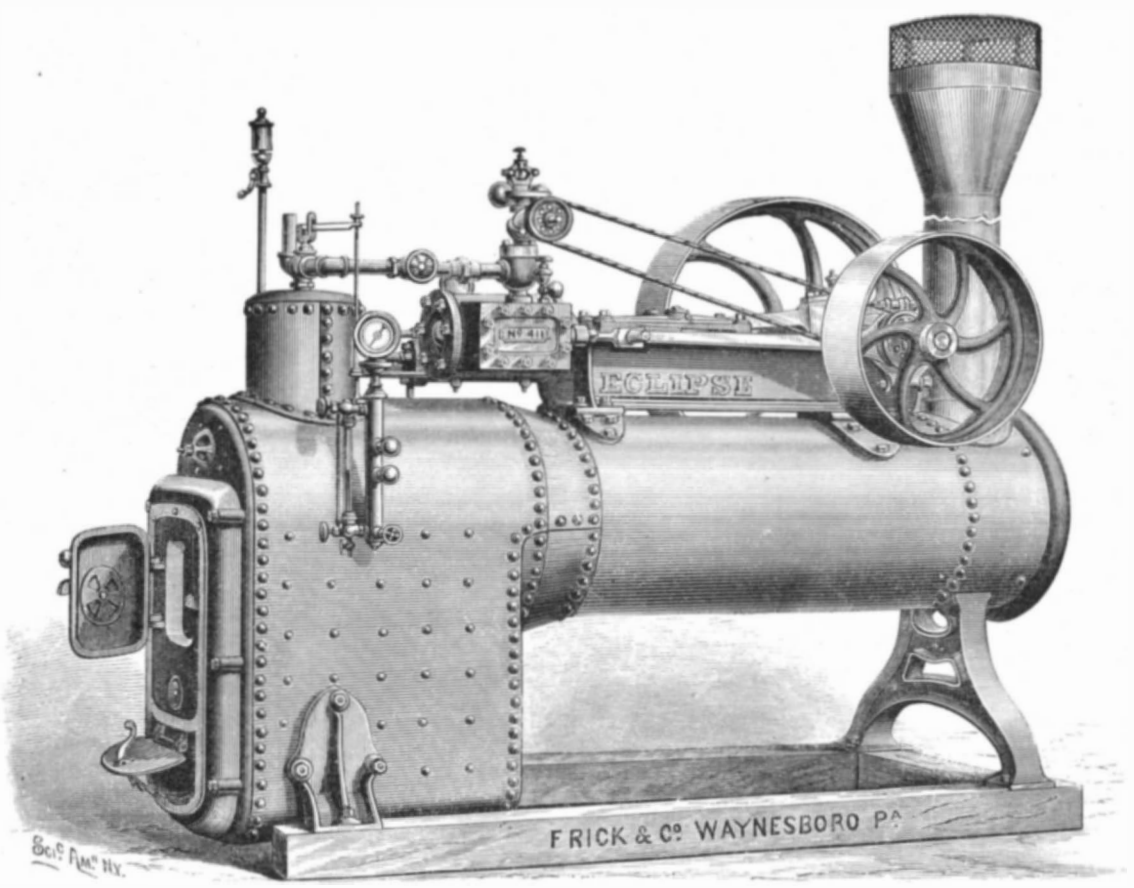


Fig. 2.—THE ECLIPSE SEMI-PORTABLE ENGINE.

Oxalic Acid and Epsom Salts.

Some fatal cases have occurred caused by the great resemblance between these salts. They may, however, be readily distinguished from each other. The most simple test is by taste, oxalic acid being extremely sour, while Epsom salts is very bitter. Again: Oxalic acid mixed with carbonate of soda or of potash effervesces, and the liquid becomes transparent. On the other hand, Epsom salts thus treated turns the liquid milky and deposits a white precipitate.

LETTERS from our correspondents in various parts of the country show that a large number of small boats, propelled by steam, and built after the plans and suggestions given in the SCIENTIFIC AMERICAN SUPPLEMENT, will be tried this summer.

How some Mysterious Boiler Explosions may Occur.

Every few months the community is shocked by a terrible boiler explosion, by means of which a large amount of valuable property and many human lives are sacrificed. We scarcely remember any investigation which resulted in bringing the blame clearly home to any one in particular. From the mystery usually thrown around these holocausts we have had numerous theories as to some inexplicable means by which the water is said to become decomposed, or the steam turn to gas, etc. There never was proved to have been a totally incompetent engineer at the bottom of the matter; and we suppose that if at any time during the past three months the steam boiler at the armory of the Fourteenth Regiment in Kings county had exploded, the gaseous or some other equally mysterious theory would have been assigned as the cause. It almost makes one shudder to read the following, which we take from the New York *Herald* of March 19:

"At a meeting of the Military Committee of the Kings County (Long Island) Board of Supervisors yesterday, James McLeer, Colonel of the Fourteenth Regiment, stated that he had employed Charles E. Palmer to take charge of the boilers at the armory of the regiment because William McClosky, appointed by the Board in January last to attend to them, had asked where the safety valve was, and when told that it was in the ash pan he had looked there for it. Colonel Briggs, of the Thirteenth Regiment, said that a Mr. Shepherd had been employed as engineer in his regiment's armory in place of Thomas Coyne, who was appointed by the Board of Supervisors, the latter having been found incompetent."

It is a matter of congratulation that engineers who look in ash pans for the boiler safety valves are scarce. It is sincerely to be hoped that the examiners who gave such an engineer (?) a certificate of competency forgot to question him upon either the location or use of the safety valve, otherwise some others of their licensees may very soon have to look for their boiler safety valves in the East River or upon a neighboring farm, or whithersoever the exploding steam may happen to send them or their fragments.

New Inventions.

A device for Reefing Jibs, intended to obviate the necessity of going out on the bowsprit to furl the bonnet, has been patented by Mr. Edward Rowell, 2d. It consists in an arrangement of eyelets in the foot of the jib, and bull's-eyes attached to the upper edge of the bonnet, which are fitted to the jib eyelets and secured by a lace line which runs through all the bull's-eyes. The lacing is provided with a metallic end piece, fitted to a tack lock which is connected with the bolt rope and the bonnet.

An improved Ventilator has been patented by Messrs. I. W. Canfield, Jr., and C. H. Demarest, of Nyack, N. Y. A globular shell is carried upon guide arms at the top of the chimney or pipe, and it is extended rearwardly into a pipe through which the wind passes. At the mouth toward the wind a flaring conical pipe is inserted, the rear end of which passes the orifice of the chimney and enters into the exit pipe mentioned. A vane regulates the direction of the apparatus.

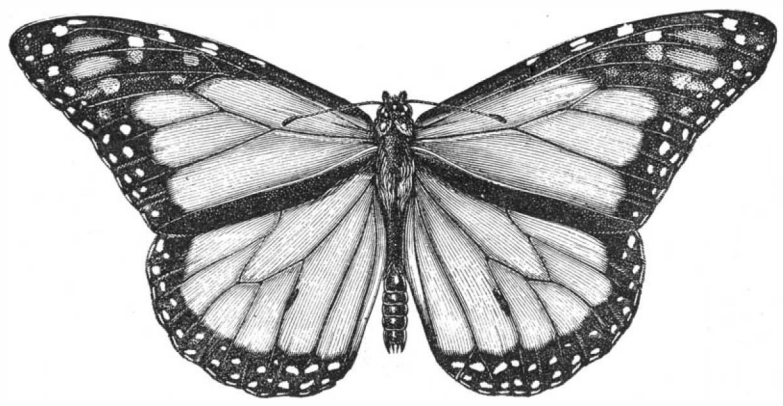
Mr. C. J. Smith, of Norfolk, Va., has invented a Safety Stove, for use in railroad cars, etc., which he claims is practically indestructible, and may be inverted and rolled about without permitting the fire to escape. In addition to devices for securely closing the doors, flues, and other openings, the special feature is the addition of an annular air chamber at the bottom of the stove, formed between the stove cylinder and a surrounding casting, both of which are perforated, the object being to prevent burning of the floor.

MIGRATORY BUTTERFLIES.

BY PROFESSOR C. V. RILEY.

Many quadrupeds that multiply rapidly acquire the migratory propensity. This is especially true of rats and lemmings, of the migrations of vast numbers of which numerous interesting accounts are recorded. Many insects normally non-migratory also exceptionally congregate and migrate in vast swarms, and this is especially the case with butterflies, flights of which, and particularly of the yellows (*callidryas* and *colias*) and the whites (*pieris*), have been reported from equatorial and South America, and from different parts of Europe. Vast flocks have also been observed at sea. The newspapers in the Southwest and the Signal officers were constantly reporting the passage over Iowa, Kansas, Missouri, and Texas of swarms of butterflies during the months of September and October last. These consisted, in every case where determinations were made, of the archippus butterfly (*Danais archippus*), herewith illustrated. This is the principal species known to thus migrate in North America. In an account of the swarming of this butterfly, published in 1870 (3d Mo. Ent. Rep., p. 151), I wrote as follows:

"It would be difficult to give any satisfactory reason for this assembling together of such immense swarms of butterflies. . . . . There are two significant facts connected with them, from which some corollary might be deduced, namely, that only those species which have a very extended range are known to form such flocks, and that they always travel, under these conditions, in a southerly or southwesterly direction. Mr. Bates ('Naturalists on the River Amazon,' vol. i., p. 249) gives an interesting account of the uninterrupted procession of butterflies belonging to the genus *Callidryas*, which passed from morning till night in a southerly direction across the Amazon, and as far as he could ascertain these migratory hordes were composed entirely of males. As I have abundantly proved, by examination of specimens since the above was written, the individuals composing the swarms of our archippus butterfly comprise both sexes; if anything, the females prevail. No satisfactory explanation of these swarms has been given, but I think they are for the most part due to an instinctive tendency to reach a warmer country in which to hibernate, and to a failure of food in the country where they developed. The flights almost always occur in autumn, when the milkweeds (*Asclepias*), upon which the larva of this butterfly feeds, have perished. The instinct to propagate is therefore at the time in abeyance. The butterflies, unable to supply themselves with sweets from flowers, are either attracted in quantities to trees that are covered with honey-secreting plant lice or bark lice, or else they must migrate southward, where flowers are yet blooming. All insects acquire the migrating instinct when crowded together through excessive multiplication. The archippus butterfly hibernates within hollow trees and in other sheltered situations. Southerly timber regions offer most favorable conditions for such hibernation. Under the most favorable conditions a large majority perish. A small portion of the females survive the winter. Such hibernated individuals, upon waking from their winter torpor, make at once for the prairies, where the milkweeds most abound. Faded, and often tattered, they may be seen flying swiftly over such prairies, for the wings of the species are strong and large. I have no doubt but that they travel thus for many hundreds of miles, keeping principally to the north, and, ere they perish, supplying the milkweeds here and there with eggs. A fresh brood is produced in less than a month, and these extend still further north, until we find the species late in the growing season as far up as the Saskatchewan country, where it can scarcely successfully hibernate, and from whence the butterflies instinctively migrate southward.

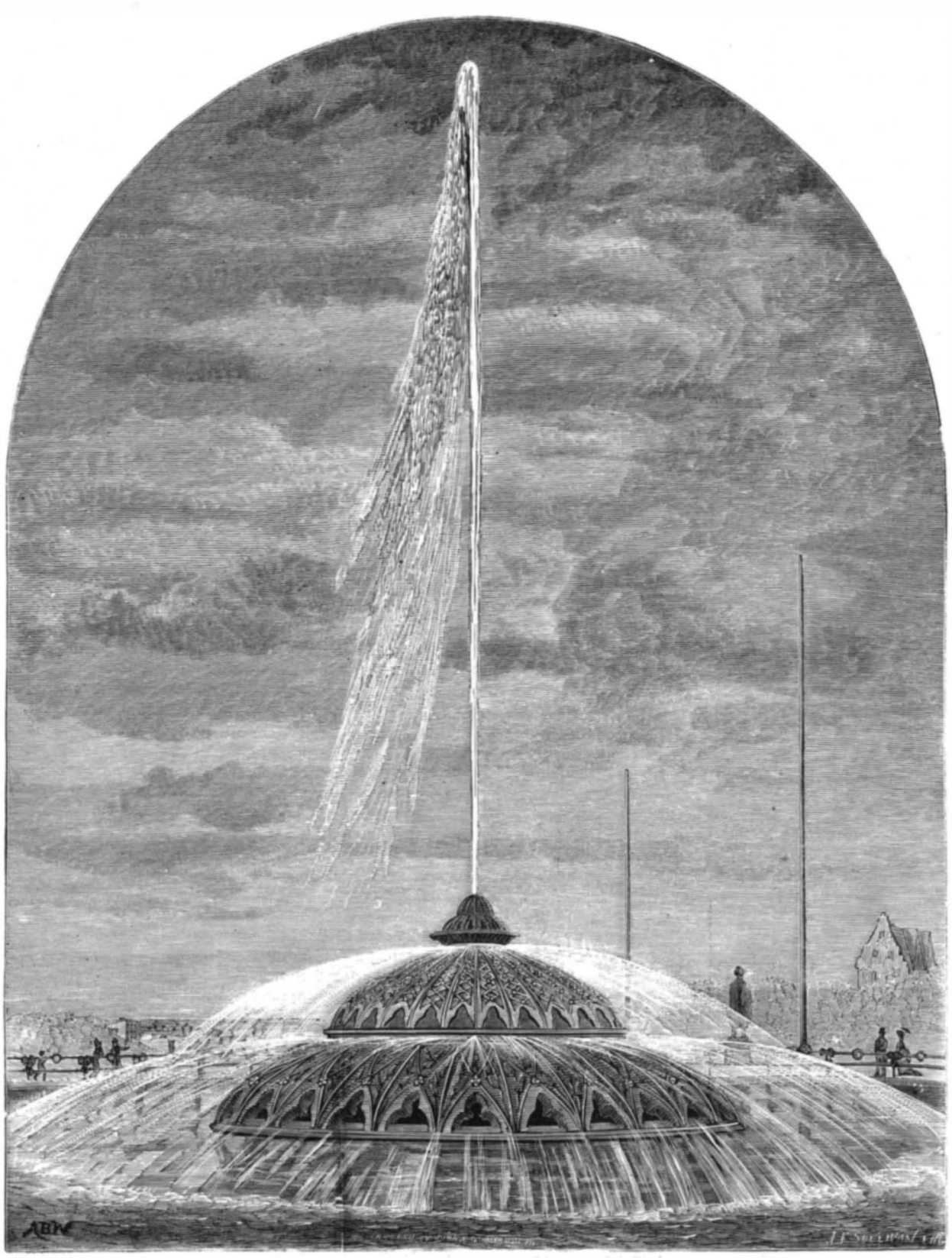


THE ARCHIPPUS BUTTERFLY.

"We can thus understand how there are two, three, or more broods in southerly regions, but only one toward British America. The exceptional flights noticed in the spring, and which, so far as recorded, take place quite early and in the same southerly direction, find a similar explanation. They may be looked upon as continuations of the autumn flights. Hibernating in the temperate belt, they are awakened and aroused upon the advent of spring, to find the milkweeds not yet started, and they instinctively pass to more southern regions, where spring is more advanced. In short, these migrations find their readiest explanation in the instinct of the species to lengthen the breeding season and to extend its range; and the prevailing winds at particular seasons are of a character to assist it. There is a southward migration late in the growing season in congregated masses, and a northward dispersion early in the season through isolated individuals. It is a notable fact that the two butterflies which most display this instinct, namely, the species in question and the "painted lady" (*Cynthia cardui*), have the widest range of known species. The last is cosmopolitan, occurring in all four quarters of the globe; while our archippus, originally confined to America, though ranging from Canada to Bolivia, appears to be following the milkweeds wherever these are, through chance or purpose, introduced. It has lately spread over some of the islands of the Pacific, to Queensland and New Guinea, and over the Azores to Europe, such spread necessarily indicating great power of long-sustained flight, since the milkweeds are not plants of commercial value, and it is highly improbable that the species has been carried in any of the preparatory states on ships."

A BETON FOUNTAIN, PROSPECT PARK, BROOKLYN.

Our engraving represents the Plaza Fountain in Prospect Park, Brooklyn, one of the most tasteful and beautiful ornaments in that pleasure ground. It is fed with water from the city water works, which are supplied from a chain of ponds some nineteen miles from the city, and extending from Jamaica east to Hempstead Plains. From these sources the water is brought in a brick-covered conduit to Ridgewood reservoir, into which it is forced by three powerful engines. This reservoir has a capacity for about 160,000,000 gallons, and is located at an elevation of 170 feet above the East River. Besides this, Mount Prospect Reservoir has a capacity for 20,000,000 gallons, with an elevation of 28 feet above that of Ridgewood. From these two reservoirs the water is distributed throughout the city through about 277 miles of pipe. To secure a supply in case of drought, a storage reservoir, having a capacity for 1,055,000,000 gallons, is in process of construction. The daily consumption of water in the city is about 30,000,000 gallons.



A BETON FOUNTAIN. PROSPECT PARK BROOKLYN.

The fountain we illustrate is especially remarkable both for its design and for the material in which the same is carried out. In the center of the basin is a grand dome 113 feet in circumference. The base is a series of Gothic arches, up the sides of which are defined beautifully trailing vine leaves. From a ring of smaller circumference issue innumerable jets, so as to form one sheet of water, which falls into the basin, leaping over the arches. The space beneath the dome is illuminated at night, producing an exceedingly beautiful effect, as the light is reflected on the water. From the summit of the structure a single strong jet rises perpendicularly in the

air. The entire stonework of the fountain is made of beton-coignet, an agglomerate of sand, hydraulic lime, and hydraulic cement in suitable proportions. These elements are ground and mixed by machinery until they reach a plastic state. The moulds are then filled by a peculiar process which entirely excludes the air, and are immediately removed. The stone within a few days is ready for transportation, and continues to increase in density. It is impervious to water, is not affected by frost, and will withstand a crushing pressure of about 4 tons to the square inch. Structures composed of it are lighter than those of natural stone, while the strength is equal, if not in many instances greater. A cubic foot of beton-coignet weighs about 146 pounds. The fountain was built by the New York Stone Contracting Company, at their factory in Brooklyn.

In the SCIENTIFIC AMERICAN SUPPLEMENT (current issue) we present a large number of applications of this very valuable material, which are remarkable as indicating the wide range of purposes to which it may be devoted, and also its special utility in particular cases where any other substitute could hardly accomplish the desired end. Of especial interest is the employment of the beton in strengthening the foundations of bridge piers, it being thus used in the case of the Portage viaduct on the Erie Railroad. On the same road a weak culvert has been lined with the agglomerate, and thus as strongly supported as if upheld by solid stone. Similarly, in the tunnel under Bergen Hill, N. J., a part of the rock which could not be retained by brick or other arching is lined with beton. This application of the material bids fair to be of great engineering importance, and the above examples, which are fully illustrated in the SUPPLEMENT, may be commended to the careful attention of all engineers. Among the other utilizations of the beton which we describe and illustrate, are its employment for ornamental architectural work, to which it is admirably suited, and its substitution for stone as a building material.

Remarkable Voyages in a Life-Preserving Suit.

Captain Paul Boyton, who a couple of years ago made himself and the Merriman life-preserving suit famous by successfully floating across the British Channel, has recently accomplished another feat which puts all previous achievements in the same line far in the shade. Beginning at Toledo, Spain, he undertook the navigation of the river Tagus to its mouth at Lisbon. The distance traversed was 600 miles, and the voyage occupied eighteen days. Captain Boyton's account of his journey is not calculated to render any one desirous of repeating the experiment. In some places the river became a torrent, dashing among sharp rocks at the rate of a dozen or two miles an hour; for miles it ran between precipices, and in a country seemingly destitute of human habitations. The swimmer "never knew but that the next angle in a cañon would land me in a whirlpool or over a precipice." During the voyage 102 waterfalls and rapids were passed, one cataract being fully fifty feet in height.

From Lisbon Captain Boyton went to Gibraltar, and there on the 21st of March swam across the straits to the African shore, direct distance 30 miles. The passage took seventeen hours, and the swimmer was swept far out of his course by the strong spring tides. The trial is regarded as one of the severest to which he has yet been subjected.

Cinders in the Eye.

Persons traveling much by railway are subject to continual annoyance from the flying cinders. On getting into the eyes they are not only painful for the moment, but are often the cause of long suffering that ends in a total loss of sight. A very simple and effective cure is within the reach of every one, and would prevent much suffering and expense were it more generally known. It is simply one or two grains of flax seed. It is said they may be placed in the eye without injury or pain to that delicate organ, and shortly they begin to swell and dissolve a glutinous substance that covers the ball of the eye, enveloping any foreign substance that may be in it. The irritation or cutting of the membrane is thus prevented, and the annoyance may soon be washed out. A dozen of these grains stowed away in the vest pocket may prove, in an emergency, worth their number in gold.

The foregoing remedy, from the *Mining and Scientific Press*, appears to be based on the homeopathic principle, "Like cures like." Whether the sticking of flaxseeds into an inflamed eye is likely to prove beneficial is questionable. Better pull out the cinder with a looped horse hair.

Glove Cleaner.

Castile soap, white	3 troy ounces.
Javelle water	2 fluid "
Water	2 " "
Water of ammonia	1 drachm.

Dissolve the soap by the aid of heat in the water, and when nearly cold add the Javelle water and the water of ammonia. The preparation should form a paste, to be rubbed on the soiled part of the glove with a piece of flannel.

The Effect of Drink.

A country attorney writes to the London *Times* to say that an old woman has just died at Ashcott, Somersetshire, aged 104 years and 8 months, who for the last 40 years was found in gin by one of his clients, at an aggregate expense of more than $1,000. It was given her to add to her comforts, under the supervision of the *squire*, who testifies to its beneficial effect. The *Times* observes that if the gin was injurious it must have been *"a very slow poison."*

[For the Scientific American.]

PLANT MIND.

II.

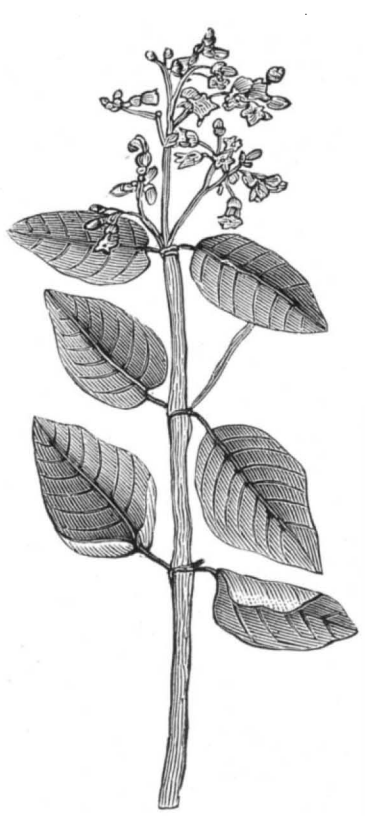
SELF-PROTECTION BY PLANTS.

Conspicuous among well ascertained facts of plant life are those which relate to construction and voluntary movement. There is an analogy which would seem to associate plants with animals in the vegetable contrivance of the *cypripedium* (see illustration), from South America, apparently to prevent the humming bird from devouring its honey. An American spider, called by Linnæus *Aranea avicularia*, and by M. Lonvillers de Poincy *phalange*, has a convex orbicular thorax, with the center transversely excavated. It catches small birds as well as insects, and has the venomous bite of a serpent. The body is described as being the size of a pigeon's egg, with a hollow on its back like a navel, and it is said to catch the humming bird in its strong nets.

CYPRIPEDIUM.

Side by side with this terrible spider we find, in South America, the *cypripedium*, of large size and bright colors, having a globular nectary of a fleshy color and the size of a pigeon's egg, with an incision or depression on its upper part. Attached to this globular nectary are divergent, slender petals, not unlike the legs of the spider. This curious similitude to the great spider seems to be designed as a protection from the humming bird, who would plunder its nutritious honey and thus arrest its existence.

Near Matlock, in Derbyshire, we find the *Flyophorus*, a flower so much resembling the small wall bee that it might be easily mistaken for it at a short distance. This resemblance lies in the nectary, and thus it may escape premature rifling. The importance of the nectary in the economy of vegetation is well known, supplying food to the vegetable males and females until they have propagated their species and are ready to die. It may be questioned, How fare the plants which are not thus protected from the depredations of the animal kingdom? In reply, botanists suggest that they either acquire means of defense, or make more honey than is absolutely necessary for their own welfare. These resemblances and protections are to be found in all quarters of the globe. In Java there is a parasite plant, *Epidendrum flos aeris*, with flowers resembling spiders. Bees and butterflies are supposed to be thus deterred from plundering the nectaries. The common nettle has a bag at its base, and a perforation near its point exactly like the stings of wasps and the teeth of adders.



APOCYNUM ANDROSÆMIFOLIUM.
(Dog's Bane.)

In the columbine (*Aquilegia*) the nectary is imagined to be like the neck and body of a bird, and the two petals standing upon each side to represent wings, whence its name (*columba*, "dove"), as though resembling a nest of young pigeons fluttering while their parent feeds them.

The word *coccux*, in Greek, signifies both a young fig and a cuckoo, which is supposed to have arisen from the coincidence of their appearance in Greece. A similar coincidence between the blooming of the rose and the birth of the nightingale in Persia, the wood anemone and the swallows in Sweden, and the marsh marigold, *Caltha*, when the cuckoo sings, was observed by Linnæus.

In the Persian iris, the end of the lower petal is purple, with white edges and orange streaks, creeping, as it were, into the mouth of the flower, like an insect, by which deception it probably prevents a similar insect from plunder ing it of its honey.

When a fly inserts its proboscis between the anthers of the *Apocynum androsæmifolium*, one kind of dog's bane (see illustration), to reach the honey, they converge more closely and with such violence as to detain the fly, which is generally caught by a trunk or proboscis, sometimes by the trunk and a leg. The flowers of this plant are not known to sleep, at least they remain open at night, and the flies sometimes escape.

There is another plant, *Medicago polymorpha*, which may be said to assume at will a great variety of shapes, as the seed vessels resemble sometimes snail horns, at other times caterpillars, with or without long hairs upon them, by which means it is probable they sometimes elude the depredations of the insects they resemble. *Salicornia* also assumes an animal similitude. The seeds of *Calendula* (marigold) bend up like a hairy caterpillar, with their prickles bristling outward, and may thus deter some birds or insects from preying on them.

Not the form alone, but also coloring matter appears to be bestowed upon plants as a defense against depredations from the animal kingdom, being often either nauseous or deleterious, and not apparently essential to the life or growth of the plant. The glands of the vegetable are believed to separate from their blood, not only mucilage, starch, or sugar for the support of their seeds, bulbs, and buds, but also bitter, acrid, or narcotic juices as a defense from insects and larger animals; but as yet some of the finest vessels of plants have not been exhibited to the inspection of our microscopes, and we do not presume to extend this article into the domain of conjecture, but propose to group together at different times only well known and interesting facts relative to the structure, lives, and habits of those singular creations, which are, we believe, unjustly and incorrectly classed as belonging to an inanimate rather than an animated sphere of being. As yet, the anatomy of plants has not been generally recognized as correspondent to that of the animal economy, but with the aid of our improved microscopes and summer science schools, the day is close upon us when our dearly loved vegetable kingdom will be placed where it rightfully belongs, namely, in the unbroken analogy which entitles it to be recognized as differing only in degree, not in kind—no longer below, but on an equality with, the animal kingdom.

R. C. K.

THE FIRST SHAD.

The first shad of the season was taken in the North River off Weehawken, March 12, an uncommonly early appearance. Formerly the first shad was expected about St. Patrick's Day; but of late years its arrival has been delayed until the 20th or 25th of the month. A large catch is expected this season, as nearly 5,000,000 young fry were turned loose in the river in 1874 by the superintendent of the North River shad-hatching establishment, and now they are of age to return. During the past five years the yearly product of the Hudson has averaged about 120,000; the average price has been about twenty-five cents each at wholesale. The season is at its height in April, and lasts three months. The arrival of shad at the mouths of Southern rivers is much earlier. At St. John's river, Florida, the run begins early in December; the fish are small and of inferior flavor. About a month later shad make their appearance in the Ogeechee river, Georgia. They are larger, fatter, and of better flavor, and are known as Savannah shad. The best of the Southern shad come from the Neuse river, North Carolina, where they appear in the latter part of February. Virginia shad, from the James and the Potomac, begin to be taken early in March. The James river shad are held in high favor in our markets. The Potomac shad are inferior both in size and quality. The shad of the Delaware are sold chiefly in Philadelphia and other Pennsylvanian cities, where they are highly esteemed. They are excelled by the shad of the Hudson, and these in turn by those of the Connecticut. Further north and east the shad are few in number and of decreasing excellence. The catch in the Connecticut river begins about the first of April, and the fish excel all others in size and quality.

The United States Fish Commission have taken steps to secure fuller and more accurate statistics of the proceeds of our river fisheries than have been had heretofore.

Death of Patent Office Examiners.

Two members of the Examining Corps of the Patent Office, Professor Brainard and Dr. Mercer, have recently met with sudden deaths, the former of neuralgia of the heart and the latter of apoplexy. Professor Brainard was one of the oldest examiners in the office, and was well known outside of his connection with the examining corps, having much knowledge of many other branches of science not connected with his official duties. He formerly had charge of the class of agriculture. Dr. Mercer was a first assistant examiner, who had been in the office for about eleven years.

NOTES OF PATENT OFFICE DECISIONS.

In Daniels *vs.* Chesterman, the Commissioner of Patents decides that a disclaimer contained in an original patent may be omitted upon reissue, notwithstanding it was entered to avoid a threatened interference, it being clearly established that the admission which it makes is an inadvertence.

In the appeal from the decision of the Principal Examiner, in the matter of the application of Elbers for the reissue of letters patent for "process of treating mineral wool," the position of the Examiner is sustained. The essential subject matter of the invention, as set forth in the original patent, was in the treatment of mineral wool with bituminous, resinous, or gumming substances, in such manner that the fibers of the wool would be coated with those substances, or with the carbonized residue derivable therefrom, rendering the wool waterproof, and preventing the decomposing and disintegrating action of atmospheric gases, particularly carbonic acid gas. This idea of coating the fiber ran through the whole specification, entirely irrespective of the fact as to whether the fiber was to be used in a loose or compact state, or whether it was to be sized or remain unsized.

The Principal Examiner objected to so much of the case as referred to the sizing of the sheets, holding it to be an entirely independent process. Upon this point the Acting Commissioner disagrees with the Examiner, holding that the sizing of the fiber stands on the same level as the sizing of paper. Thus it is apparent that if an inventor had devised a new process of paper making, the Patent Office would not require him to confine his specification to the method of making unsized paper, since it is evident that for some purposes a sized paper would be desirable, and that it could be prepared without the slightest departure from the underlying principles of the invention, and by the ordinary exercise of the well known principles of the art. The same reasoning should apply to the sizing of the fiber.

The Examiner further objected to the description of the amended specification as insufficient, because it set forth the general theory of a process invention, but failed to disclose some one method of carrying it into effect. He further objected that the claim was not tangible or well defined, because from the claim it was uncertain whether the mineral wool or the bituminous substances were to be "in a vaporized condition." The position of the Examiner upon both of these last points is sustained and approved by the Acting Commissioner, who holds that a specification abounding in generalities, with not a single hint as to the preferable way of carrying the invention into effect, but simply stating the purposes to be attained and the general manner of their accomplishment, will not suffice; but that the applicant must furnish a description that will tell *how* the invention is practiced, as distinguished from its general theory, and must accompany it with a clear and tangible form of claim.

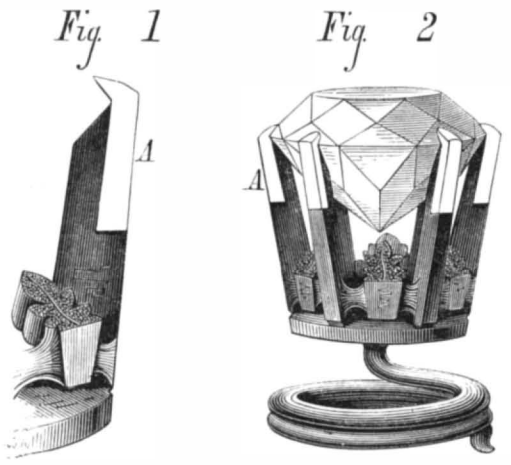
In an interference case between the application of J. J. Greenough for a reissue of his patent for a circular loom, dated November 21, 1865, the patent of Thomas Nelson, December 16, 1856, and the patent of Walton & Naudain, November 1, 1864, upon an appeal by Nelson from the decision of the board who had awarded priority to Greenough, it appeared that eleven years after the grant of Greenough's patent he filed an application for a reissue, embracing for the first time the broad claim, "in a loom for weaving circular fabrics, the combination with the shedding mechanism of two or more shuttles in a circular race for weaving at the same time, and mechanism for driving the said shuttles along the race." This claim was not made until twenty years after the combination referred to had been shown in the patent granted to Nelson. Thus far the interference has been held to be substantially between Greenough and Nelson, as Walton & Naudain did not take any testimony. The patent of Walton & Naudain, however, was granted in 1864, their application filed in October, 1862, and Nelson's invention was put into practical use as far back as 1857. The testimony in behalf of Greenough shows that he conceived the application as early as 1838, that he described it to others in 1840 or 1841, and continued to talk about it until 1863, when he completed full drawings and a model preparatory to filing his application. He did not then make the broad claim, and there is no positive proof that his machine, as described and claimed, has ever been put into practical use, or ever went beyond the experimental condition. The Commissioner therefore decided that, at the time of filing his application in 1865, Greenough had notice of patents previously granted to others embracing the point now in dispute and made no claim; that he has not overcome the *prima facie* case made in behalf of Walton & Naudain by showing practical operation of the invention before the grant of their patent; that his long delay in not making application for this claim, and failure to put the same into practical operative shape till after other patents containing the same devices had been granted and expired, are not satisfactorily accounted for; and in view of these facts, has not shown that he is entitled to protection for the broad matter now in dispute. The decision of the board in favor of Greenough was therefore reversed.

Egypt and the Nile.

Egypt depends on the Nile for its water and virgin soil. If the country does not get its annual gift from the river the crops fail. Modern enterprise has made itself felt in that sluggish land, and by canals and steam pumps is doing much to improve it.

PLATINUM-TIPPED SETTINGS FOR DIAMONDS.

Any one who has ever noticed the difference between the modern style of setting diamonds and that in vogue fifty years ago, cannot fail to have remarked that the present mode of setting rather tends to obscure the gem, and that although the latter is set high and is not closely encompassed as used to be the case, still the old manner of holding the stone apparently exhibits it in greater brilliancy. The reason is that formerly silver alone was used for settings, while now gold is employed, and that the whiter metal harmonizes with or rather is not noticed beside the luster of the stone, while the yellow metal, especially if it becomes dull by wear, is palpably apparent wherever it comes in immediate contact with or partially incloses the jewel. Silver, however, blackens and is not fit for fine jewelry, and hence has fallen greatly out of use, and as a substitute for it platinum has been used. This metal, however, has a coarse appearance when employed for the delicate claws which grasp a *solitaire*, but it is strong and durable, and, besides, it possesses the necessary white color.



PLATINUM-TIPPED DIAMOND SETTING.

An ingenious device, allowing both platinum and gold to be used in diamond settings, has recently been introduced by Messrs. Ripley, Howland & Co., of 35 Maiden Lane, this city, and the manner in which the metals are ingeniously combined will be readily understood from our engravings, which are all enlarged views. Fig. 1 represents one of the claws which hold the stone. These are of gold, except at the outside upper portion, where a piece of platinum, A, is inserted. The diamond is placed in the setting as shown in Fig. 2, and the portions bent over to grasp it are the platinum ends, so that only the white points of that metal come in contact with the stone. These, as indicated, are scarcely distinguishable from the gem, are equally strong, and are claimed to be more durable than gold, while they do not, in any wise, interfere with the full brilliancy of the gem.

For further information address the manufacturers as above, or at 383 Washington street, Boston, Mass.

THE STAFFORD SCROLL SAW.

In using scroll saws it is necessary to pass the end of the saw through the work to fasten it, and then detach it and

THE STAFFORD SCROLL SAW.

take it out as each opening in the pattern is finished, however small the aperture may be. In the present machine this is all obviated, through the absence of any fastening at the lower end of the saw blade. The latter works in slotted pieces both above and below the table, which is made just deep enough to embrace the back, leaving only the short section of the blade which makes the cut unsupported. This section is about ⅛ inch longer than the thickness of the wood to be cut, and may be lengthened or shortened as desired. The blade thus held cannot bend sideways or backward, as the wood itself holds the otherwise unsupported part in place. It is simply necessary therefore to raise the saw and insert the lower end in the aperture in the wood to begin work at once.

The main belt, as it is carried up from the drive wheel, is passed round a cone pulley, one groove of which carries another belt, which passes forward to the driving pulley on the saw frame. The shaft on which this pulley is fastened passes through an upright sliding bar, and at the other end is a crank with pitman, which connects with the saw clamp. The latter is reciprocated on the lower end of the sliding bar. The saw frame (which has the foot attached) is first raised from the table, so as to leave about ⅛ inch space between the foot and the wood to be sawed. It can then be fastened in that position by tightening a thumb nut. To insert a saw, the sliding bar is raised and the driving pulley is turned until the crank and pitman are at the highest point. After cutting off all but ½ inch of the blank at the lower end of the saw, the blade is passed down from the top until the lower end, going through the foot and even with the lower side, enters the guide slot. The saw is then ready for operation, and need not be unfastened again until it is necessary to change the blade. After drilling the required number of holes in the pattern, the wood is placed on the table with one of the holes directly under the saw; the small driving pulley is then turned with the thumb and finger until the point of the saw is passed down through the hole in the wood and into the slot in the table. The sliding bar is then lowered, which carries the saw still further down and sufficient to prevent the point coming out when the machine is in motion. When this opening is sawed out the sliding bar is raised and the crank turned to the highest point, and the saw may be adjusted in the next opening. The tilting table is fastened at any desired angle by means of the small wheel and screw underneath. There is also a cup which catches the sawdust and prevents it falling on the clothing of the operator.

In connection with the crank and pitman is an air pump or blower, which removes the dust from the work. The drill is stationary while the saw is in motion, but it may be started by shifting the main belt from the pulley at the back to a similar one, which starts the drill and stops the saw.

The No. 2 machine, as shown in our illustration, will swing 18 inches between saw and frame, has a 12 inch polished iron tilting table, drilling attachment, with self centering steel drill clutch, blower, dust cup, double foot treadle, one drill, one dozen saws, pair of cutting nippers, and wrench. It is mounted on an iron stand with black walnut top.

It is intended to make machines of larger sizes to be run by power, in which case, owing to the larger sized saws used, much thicker wood can be sawed. For particulars as to licenses, etc., address the patentee, N. Stafford, 66 Fulton Street, New York city.

New Agricultural Inventions.

Mr. John Butterfield, of Woodlawn, Mo., has invented an improved Self Dropper for Seed Planters. The dropping slide, which works reciprocatingly in the bottom of the seed hopper, has at each end two holes, in which are pivoted small spouts of such a size as to hold just the amount of seed required for each hill. These spouts are hinged at their outer ends, so as to drop alternately into the holes in the bottom board of the hopper and discharge the seed into conductor spouts which convey it to the ground. As the slide moves, the spouts are alternately filled from the hopper, and upset and emptied of their contents. The slide is operated by suitable lever mechanism from the drive wheel, and is moved twice at each revolution of the latter.

Mr. J. H. Riggan, of Forestville, N. C., has made certain improvements in Plows, which consist in the novel construction of a sweep, to adapt it to take the place of an ordinary point, and in the combination of a guard plate with the standard and the sweep, to prevent the seat for the mould board from being worn. The object is to furnish a strong plow, and one in which the various parts may be readily changed to adapt it to the various kinds of plowing required to be done.

An improved Plow Clevis has been invented by Mr. D. A. Kennedy, of Eau Claire, Wis. It consists in a combination, with a sleeve, of a vertical and a horizontal clevis, locked by an eccentric pin. By moving the pin from one to another of the slots in the horizontal clevis the plow may be adjusted to take or leave land, as may be required; and by turning the eccentric pin the vertical clevis may be raised or lowered, and secured in place, to cause the plow to work deeper or shallower, as desired.

A new Potato Digger of simple construction has been patented by Mr. C. O. Seamans, of Chesterton, Ind. It resembles an ordinary plow in appearance, the beam, standard, landside, and share being similar to corresponding parts of a plow, except that the share is made longer and makes a cut about two feet wide. An arched sifting frame of parallel rods follows the share, which is drawn through the ground at such a depth as to pass beneath the potatoes. The latter are caught by the sifter, separated from the earth, and left behind on the surface ready to be gathered.

An improved Gate, patented by Mr. J. D. Hagaman, of Weston, Mich., is especially adapted to farm use, as its height is adjustable, so that the space between the lower part and the ground may be increased or diminished to allow passage of small stock or to clear obstructions of snow, ice, etc. This is accomplished by adding pivoted longitudinal bars and an adjusting lever.

The New Metal "Gallium."

A lecture was recently delivered by Professor Odling at the Royal Institution on the new metal "gallium." The professor said that the number of kinds of matter known to chemists which they have not succeeded in decomposing, but can trace undecomposed through distinct series of combinations, is 64. These have been roughly classified into metals, semi-metals, and non-metals, the first class being considerably the most numerous, and the several classes merging gradually into one another. The latest known of the non-metallic elements is bromine, which was discovered in 1826 by the eminent French chemist, recently deceased, M. Balard. Within the last 20 years, however, five new metallic elements have been discovered, being at the average rate of one new element every four years; while some evidence of the identification also of yet a sixth new metallic element has recently been put on record. But the latest known of the fully made out new elements is gallium, which was first recognized by M. Lecoq de Boisbaudran in the autumn of the year 1875, and so named by him in honor of the land of its discovery, France. Like its four predecessors made known within the last 20 years, gallium was discovered by the process of spectrum analysis, applied in this instance in a special manner contrived by the ingenuity of M. de Boisbaudran himself, long eminent as a spectroscopist. The spectrum of gallium is characterized by two marked violet lines, the less refrangible of them being especially brilliant. Hitherto the new metal has been recognized only in certain varieties of zinc blende, that of Pierrefitte in the Pyrenees having furnished the chief portion of gallium hitherto obtained from any source whatever—nearly half a ton of this ore having been employed by M. de Boisbaudran to furnish the dozen grains or so of metal wherewith he has been able to establish the leading properties of the element. In its appearance gallium manifests a general resemblance to lead, but is not so blue tinted or quite so soft, though it is readily malleable, flexible, and capable of being cut with a knife. Like lead again, and unlike zinc, gallium is not an easily volatile metal. Unlike lead, however, it acquires only a very slight tarnish on exposure to moist air, and undergoes scarcely any calcination at a red heat. The specific gravity of gallium is a little under 6, that of aluminum being 2·6, that of zinc 7·1, and that of lead 11·4. A most remarkable property of gallium is its low melting point. It liquefies completely at 86° Fah., or below the heat of the hand; and, still more curiously, when once melted at this temperature, it may be cooled down even to the freezing point of water without solidifying, and may be kept unchanged in the liquid state for months. Indeed, in the original communication of its discovery to the French Academy, it was described as a new liquid metal, similar to mercury; but on touching with a fragment of solid gallium a portion of the liquid metal in this state of so-called sur-fusion it at once solidifies. Unlike lead, again, gallium is a highly crystalline metal, its form being that of a square octahedron. In its chemical habitudes the rare element gallium shows the greatest analogy to the abundant element aluminum. In particular it forms a sort of alum not to be distinguished in its appearance from ordinary alum, but containing oxide of gallium instead of oxide of aluminum or alumina.

But the chief interest of gallium, from a scientific point of view, is connected with the history of its discovery. All previously known elements have been discovered, so to speak, accidentally, and their properties have been not in any way foreseen, but rather met with as subjects of surprise; but the blende of Pierrefitte was deliberately taken up for examination by M. Lecoq de Boisbaudran in the expectation of finding a new element—an expectation to which he was led, in the course of his study of the spectra of known elements, by a train of speculation of which he has not yet made known the details. The existence of an element having the characteristic properties of gallium was, moreover, upon entirely different grounds, predicted very definitely by a Russian chemist, M. Mendelejeff, in 1871, and in a more general way several years earlier by an English chemist, Mr. Newlands. This double prediction was based on a study of the relations of the known atomic numbers of the elements. These numbers have only lately been perceived to form a tolerably continuous seriation, which, again, is associated in a remarkable manner with the seriation in properties of the elements themselves. In the series of numbers, however, certain terms are here and there missing, and in particular a number was missing which should belong to an element having properties intermediate between those of aluminum and iridium. What these properties would be was predicted in most minute detail by M. Mendelejeff in 1871. He predicted, for example, that the specific gravity of the missing metal would prove to be about 5·9. Operating on very small quantities, M. de Boisbaudran, in the first instance, found the specific gravity of gallium to be 4·7; but on repeating his determination in 1876, with special precautions and on a somewhat larger though still very small scale, he found it to be exactly 5·935, certainly a most remarkable fulfillment of the prediction with regard to it.

Eight Hours a Day.

Under a recent order of the Secretary of the Navy, the pay of all workingmen is fixed on the basis of ten hours for a day's work, and consequently those who work only eight hours a day will be paid one fifth less. The promulgation of this order has brought a large delegation from the various Navy Yards to interview the Secretary and induce him to revoke the order. The delegation was informed by the Secretary that, in his opinion, labor under the Government should have no advantages over, and should be placed on the same basis as, that engaged in private industries. In view of this, under the present interpretation of the law, he should be compelled to enforce his order. If Congress, however, would more clearly define the law and fix eight hours as a full day's work, he would not in any way interfere with its execution.

In this connection it may be stated that the House Committee on Education and Labor has agreed to report a joint resolution declaratory of the meaning of the eight hour law, to the effect that, while that law stands on the statute book, a full day's pay shall be paid for eight hours' work in the Government service.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, April 6, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury sets	7 52 eve.	Saturn rises	5 01 mo.
Venus rises	3 47 mo.	Uranus in meridian	8 52 eve.
Mars sets	11 07 eve.	Uranus sets	3 44 mo.
Jupiter rises	2 37 mo.	Neptune sets	8 01 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	11 01 eve.	Sirius in meridian	5 39 eve.
Regulus in meridian	9 01 eve.	Procyon in meridian	6 32 eve.
Spica rises	6 55 eve.	Aldebaran sets	10 26 eve.
Arcturus in meridian	1 13 mo.	Algol (2d-4th mag.var.) sets	11 08 eve.
Altair rises	0 18 mo.	Capella sets	2 19 mo.
Vega rises	8 38 eve.	7 stars (cluster) sets	10 08 eve.
Deneb rises	9 41 eve.	Betelgeuse sets	11 13 eve.
Alpheratz sets	6 53 eve.	Rigel sets	9 39 eve.

REMARKS.

Mercury is rapidly approaching his eastern elongation, and six days hence, April 12, will be most brilliant. He can, however, be seen at present, as he is 1h. 22m. high at sunset, and somewhat north of the sun's path. From April 10 to 15 will be a very favorable opportunity to observe this planet, owing to his extreme northern latitude and the short twilight. Near Neptune April 9, being 4° north. Mars will be nearest the moon April 7, being 3½° south. Uranus will be nearest the moon April 12, 10h. 33m. evening, being only about 1°, or double the moon's apparent diameter, north.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to find the planets.

M. M.

Position of Planets for April, 1878.

Mercury.

On April 1 Mercury rises at 6h. 12m. A.M., and sets at 7h. 22m. P.M. On April 30 Mercury rises at 5h. 19m. A.M., and sets at 7h. 43m. P.M.

Mercury should be looked for some 8° or 9° north of the point of sunset. It will be in the best position about the middle of the month.

Venus.

The morning skies in April will be as rich in the number and brilliancy of the planets as were the evening skies in the preceding autumn. Venus will be very brilliant all through the month.

On April 1 Venus rises a little before 4 A.M., and sets near 3 P.M. On April 30 Venus rises at 3h. 15m. A.M., and sets in the afternoon near 3 o'clock.

Venus can probably be seen with the naked eye, at meridian passage, between 9h. A.M. and 9h. 30m. A.M. through the month.

Mars.

Mars is still a noticeable object in the evening skies. It rises on April 1 at 8h. 17m. A.M., and sets at 11h. 14m. P.M. On the 30th Mars rises at 7h. 33m. A.M., and sets at 10h. 47m. P.M.

Mars will be 7° north of Aldebaran and have nearly the same right ascension on April 2.

Jupiter.

On April 1 Jupiter rises at 2h. 57m. A.M., and sets at 27m. after noon. On the 30th Jupiter rises at 1h. 13m. A. M., and sets at 10h. 50m. A.M.

Although Jupiter is far south, it cannot fail to attract the attention of any one who looks out upon the morning skies.

Saturn.

On April 1 Saturn rises at 5h. 19m. A.M., and sets at 4h. 52m. P.M. On the 30th Saturn rises at 3h. 33m. A.M., and sets at 3h. 15m. P.M.

In the latter part of the month Saturn, Venus, and Jupiter will all be brilliant in the morning. Saturn rises later than Venus, and keeps very nearly the same diurnal path; it will seem pale and small when compared with Venus, but can be recognized, being much brighter than the stars around it.

Uranus.

Uranus comes to the meridian in the evening, and is favorably situated for every observer. It is no longer so near to Regulus as to come into the same field with a glass of any considerable magnifying power. But it can be found by sweeping around Regulus, and will be known by its pale white moon-like disk.

On the 1st Uranus comes to the meridian at 9h. 12m., while Regulus comes to the meridian at 9h. 21m. Uranus is 1° 7′ above Regulus. The sweep of the telescope should be 2¼° west of Regulus and 1° 7′ above that star. If the planet is found, its place can be easily kept, as its apparent motion among the stars is exceedingly slow; it is moving a little toward the west and slowly increasing in altitude.

On April 1 Uranus sets about 4 A.M., and on the 30th a little after 2 A.M.

Sun Spots.

The year 1878 is that of the minimum of sun spots. The first group seen this year was found on March 14, and photographs were taken on the 15th and 16th. It consisted at this time of eight small spots connected by the gray surrounding known as penumbra. This group must have passed out of sight by the 17th.

The Brain of the Chimpanzee.

We are favored by Dr. E. C. Spitzka with a more detailed report of the autopsy of the dead chimpanzee recently made at the New York Aquarium before many distinguished surgeons and scientists of this city.

Species, Troglodytes niger (chimpanzee); *sex*, male; *age*, about two years. All the organs greatly resemble those found in the human race. When the brain was removed all present were struck by its being almost indistinguishable from that of a human infant, especially at the base. The cerebrum was richly convoluted and overlapped the cerebellum about one third of an inch.

It had also the same lobes, and was as rich in convolutions as the brain of a Bechuana, possessing also a well developed island of Reil. Careful examination, however, showed that it had also an operculum of the occipital lobe, which is not found in the human subject. One of the most interesting features of this brain was the absence of a trapezium, and the presence of the olivary bodies.

Now, although a rudimentary olivary body exists in the lower mammalia, yet it causes no perceptible prominence of the medulla, and such a prominence is first indicated in the baboon.

But in this chimpanzee it was as full and large as in the human race, a fact in full accord with the high development of the lateral lobes of the cerebellum, for the olivary bodies keep pace in development throughout the animal kingdom with the development of the cerebellar hemisphere.

The island of Reil, whose relations to the higher faculties are strongly documented by the prevailing physiological belief that it is subservient to the faculty of speech, was also in this instance large and well developed.

Dr. Spitzka, who is making observations on the brains of other animals, will make a special microscopical study of the present specimen, the result of which will be published later.

Recent Experiments on Digestion.

Professor Garrod, in a recent lecture on the "Protoplastic Theory of Life," observed:

"It has now been for some time known, that though gastric juice will not dissolve the walls of the stomach during life while the blood is circulating through them, as soon as death occurs they are themselves the subject of the action of the juice. Both in *post mortem* examinations and in observations on newly killed rabbits this has been clearly proved." Professor Garrod exhibited a suggestive apparatus he had devised to illustrate how the walls are preserved.

A small furnace was made of coils of metal gas piping, and so arranged that a supply of water circulated through the tubing. In this furnace a fire was maintained at a great heat.

The piping was not apparently affected. As soon as the water supply was cut off, however, the piping began to melt and soon fell away. The stoppage of the flow of water was intended to represent the stoppage of the circulation of the blood in the walls of the stomach, while the fire would illustrate the action of the gastric juice.

Some experiments of Claude Bernard were also explained, by which he was able to determine the function of the pancreas.

The pancreatic juice acts mainly on the starchy foods, and also helps to change fats into materials that can permeate through the walls, and so get from the alimentary canal into the blood system.

The effect was illustrated by taking two moist filter papers containing oil. To one some pancreatic emulsion had been added an hour previously, and here a passage through the filter paper had occurred. In the other case, without anything added to the oil, nothing had passed.

Bernard's researches on the liver appeared to suggest that most probably the bile is partly a secretion and partly an excretion, the result of the selective process of the liver on the blood as it passes through it.

Formula for Making Citrate of Magnesia.

Jenning's carbonate of magnesia	4 ounces.
Citric acid	8 "
Oil of lemon	25 drops.
Sugar	14 ounces.
Water	q. s.

Drop the lemon oil on 4 ounces of carbonate of magnesia, scrape it, and place, together with the citric acid and six parts of water, in a wide mouth bottle. In the course of a few hours the solution will be effected. Add the sugar, and dissolve by frequent agitation. Filter through paper, and divide the clear liquid into twelve suitable bottles. Lastly, these bottles must be nearly filled with filtered water, and to each of them is added, immediately before corking, forty grains of chemically pure bicarbonate of soda.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line.

NEW BOOKS AND PUBLICATIONS.

REPORTS OF JUDGES OF GROUPS 2, 5, 6, 7, AND 8, CENTENNIAL EXPOSITION. J. B. Lippincott & Co., Publishers, Philadelphia.

The above-named reports relate respectively to pottery, glass, etc.; timber; fish and fish products; furniture, and fabrics. Abstracts of the reports of individual judges on each exhibit are given, and several longer papers are included, reviewing various classes of machines, products, etc., embodying much useful and interesting information.

Notes & Queries

A. L. B.—Consult Pepper's "Play Book of Chemistry" and "Chemical Magic," which you may obtain through publishers advertising in our columns. —W. H. H.—We do not give addresses in this department, but you will see that the "Business and Personal" column can be used to obtain such information. As to freight rates you should apply to the agent. The United States laws require that all steamers should be managed by licensed officers.—W. C. B.—As we understand the arrangement, it would be better to place the pipe within an evaporator large enough to inclose it. You can use a pipe ½ to ¾ inch in diameter.—F. C. R. —Altitude is determined by barometric observations. For calculations of latitude, longitude, and eclipses, consult a practical work on astronomy.—F. & Co.—Consult Normandy's "Commercial Handbook of Chemical Analysis" (edition of 1875).—E.B.—See answer No. 10, p. 123, current volume.—L. G.—See answer No. 28, p. 140, current volume.—T. L. H.—You should describe the arrangement of the apparatus.—E. C. H.—Youwill find the matter fully treated in Auchincloss on "Link and Valve Motion."—G. M. M.—See SCIENTIFIC AMERICAN, October 21, 1876, p. 265.—H. E. C.—See SCIENTIFIC AMERICAN, May 1, 1875.—A. J. McK.—A windmill will answer very well. Consult advertising columns for addresses of engine builders, or insert notice under head of "Business and Personal."—W. H. H. G.—There are a number of suitable devices in the market.—W. C. S. and E. S. J. are referred to answer No. 19, p. 155, SCIENTIFIC AMERICAN of March 9, 1878.—L. B.—We think you can get better results with one of the semi-steels, such as Bessemer or Siemens-Martin.—C. E. G.—Use two 2 x 3 inch cylinders; two screws, 12 to 15 inches in diameter, and 2 feet pitch; boiler, 2 feet in diameter and 4 feet high. The screws should be three-bladed, and set at an incline, so as to be submerged.—L. A. W. —Full instructions on tempering spiral springs are contained in SUPPLEMENT No. 20. You should make tests under the actual working conditions until you obtain satisfactory results.—J. D.—See SCIENTIFIC AMERICAN, March 30, 1878, p. 203.—A. F. G.—We think the plan described by you will answer.—G. S.—If the temperature of the air is constant, the pressure varies inversely as the volume. The formulæ to be used when the temperature varies are given in SCIENTIFIC AMERICAN, August 21, 1875, answer No. 14.—Z. S. R.—See SCIENTIFIC AMERICAN, May 1, 1875.—B. K.—The investors should consult a good engineer. We doubt whether any but an experienced workman could dye the fur as you wish. For addresses of manufacturers, insert a notice in "Business and Personal" column.—A. W. M.—Notwithstanding all the stories about the value of divining rods, the evidence of facts, as well as the opinion of scientific men, is decidedly against them.—H.C.D.—Use sheathing paper.—F. R. Consult Osborn's "Metallurgy of Iron and Steel;" Crookes & Rohrig's "Treatise on Metallurgy;" Overman's "Manufacture of Iron;" Percy's "Metallurgy," and other standard works, which you may obtain through dealers advertising in our columns.—A. S.—See answer to D. C. L., this page, and p. 91, vol. 30.

(1) F. T. P. asks: What will cure stammering? A. Try speaking slowly.

(2) F. B. H. asks: With what acid, or other means, can nickel be stripped from a piece of Britannia ware without injuring the surface of the latter? A. Nickel cannot readily be stripped from such an alloy cleanly. You may try a bath composed of a strong hot solution of an alkaline nitrate acidified with oil of vitriol. Dip, and rinse well in water; repeat if necessary. Experience may suggest some improvement.

(3) W. W. asks: How is etching on zinc done? A. Heat the metal and cover it uniformly with a film of wax. Through this to the surface of the metal etch with a fine graver, then expose to dilute sulphuric or hydrochloric acid for a few minutes.

(4) J. A. L. asks: How can I refill the porous cells of a Leclanché battery? A. Hold the top of the porous cup in a gas flame until the pitch with which it is sealed is softened, then draw out the carbon plate, and refill the cup with black oxide of manganese and pieces of gas coke, in about the proportion of five parts of the oxide of manganese to one of gas coke.

How can I solder a copper wire to a zinc plate? A. Have the surfaces of the metals scraped and thoroughly clean; moisten them with solution of zinc chloride, then lay on the joint a small piece of soft solder, and then melt with a blowpipe flame or heated sad iron.

(5) N. W. H. asks: 1. Would an upright boiler, 50 square feet heating surface, rated at 5 horse power, be large enough to furnish steam for an engine 5 x 7, cutting off at two thirds, and 175 revolutions per minute? A. The boiler is rather small. 2. Is there any means except by the indicator to determine the actual horse power of small engines and boilers? A. You will find some notes on testing small engines and boilers in the SCIENTIFIC AMERICAN for October 31, 1874.

(6) E. A. S. asks: What bath and battery do you recommend for nickel plating? A. Use a bath containing ¾ lb. ammonio-nickel sulphate to each gallon of water. The nickel anodes should expose a somewhat larger surface in the bath than the work. Use a Smee battery (carbon negative), exposing zinc having a surface equal to that of the work in the bath, and an intensity equal to two or three couples of Smee. Clean (by scouring and acid dip) the work thoroughly, and place it in the bath, connected with the zinc of the battery—the nickel anodes being in connection with the carbon pole. The bath should be kept neutral with ammonia. See also page 209, this issue.

(7) R. & T. ask for a recipe for a cement to be used for repairing glass, leather, etc. A. 1. Dissolve fine glue in strong hot acetic acid to form a thin paste. 2. Soften fine glue or isinglass by soaking in cold water, and dissolve it in the smallest possible quantity of proof spirits by aid of gentle heat over a water bath; in 2 ozs. of this mixture dissolve 10 grains of gum ammoniacum, and while still liquid add ½ drachm of mastic dissolved in 3 drachms of rectified spirit, and stir the mixture. Keep in stoppered bottle. For use melt by standing the bottle in warm water. 3. A fused mixture of pure asphaltum and gutta percha in about equal parts.

(8) D. C. L. asks: What is the rule for calculating the power of a rotary engine? A. Multiply the area of the piston in square inches by the effective pressure in pounds per square inch, and by the speed of the center of the piston in feet per minute, and divide the product by 33,000.

(9) B. F. W. asks: Will you be kind enough to inform me how I can calculate the distance at which the ball of a safety valve should be placed to blow off at any given pressure? A. Multiply the weight of the lever by the horizontal distance of its center of gravity from the fulcrum; the weight of the valve by its horizontal distance from the fulcrum; the area of the valve by the steam pressure and horizontal distance of the valve from the fulcrum. Add together the first two products, subtract their sum from the third product, and divide the difference by the weight of the ball.

(10) J. P. D. asks: What is the greatest velocity ever attained by a ball from any sized gun? A. About 1,800 feet per second.

(11) G. W. H. writes: I wish to bring water to my house from a street main, 650 feet distant. The pressure will be that due to a head of 125 feet. I would like to be able to throw a ½ or ⅝ inch stream 30 to 40 feet. Would it do to lay 2 inch wrought iron pipe one third the distance, 1¼ inch pipe one third, and 1 inch the remaining distance, or would a smaller pipe answer? A. It would not be well to use any smaller pipes.

(12) D. H. S. asks: 1. What is the weight of a large passenger locomotive? A. About 34 tons. 2. What is the weight of a locomotive boiler, as compared with that of a Cornish engine, both having the same heating surface? A. The locomotive boiler weighs much less per square foot of heating surface.

(13) O. A. B. asks: About what width of face is required for a cast iron gear to transmit 12 horse power, one wheel large, and the other having 18 teeth, the cogs to be of 2 inches pitch, and have a speed of 260 feet per minute? A. From 3 to 4 inches will answer.

(14) R. B. asks: 1. When the Great Eastern broke her rudder at sea, some years ago, was the rudder itself carried away, or did the rudder post twist off and leave a short stub? A. The rudder post twisted off. 2. How was it temporarily fixed? A. By wrapping a chain around the collar bearing to control the rudder. The arrangement was described and illustrated in the SCIENTIFIC AMERICAN for October 26, 1861.

(15) W. E. C. asks: Are owners of steam yachts liable to a penalty for not having a licensed engineer and pilot? A. The penalty is $500 for each offense.

(16) W. C. F. asks: What weight of hard coal would be required to heat 1,000 lbs. of wrought iron to 500° Fah., without allowance for waste of heat; and what percentage of the heat can be utilized in a well constructed furnace? A. In a perfect furnace this would require between 4 and 5 lbs. of coal. In practice you might realize from 40 to 50 per cent of the theoretical effect; but it is our impression that few small furnaces do as well as this.

(17) F. J. S. asks: Is there any telephone which can be used without a battery? A. No battery is required to operate the telephone described in SCIENTIFIC AMERICAN, No. 14, vol. 37, and on p. 155, answer No. 19, of SCIENTIFIC AMERICAN of March 9, 1878.

(18) G. L. writes: This is written with ink made precisely as directed in recipe given to G. F. (February 2.) It is rather pale when first applied, but will probably be a jet black when you receive it. [It is.] Now I would like to know (1) if there is anything I can add to it that will make it jet black as soon as written with, without thickening or destroying any of its requisites as a good ink. A. Add a little extract of logwood. 2. What will prevent thickening and evaporating? A. Keep it from the air. 3. Is there anything with a more pleasant odor than creosote, or without odor, that will prevent moulding? A. Oil of cloves is often employed.

(19) B. M. and others ask for a recipe for ebonizing wood. A. Apple, pear, and walnut, if fine grained, may be ebonized by the following process: Boil in a glazed or enameled iron vessel with water, 4 ozs. of ground gallnuts, 1 oz. of logwood chips, and ½ oz. each of green vitriol and crystals of verdigris. Filter while warm, and brush the wood over with this repeatedly. Dry and brush over with strong cold solution of acetate of iron and dry. Repeat this several times, and finally dry in an oven at a moderate temperture, and oil or varnish.

(20) S. H. P. asks: Which will haul the harder, a railroad car with journals 3 inches in diameter and 4½ inches long, or the same car with journals 3½ x 5½ inches, weight of car supposed to be the same? A. This matter can only be settled definitely by experiment. With very moderate pressure the small journal might require less power than the other, while by increasing the weight the result might be reversed.

Which way will water run the faster, through a tunnel into large end and out of small, or into small end and out of large end? A. We imagine that the difference, if any, may be slightly in favor of the latter course.

How much does 1 cubic foot of mercury weigh, at varying temperatures? A. At 32° Fah. 849 lbs., at 60° 846 lbs., at 212° 836 lbs.

What degree of heat Fah. does it require to ignite common burning gas, kerosene oil, and common lard oil? A. The gas and oil ignite at red heat, and kerosene at almost any temperature, according to its quality. The temperature of ignition of different substances can be greatly lowered by special conditions.

What is the difference between a block 1 inch square and a 1 inch cube? As the terms are frequently used, there is no difference; but, speaking precisely, a block 1 inch square is a block with only two dimensions, or a plane surface.

(21) L. H. J. asks: 1. What are the proper diameters for the supply and exhaust pipes, piston rod, and crank pin of a 2 x 4 inch horizontal engine, running at 500 revolutions per minute, with 80 lbs. pressure? A. Supply pipe, ½ inch; exhaust, ⅝ inch; piston rod, ⅜ inch; crank pin, ¾ inch. 2. What will be the best way to pack the piston? A. Light cast iron rings will answer very well.

(22) E. A. M. asks how to remove scale from iron and steel. A. The articles to be cleaned may be left for a few hours in a bath of sulphuric acid and water, and then scoured with sand.

(23) F. O. S. asks: 1. What horse power (I mean the measure so termed, not the equivalent strength of horses) does a yoke of oxen exert, and what proportional increase would be gained by connecting 2, 4, or 8 couples? A. In ordinary practice, 1 yoke of good oxen may exert 1½ horse power per day of 8 hours, and if they could be made to work together, each successive yoke would add the same amount of work. 2. Are portable engines made of a power equal to 8 yoke of oxen? A. Yes.

(24) J. T. L. asks: 1. Given the value of a first water diamond of 1 carat, what is the rule for computing the price of similar stones of greater size? A. The common rule is to multiply the weight of the diamond by itself, and the product by the price of a single carat stone of the same grade. In practice, however, this and other rules do not hold absolutely good. Much depends upon the cutting and other characteristics, even of stones of apparently the same quality, and the fixed rules are always more or less deviated from. 2. What does it cost to have a diamond cut? A. The price is determined, on inspection, by the cutter. It varies greatly. 3. What did the Koh-i-noor, belonging to the crown of England, cost? A. It was presented by the East India Company. Its value is supposed to be about £2,000,000.

(25) O. B. asks: 1. Which is the more powerful explosive, gun cotton or gunpowder? A. The former. 2. Is gun cotton liable to explode on concussion or by friction? A. Yes. 3. Is fine grained powder more powerful than coarse? A. It depends upon the use and mode of application. The size of the grains determines the rate of combustion; and, while the total effect may be the same, it may be applied through a longer or shorter space of time.

(26) J. T. T. asks: 1. Is there any metallic or other hard substance to which clay made into mortar—as for bricks or stiffer—will not adhere when subjected to pressure? A. Possibly very smooth and hard metallic surfaces may answer. 2. What is understood by a horse power as compared with the power of men worked similarly? In other words, how many men does a one horse power equal? A. Between 10 and 15, according to the character of work and men.

(27) "Guitarist" asks: Is there any means of making the tone of a guitar louder than is usually the case? A. It can be done by improving the sounding board.

(28) W. S. C. asks: How many horse power are required to grind and bolt 12 bushels of wheat per hour, and how many to grind 12 bushels of corn per hour, without bolting? A. We think 6 and 5 horse power, respectively, would be ample.

(29) F. D. D. asks: What size of propeller will be advisable, for speed, with a 6½ x 6½ inch engine, in water 4 to 8 feet deep? A. Make a propeller about 3 feet in diameter, and 4½ feet pitch.

(30) W. M. S. asks how to prevent a boat from water soaking. A. Use white lead mixed in linseed oil.

(31) G. H.A. asks: What is the comparative cost of heating private and public buildings by furnaces and hot air, or steam pipes; also the comparative healthfulness of the two methods for schools, etc.? A. There is not much difference, as far as healthfulness is concerned, between steam and furnace heat, with well designed apparatus and good ventilation. For heating large buildings, steam heaters are frequently more economical than furnaces.

(32) H. E. F. asks: 1. Will two engines work on one shaft if the engines run at different speed? A. They can be made to work by proper connections. 2. How fast should a 19 inch fan run to blow a fire under a boiler? A. Run it at the speed recommended by the maker. 3. Should it blow into the smoke stack or into the fire? A. It makes no great difference into which place it discharges.

(33) J. V. C. asks: At what horse power is an engine working with cylinder 10 x 20, boiler pressure 70 lbs., and 125 revolutions per minute? A. Multiply effective pressure on piston, by area of piston, in square inches, and by speed of piston in feet per minute, and divide the product by 33,000.

(34) E. H. asks: Would an engine of 2 horse power be large enough to run a steam launch 28 feet over all, 25 feet between uprights, 6 feet beam? What would be the speed, supposing the boat to be well modeled? A. With such an engine you might realize a speed of 3 or 4 miles an hour.

(35) A. A. R. asks: What is the shortest reliable rule for calculating the capacity of circular cisterns? A. Multiply the square of the diameter in feet by 0·7854 times the height in feet. The product is the capacity in cubic feet.

(36) J. F. W. asks: How can I remove scale from sheet steel? A. By an emery wheel, or by a bath of dilute sulphuric acid.

How can I tin malleable iron, so that it will be smooth and bright? A. The articles must first be thoroughly annealed while excluded from the air, and when cold submitted to a hot but dilute pickle of sulphuric acid. After the oxide is removed they should be cleansed in water. When dry, plunge them in a bath of hot palm oil, and when heated to the temperature of the oil

(about 200° Fah.), immerse quickly in a bath of melted tin. Remove, and drain. To obtain a thicker coat of tin submerge again in the tin bath, heated but little above the melting point.

(37) H. W. makes this suggestion with regard to leaky skylights, in response to the inquiry of B. P. L.: My practice has been to put on a good stiff coat of paint and sand it. The paint should set hard on the glass and the sand be thoroughly dry. I sometimes have to repeat it, but not often. However, a second coat of paint and sand renders it much more durable.

(38) E. C. H. writes: I wish to increase the draught of my engine. If I introduce the exhaust a foot or two from the top of the chimney, will it be likely to injure the chimney, and will it increase the draught? The chimney is 22 feet high, brick, square, and 2 feet in clear. A. We think the exhaust will not injure the chimney, and will increase the draught.

Will you please give me number of threads per inch of a ⅜ inch pipe tap? A. Eighteen.

(39) W. H. T. asks: What is the best and cheapest method of annealing small castings? A. Heat them for 6 hours inclosed in a box and surrounded with lime, and allow them five or six hours to cool, by covering the box (after extraction from the fire) with sand.

(40) I. K. asks: What is the pulling or pushing force of the average locomotive? A. About one sixth of the weight on its driving wheels.

Will a single lens, double convex, answer for a camera to view landscapes, etc.? A. Such a lens will answer.

Will a boiler of the following dimensions furnish steam sufficient for a 3 horse engine: height 48 inches, diameter 22 inches, with 30 tubes 2 inches in diameter and 36 inches long? A. It probably will, if the engine is well designed.

(41) W. T. R. writes: Can you suggest any way of preventing brass stencil plates from affecting the color of the paint used? A. Lacquering the plates may answer, but nickel plating would doubtless be preferable. Varnish would probably soon wear off.

(42) "Inquirer" writes: Please give me a recipe for making mucilage. A. Dissolve gum dextrin in hot water with the addition of a little acetic acid.

What will keep washing blue from settling? A. Agitate the water.

(43) R. E. B. asks for a recipe for a ladies' shoe polish? A. Borax, 1 part; shellac, 4 parts; dissolve by continued boiling in a small quantity of water, and color with soluble aniline black or black ink.

(44) G. W. & Sons write: We are troubled a great deal with organic matter in water used in our brewery. Could we remedy it by first precipitating the organic matter and clayey parts of the water with potassium permanganate and alum, and then filter through sand and bone charcoal? We think that the filter would require less cleaning by first precipitating the organic matter and clay. A. Yes; but sulphate of alumina is preferable to alum. Dr. Crookes recommends the following mixture: Calcium permanganate, 1 part; aluminum sulphate, 10 parts; fine clay, 30 parts. The potassium permanganate may be used in place of the lime salt. He finds that one part of this mixture will purify almost instantly 5,000 parts of foul ditch water or sewage; it settles quickly, and the supernatant liquid may after fifteen minutes be drawn off without filtration.

(45) S. B. asks: How much will a well seasoned stick of timber (Southern pine or oak), 50 feet long, vary in length by a change in the temperature of 100° Fah.? A. There is no absolute formula for such cases, the change in dimensions depending upon a variety of elements, such as the grain of the wood, the nature of seasoning, etc. No timber is absolutely dry, and will consequently continue to shrink irregularly as further portions of moisture are evaporated; while the same stick changes character from day to day as the humidity of the air varies. Alterations in shape are therefore rather due to hygroscopic than thermal variations, and hence wood cannot be classed, in regard to expansion and contraction, with substances which, like the metals, have a definite coefficient of expansion. The change in length will be usually less than one third the alteration in cross section. In practice it is disregarded.

(46) A. B. asks: How may pencil marks be removed? A. We believe that rubber or a steel eraser are the only means.

(47) L. D. asks how to purify impure well water. A. Reduce separately to fine powder and mix thoroughly 30 parts fine clay, 10 parts sulphate of alumina, and 1 part of permanganate of lime. Add this to the impure water in the proportion of 10 to 30 grains to the gallon (depending of course upon its impurity), agitate, and allow to settle for half an hour. Less must be used if detected in the taste or color of the water after settling. Permanganate of soda or potassa may be used if the lime salt cannot be obtained.

(48) E. S. wishes to know the number of pounds of chloride of calcium required to bring a cubic foot of water to a density of 30° Baumé. A. About 28 lbs., under ordinary conditions.

(49) J. T. asks: What will restore hard rubber goods when tarnished? A. Sometimes repolishing; often nothing.

(50) G. S. asks: What was the fastest run of the Jarrett & Palmer "Centennial" train? A. Ninety miles in 99 minutes, Jersey City to West Philadelphia, without stop.

(51) E. D. R. wishes to know whether isinglass is identical with mica. A. Isinglass is the name given to a gelatin properly prepared from the sounds or air bladders of fish. The name was also applied by Hill, in 1771, in his work on "Fossils," to large sheets or plates of muscovite (the most common of the mica group) to distinguish it from the small particles constituting mica schist. The name is, however, properly restricted to fish gelatin.

(52) F. J. O. writes: I have been experimenting in transferring printing and lithographs on wood for engraving. I find certain kinds of hard varnish printing and lithograph inks I can make no impression on. I have used strong solutions of caustic potash and alcohol, strong potash lye, glycerin, all to no purpose. Can you give a recipe for a solution that will loosen these hard inks and yet not destroy the picture? A. Try the following: carbon disulphide, 95 parts; absolute alcohol, 5 parts.

(53) E. L. B. asks for a recipe for a preparation to put on plow castings after they are polished, so as to retain the polish and keep the metal from rusting. A. Cover with a mixture of white lead and tallow when not in use.

(54) F. A. S. writes: Having learned by experience what a nuisance a leaky stovepipe, like that of A. H. J. (p. 75, current volume), may become, let me prescribe a remedy which I have found successful. In the first elbow from the stove I cut out a strip of the iron 2½ x 4 inches, and had a sliding cover for the opening. I open it some every day, and always at bedtime, and leave it till morning. The pipe has never dripped since I began this treatment, and is as clear and dry as when put up.

(55) H. A. F. writes: I have a gold pen which has too coarse a nib. Is there any way in which I can sharpen it without sending to a manufacturer? A. We doubt whether you can alter it successfully, if you have no experience.

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

R. H.—It is an excellent quality of asbestos.—E. P. B.—It is zinc blende—zinc sulphide. Of some value.—Mrs. S. C.—It appears to be the dried bark of the black willow (*salix nigra*).—A. R. C.—Brick clay is not quoted in the market; it could be bought at about $2 or $3 per ton; fire clay, $5 to $7 a ton.—J. F. H. & Bro.—It is a ferruginous shale—composed principally of silicate of alumina or clay and silicious sand, colored by sesquioxide of iron.—S. J.—The sample is an excellent guano. An analysis would determine its value.—L. G.—The platinum sand is of value. The clayey asbestos might be used by paper makers. Sample of diamond earth not received.—D. V.—It is a ferro-cupric sulphide in quartz gangue.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

The Phonograph. By J. C. D.
Velocipede Travel. By T. B. and W. E. G.
"Multum in Parvo." By L. S. B.
The Oroheliograph. By G. B. S.
Mechanical Adjustment by Mirrors. By A. S. C.
An Astronomical Myth. By W. I. L.
The Rail Puzzle. By H. G. U., D. J. C., and "Vulcan."
Electrical Phenomena. By A. E. H.
A New Motor. By H. S. M.
The Safety Valve. By T. J. L.
Snake Cannibalism. By F. N. P.
Mind Reading. By J. L.
Gravitation. By G. V.

HINTS TO CORRESPONDENTS.

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 fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

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INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 26, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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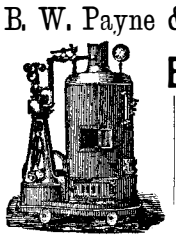

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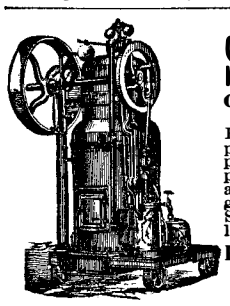

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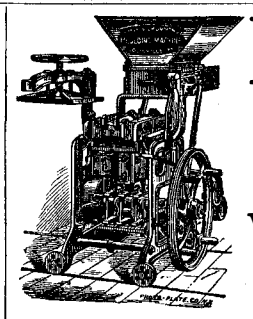

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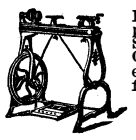

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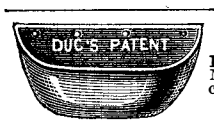

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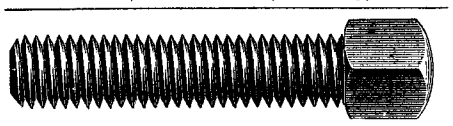

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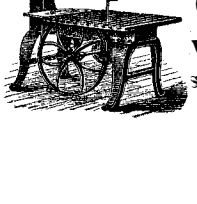

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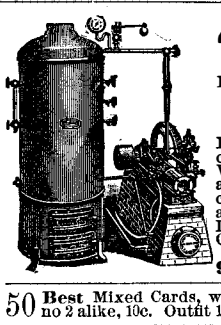

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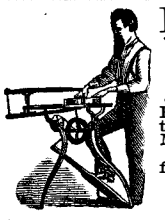

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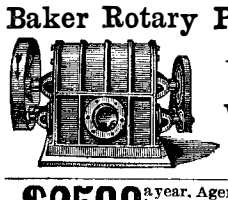

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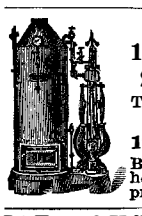

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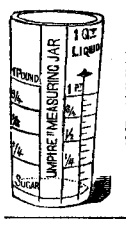

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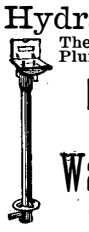

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