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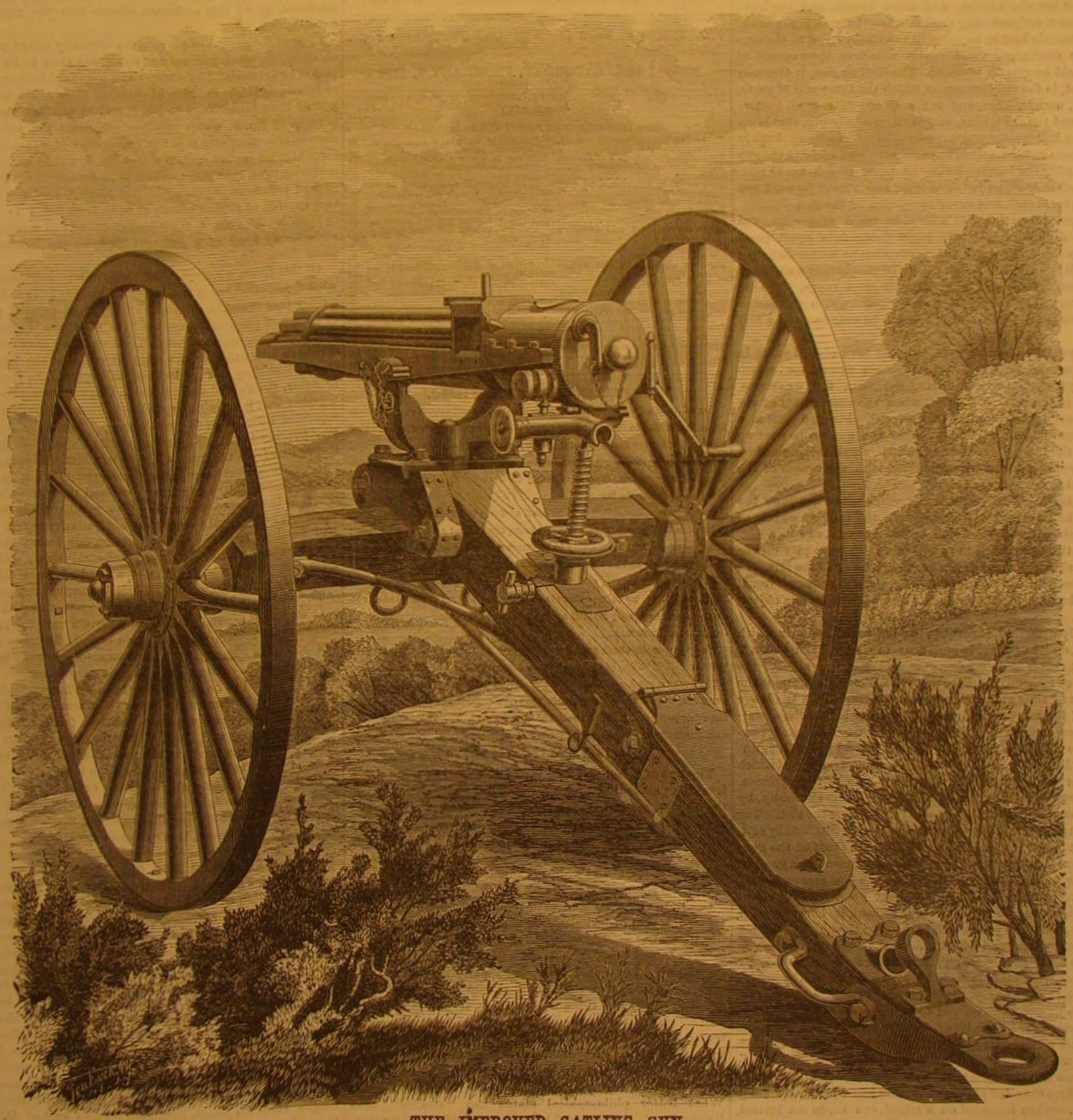

THE IMPROVED GATLING GUN.

THE GATLING GUN.

We devote our initial page this week to the illustration of another of those engines of war which are destined to play no small part in the arbitration of disputes between nations. The more formidable the weapons become, the less likely are nations to attempt to decide their differences by resort to arms, and the more destructive the means for its prosecution the shorter the duration of the conflict, and the less the amount of evil inflicted upon mankind.

We deem it unnecessary to enter into any minute description of the mechanism of the Gatling mitrailleuse, depicted in our engraving, as it has already, in its earlier and less improved forms, received ample notice in our journal, and since has elicited not only commendation from army officers, but substantial support from foreign governments. The attention of the reader is directed to the improvements which have lately been made in its construction, rendering it, according to the inventor's statement, the most efficient battery gun yet invented.

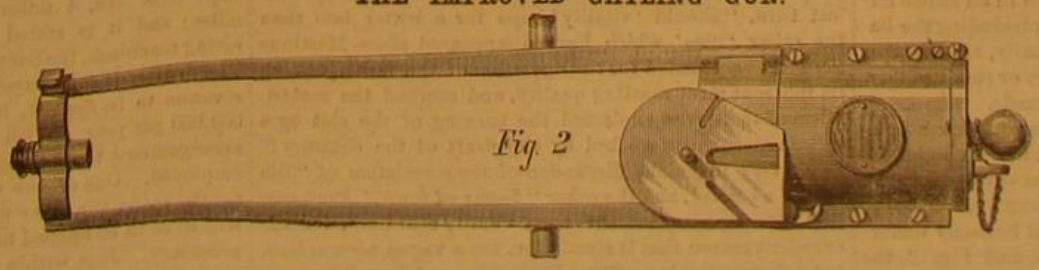

Fig. 2

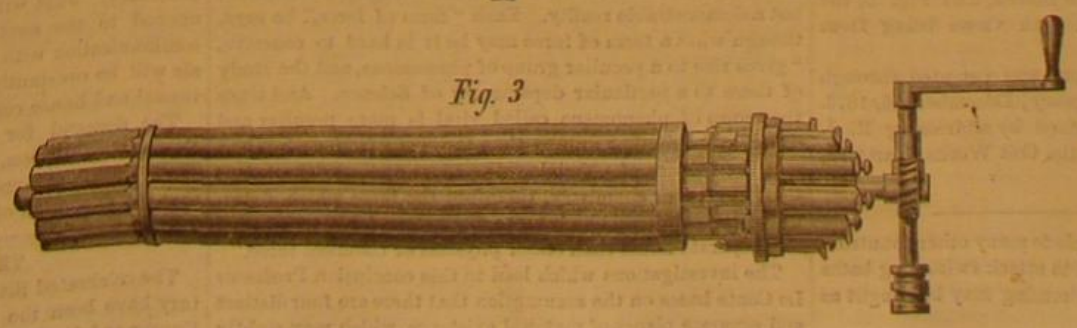

Fig. 3

Rapidity and continuity of fire, together with simplicity and absence of complexity of parts, are the essential advantages to be noted. Each barrel is provided with its own independent lock or firing mechanism, and these are made interchangeable and strong. Should any get out of order, one or all of the locks can, in a few moments, be

removed and others substituted in their places, and the gun kept in working order at all times, on the field of battle. This is a feature of great importance, as the lock mechanism is the most essential part of a machine gun, and is practically the only part liable to get out of order from use. The lock mechanism of many other machine guns forms an entirety, and is so united and encased that, should any part of the same get out of order, a circumstance which is liable to happen in long and continued firing in time of action, the whole machine would become disabled and would have to be taken to a machine shop for repairs. In such a contingency, it is needless to remark, the enemy would not be likely to await the completion of the job.

All the locks in the Gatling gun revolve simultaneously with the barrels, carrier, and inner breech, and the locks have also a reciprocating motion when the gun is revolved. If the barrels had to be brought to a state of rest at the time of each discharge, the inventor considers, the rapidity of fire would be greatly lessened. The Gatling gun, it also may be noted, is the only firearm in which the three sets of parts, namely, barrels, locks, and inner breech (Fig. 3) all revolve at one and the same time, and it is the only gun that loads and fires incessantly while these several parts are kept in continuous motion. It is impossible to load and fire the gun when either the barrels, locks, or inner breech are at rest. Each lock in the gun revolves once, and moves forward and back once, at each and every revolution of the gun.

The piece fires a shot at a time, in rapid succession, and thus by dividing the time in rapid firing into equal parts between the discharges, and preventing an accumulation of recoil, it admits, it is claimed, of large charges and heavy balls, and consequently exceptionally great range. The extreme range of the largest Gatling gun, which discharges half pound solid lead balls, is said to be over two and a half miles.

The peculiarity of no recoil existing is of special value in the defense of bridges, fords, mountain passes, etc., which are frequently attempted during darkness, fog, or storms, as also in the smoke of battle, when the movements of the enemy cannot be accurately observed. Firing a shot at a time also allows a lateral motion of the gun to be kept up during the time of rapid firing, which result is attained by the traversing mechanism connected with the breech of the gun and the carriage, as shown in Fig. 1.

This improved traversing mechanism not only allows the gun to be traversed without moving the trail or wheels of the carriage, but enables the operator at will, and in a second of time, to change the angle of fire so as to play on the enemy should he move either to the right or to the left. In other words, the shots can be spread along the enemy's front, or can be all concentrated to one point or upon one object, at will.

Briefly described, it consists in a horizontal cylinder which carries, on its upper side and near the right hand end, a T flange to enter in a T groove upon the lower side of the breech of the gun (Fig. 2) so that the latter may slide upon the flange and thus gain the necessary sweep. On the lower part of the same end of the cylinder, the ball of the elevating screw is received in a transverse groove. The cylinder extends to the left of and below the breech, and in it is longitudinally inserted a screw which carries a nut, a portion of which projects through a slot in the front side of the cylinder. The screw is actuated by a hand wheel at its extremity, by which means the nut is caused to travel along the slot. The nut has on its projecting side a socket, and in this, held by suitable catch mechanism, is a pin. The crank shaft of the gun, Fig. 3, extends through the breech and terminates in a grooved cylinder, in the channels of which the pin just mentioned enters, except when it is thrown out of gear. It is evident that, when the grooved cylinder is rotated, its curved groove acting against the pin, which is held immovable after being adjusted by the hand wheel, causes the T groove on the gun to slide along the flange on the cylinder first mentioned. By this means, the piece is caused to sweep the horizon by merely actuating the ordinary firing crank. The groove cylinder has two grooves, one curved to correspond with the number of degrees over which it is desired to swing the barrels, and the other straight, the effect of which is, of course, to allow the gun to remain stationary.

We are informed that the smallest sized Gatling gun—which fires over 400 shots per minute and which weighs only 125 lbs.—when mounted on a tripod, can be, in an instant, traversed so as to fire to any point embraced in an entire circle, thus furnishing its own support and precluding the liability of its capture by a flank attack. Finally, the inventor adds that his system admits of either large or small caliber. Eight different sizes of the guns are now made. The smallest size is the only machine gun in existence which admits of being mounted and fired from a tripod, and its lightness and effectiveness specially commend it for cavalry service, mountain warfare, boat service, etc. From Figs. 2 and 3, the two principal divisions of the arm will be easily understood. Fig. 2 shows the frame and breech, and Fig. 3, the barrels, locks, and firing crank, both views being from above.

The improved training mechanism was patented through the Scientific American Patent Agency, December 16, 1873. Further information may be obtained by addressing R. J. Gatling, whose manufactory is at the Colt Works, Hartford, Conn.

AUSTRALIA has set a good example to many other countries. In that colony it has been decided to attach swimming baths to all the State schools, so that swimming may be taught as an essential part of education.

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Contents:

(Illustrated articles are marked with an asterisk.)

IS VITALITY VITAL?

The line of progress along which Science has come down from the past is thickly strewn with dead and dying terms, the empty husks of theories which have had their day and ceased to be. Many of these terms have dropped entirely out of use. Others have survived in form, but with so many changes of meaning that they remind one of the tenements of hermit crabs, shells whose original occupants have long since gone where good mollusks go.

One of the most significant of recent word demises, real or reputed, is that of "vitality," as the name of the principle of life, a peculiar something in living matter unrepresented in other or "dead" matter. To not a few of our leading thinkers, the word has ceased to harbor its original tenant; and some go so far as to insist that it should be dropped from the vocabulary of Science as useless, if not misleading. Huxley humorously compares the imagined force it represented to a supposable "aquosity," which might be thought to enter the oxide of hydrogen at the moment of its formation to give rise to the properties and phenomena which make water so unlike its constituent elements, and asks: What better philosophical status has "vitality" than "aquosity?" "And why," he continues, with a mildly ironical turn, "should 'vitality' hope for a better fate than the other 'ities' which have disappeared since Martinus Scriblerus accounted for the operation of the meat jack by its inherent meat-roasting quality, and scorned the materialism of those who explained the turning of the spit by a certain mechanism worked by the draft of the chimney?" In his very ingenious discussion of the correlation of "life force," so called, and the other "forms of force," Professor Le Conte insists that the term vitality still lives, for the excellent reason that it stands for, not a vague assumption, but a demonstrable reality. Each "form of force," he says, though what a form of force may be it is hard to conceive, "gives rise to a peculiar group of phenomena, and the study of these to a particular department of Science. And since the group of phenomena called vital is more peculiar and different from other groups than those are from each other, and the science of physiology is a more distinct department than physics or chemistry, therefore the force which determines those phenomena is more distinct and better entitled to a separate name than either physical or chemical force."

The investigations which lead to this conclusion Professor Le Conte bases on the assumption that there are four distinct and separate planes of material existence, which may rightly be considered as lying in vertical order and ranking according to position. These planes are, counting from the first and lowest, (1) the plane of elementary existence; (2) chemical compounds; (3) vegetable life; (4) animal life. Corresponding to these planes of matter are four planes or forms of force, similarly related. The first and lowest, called physical force, operates alone on the plane of elementary matter. A higher form, chemical force, enters upon and operates on the next plane in connection with the first. The third plane is the field of operation for three forms of force; the two already named and the new and peculiar one, vital force. On the fourth material plane, the force peculiarly characteristic of animal life, the will, operates in addition to the other three. A fifth plane, the human, with free will as its characteristic, raises this elaborate scheme into the region of metaphysics.

Each of the groups of phenomena currently called physical, chemical, vital, rational and so on, are thus to be interpreted as determined by distinct and peculiar kinds or forms of force. It is the function of chemical force alone to raise matter from plane No. 1 to No. 2, and to produce the phenomena of No. 2, which together constitute the science of chemistry. Similarly it is the prerogative of vegetable life force to raise matter from No. 2 to No. 3, and to execute all movements on that plane, which together constitute the science of vegetable physiology. But there is no force in Nature capable of raising matter at once from No. 1 to No. 3, or from No. 2 to No. 4, "without stopping and receiving an accession of force of a different kind, on the intermediate plane."

All this forms a consistent and very plausible system, but what foundation has it in the eternal verities? Is it demonstrably true that the alleged superimposed parallel planes of force and phenomena are not figments of the imagination, and misleading ones at that? The two upper ones certainly approach each other at one edge (to continue the figure) so closely that they seem to be in actual contact. In their lower fields, the animal and vegetable kingdoms come so nearly together that it is quite impossible to discover the line which separates them, if such line there be. Again the products long supposed to be the peculiar work of vital force (as distinguished from the force which determines ordinary chemical combinations) have been so numerously built up from their elements in the laboratory, without the intervention of life, that the supposed necessity for a peculiar force for such work has been greatly reduced, if not quite destroyed. And still further, is it not a sheer assumption to say that the movements of matter in the hypothetical state, which we term elementary, must be due to a kind of force differing absolutely from that which determines chemical compounds?

The real state of the case appears to be something like this. that we find it convenient to group certain varieties of phenomena into arbitrary classes, with boundaries more or less distinct. For like reasons, we are accustomed to say that the impelling cause or causes in one group are chemical, in another vital, and so on; and sometimes we forget that these terms have reference solely to our classifications, and do not necessarily designate separate entities, forms of force or whatever we may call them. The expansion of steam under diverse conditions produces the most diverse and dissimilar results; but it is the same motor all the time.

To denote a broadly characteristic order of activity, the term vitality is useful and convenient. As indicating a force inherent in and wholly peculiar to living matter, something *sui generis*, so to speak, it is evidently doomed.

THE DOVER AND CALAIS TUNNEL.

There seems at length to be a definite project proposed for the construction of a tunnel across the Straits of Dover, between England and France. An Anglo-French committee has for some time past had the matter under consideration, with the object of inquiring into ways and means and of discovering the most practical method of accomplishing the work. This body, among the members of which we find the names of Lord Richard Grosvenor, Mr. Thomas Brassey, M. P., Admiral Elliot, and Messrs. Hawkshaw and Brunlees, engineers in the English section, and of MM. Chevalier, Paris, Talabot and other distinguished men of the French delegation, have adopted a plan which calls for a tunnel open only at its ends, and without the intermediate establishment which has been proposed in the middle of the strait. Its length from the South Foreland, 5 miles east of Dover, to Cape Gris Nez, 4 miles west of Calais, will be about 21 miles; and it is stated that, with the new Brunton perforating machines, the bore can be finished in four or five years. The estimated total expense is $40,000,000, and the probable revenue to be desired, it is believed, will reach about $4,000,000 per year. With regard to ventilation, the ordinary arrangements for making a draft as used in mines will be employed. One of the ends of the tunnel will be permanently open; the other will be provided with doors which will have to be opened to admit the passage of trains when necessary. Just within the doors, a large orifice will be opened to the summit of the vault of the tunnel and in communication with a fire. By the draft thus caused, the air will be constantly drawn in from the open end of the tunnel and hence continually renewed.

The demand for a concession presented by the Anglo-French Commission, says *Les Mondes*, is now under public consideration at Arras, in the Pas de Calais, and it is believed that the execution of the project will before long be begun.

THE SIAMESE TWINS.

The celebrated Siamese twins, which for the last half century have been the foremost of living curiosities, both in Europe and America, recently died at Salisbury, N. C. These

remarkable personages were born in Siam in 1811, and constituted part of a family of fifteen children, several of whom were twins, though none save these two were in any wise deformed. Chang and Eng, however, were linked together by a fleshy ligature, which was about a foot in length, two inches broad and four inches thick. Through it ran a large artery and many veins, making their circulation identical. Each brother had, however, an entirely separate existence, and, with the exception of the ligature, which was equally sensitive to both, their senses were totally disconnected.

In 1850 Barnum exhibited them throughout the country, and out of their salaries they managed to amass some $40,000. With this money the brothers purchased two adjoining plantations in North Carolina, assumed the surname of Bunker and, strange to say, married. The courtship, it is stated, was done by proxy, and the wives, English women, who had only seen their husbands once at a show in London, were selected by the twins from likenesses forwarded by an agent. At the time of their marriage the brothers were forty four years of age and their wives, who were sisters, respectively twenty-six and twenty-eight. Their domestic life is said to have been very peculiar. The wives lived in separate homes and the husbands alternated, staying one week at Chang's house and the next week at Eng's. Each looked after his plantation and other business during the weeks of his living at his own place, and the visiting brother was not supposed to interfere. The families increased rapidly, Chang having six children and Eng five; of these four were deaf mutes, though not deformed, while the rest were strong and healthy. The domestic life of the brothers was not happy, and serious difficulties occasionally took place, resulting in the estrangement of the families for long periods. They were slave owners and cruel masters, and during the war manifested strong southern proclivities. At the end of the rebellion, their wealth was very much reduced, and they again went into the show business, with only partial success.

The brothers were of medium size and of peculiarly repulsive faces. Chang was the most robust and good natured, while Eng was often sick and morose. Chang also was the mental superior, although both were ignorant and had intelligence that scarcely rose above low cunning. As they grew old, the almost certainty of the death of one resulting in that of the other rendered them fretful and nervous. While in Europe, they consulted the best physicians regarding the possibility of a separate existence; but when the ligature was compressed so that all transfusion of blood between them stopped, Eng fainted, proving that neither could sustain a separate circulation. About a year ago Chang had a paralytic stroke which rendered his health the worse of the two; and as a relief from suffering, he drank freely. His death occurred first; and the shock, or more probably the cessation of circulation, affected Eng so strongly that delirium, followed by stupor, almost immediately set in. At the end of two hours, he also expired.

THE ONE HUNDRED THOUSAND DOLLAR CANAL REWARD.

The Canal Commission of the State of New York, charged with the duty of trying and examining the various boats that were presented last year in competition for the reward of one hundred thousand dollars, have lately made their report to the Legislature. They say that, owing to the technicalities contained in the law under which the reward was offered, they have been unable to make an award to any of the competitors. They ask that the law may be modified and new trials allowed. They report that two of the competing boats very nearly filled the requirements. These were the steam canal boat William Baxter and the steam canal boat William Newman. The requisition was that each boat should be able to carry 200 tuns of cargo besides motive power, and make an average speed of three miles per hour.

The William Baxter was built especially to compete for the prize. She is 96 feet long and 17 feet beam, and has much sharper lines than the ordinary canal boats. Her bottom is perfectly flat, and her sides, stem, and stern, vertical. The outlines of the immersed portions of her bow and stern are the same. She has an overhanging deck at the stern to protect her propellers, and with 200 tuns of cargo she draws 5½ feet of water. Her machinery consists of a Baxter upright boiler, and a pair of Baxter compound condensing engines, 7x12 and 12x12. Her boiler is 6 feet high, 46 inches diameter, and has 152 two inch flues, and a grate surface of 7 feet. She is propelled by 2 three bladed twin screws of 4½ feet diameter and 4 feet pitch. The amount of coal consumed in running from Syracuse to Utica, a distance of 56 miles, was 830 pounds.

The William Newman has a Hubbard hydraulic propeller. She has a horizontal tubular boiler, 8 feet long and 44 inches in diameter, and a grate surface of 13 feet; and she is driven by a single 12x12 upright engine. The propeller is 4 feet 8 inches in diameter and 3 feet long. The amount of coal consumed from Syracuse to Utica was 4,500 pounds.

The time for competition has now expired. If the Legislature at its present session should renew the reward, we shall promptly inform our readers.

THE TURNER CAR BRAKE.—APPLICATION FOR AN EXTENSION.

An application for extension of the car brake patent of Charles B. Turner, dated November, 1848, and extended in 1863 for seven years, is now before the Senate Committee on Patents. Messrs. Batcheller & Thompson, the assignees of the inventor, submit their claim on the ground that they have received no adequate compensation for the use of the device, having been opposed so strenuously by railroad combinations throughout the country that they have been compelled to expend in litigation about as much money as they have received.

The railroads, which are represented by Mr. Wm. D. Bishop, President of the New York and New Haven R. R. Co., and Mr. Joseph Howard, counsel for the Pennsylvania R. R. Co., contend that adequate compensation has been received, and that the patent is invalid by reason of a prior invention. This last assertion seems to be in direct variance with Judge Drummond's decision in a recent infringement suit brought by the assignees against certain railroads in Illinois. A master in chancery reported adversely to the defendants, who had associated themselves together, and found heavy damages. The railroads filed a bill of exceptions, but the opinion of the appellate court, as delivered by Judge Drummond, sustains the master in every particular. The decree is that the patent is good and valid; that the inventors have never neglected or abandoned such patent; that the instrument covers the connecting of all the brakes of a car with windlasses, so that a brakeman, by operating any one of the latter, can apply all the brakes to the wheels; and that the Stevens brake, used by the defendants, contains all the covered combination.

The railroads, as represented before Congress, are strongly opposing the extension; and after the presentation of the case by Mr. S. D. Cozzens, of counsel for Messrs. Batcheller & Thompson, a postponement was obtained by Messrs. Bishop and Howard, in order to afford necessary time for consultation as to the nature of the reply they will make to the application. The matter, therefore, is adjourned for some days.

THE NEW ENGLAND ASSOCIATION OF INVENTORS AND PATENT OWNERS.

To the Editor of the Scientific American:

Many of your subscribers were surprised to see, in your issue bearing date January 10, 1874, a leading article mentioning the New England Association of Inventors and Patent Owners in a spirit tending to mislead your readers. I would ask you to amend what evidently proceeds from insufficient information. I have sent you a prospectus of the Association, and trust that its perusal will lead you to see that its objects are neither as limited nor as selfish as you state them to be.

The objects aimed at are "to collect and diffuse statistics tending to demonstrate the usefulness of patent laws, and the growth of our arts and manufactures under their influence; to draw from the Congress of the United States such recognition of their general value as shall secure a just and liberal basis of patent protection; to bring together all persons interested, and reconcile their differences, and to take such action as may best promote the general prosperity of the classes represented in its membership."

As no inconsiderable number of your subscribers are members of this Association, and there seems to be no question of its being able to be put to good uses, and assuming that you desire to give only reliable intelligence to your readers, I would ask, on behalf of the Association, that you correct the impression created by the strange *animus* of the article in question. Very respectfully,

THEO. A. DODGE, President of the Association.

REMARKS BY THE EDITOR.—In respect to the above association, our language was as follows (see page 16 of our current volume): "The objects of this Association, so far as we can gather them from the proceedings, are to render mutual aid and benefit to the members in the management of their patents, to secure the extension of their several patent monopolies, compel the payment of fair prices for patents by railway companies, and in other ways to promote the general prosperity of the country."

We have received the prospectus above referred to, which consists of a report signed by Mr. Dodge, upon the expected scope of the Association. It is a very creditable document, and contains various excellent suggestions, to which we shall hereafter have occasion to allude. It does not, however, purport to be a statement of the proceedings of the original meeting of the Association, and has therefore no bearing upon the question of the accuracy of our remarks concerning those proceedings.

We think, if Mr. Dodge will refer to the reports of the meeting once more, as contained in the Boston daily papers, he will find that our statement was substantially correct. The "strange *animus*," the impression of which Mr. Dodge, on behalf of the Association, asks us to correct, refers, we presume, to the objections we presented to the Hill resolution. This resolution covered, indirectly, as we thought, an endorsement by the Association of one of the Vienna propositions, to the effect that governments ought to fix the prices at which patents shall be sold; in other words, that the inventor, after he has received a patent, ought to be deprived of its control. Now, if there is any one point which imparts a distinguishing excellence to the American patent law over the continental system, it is that we give *to the inventor* the free, untrammeled right to make use and dispose of his patent during the entire term for which it is granted, according to his own best judgment. We permit no government interference with him, and have no sneaking government detectives to dog his footsteps, as in some parts of Europe. The mere suggestion of an alteration of our patent laws, to authorize such interference, is abhorrent to the feelings of American inventors, and contrary to public policy.

These views of ours we believe to be fully in accord with the feeling of the great mass of our readers. Mr. Dodge is mistaken if he supposes that many of our subscribers, in the Association, were surprised at seeing the expression of them.

In so far as the New England Association shall actually *do* anything to promote the interests of inventors, or encourage the progress of the useful arts, its members well know that they may always count upon us as being with them, heart and soul. But when they go for the approval, even indirectly, of government interference in the sale of patents, we are not with them, because we believe it to be a wrong policy.

THE PHILOSOPHY OF THE SAND BLAST.

At first sight, the cutting of a diamond or other hard substance, by another so much softer as sand is, seems flatly contradictory to common experience. Still, to any one who has ever fired a rifle ball against a rock, the fact that a flying soft body will bruise or crush a harder one is neither surprising nor new. The possible perforation of a pine board by a tallow candle, fired from a musket, is an illustration of the same fact, familiar to every school-boy. In the sand blast, however, the effect seen is so manifestly disproportionate to the momentum of the individual particles that the explanation usually given in the grosser cases fails to hold good. Grains of sand, of very unequal size, appear to do precisely the same work when moving at the same rate, thus directly contradicting what has hitherto been an unquestioned law of impact.

Whence arises the discrepancy between what is and what might be expected? To answer this question, an English investigator has reconsidered the laws of impact, and finds that one of great significance and importance has heretofore been entirely overlooked. It is this: At the moment of first contact, the pressure between impinging bodies is independent of their size.

This law has been undetected heretofore, simply because the laws of impact have been considered mainly with reference to the centers of gravity of the bodies, while little or no attention has been paid to the points of impact and what goes on there between the instant of first contact and the time when the center of gravity is changed. Even with the compacted bodies, it takes time for the pressure to extend to the inner particles.

Hence, on the instant of impact, it is only those particles in contact which are affected, and the rest of the body might be removed without altering the effect. In other words, the effect of impact is independent of the quantity of matter behind the particles which actually impinge.

That the effect of the sand blast is—as this law indicates—a battering, not a grinding, action is clearly shown by the microscope. A polished glass surface, that has been exposed for an instant to the blast, is spotted with points from which scales of fractured glass have been broken away in irregular direction. Each spot appeared as if a pellet of glass had been driven in by the collision, and the wedge-like action thus set up had driven away the surrounding glass. The polariscope confirms this inference. When thus tested, each spot shows a colored halo, proving that the surface of the glass is under strain.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE VULCANIZATION OF HYDROCARBON COMPOUNDS.

In treating bituminous substances, such as asphaltum, grahamite, petroleum residuum, the different mineral resins, coal tar, etc., with sulphur, chloride of sulphur, or sulphur in combination with various bases, such as sulphuret of iron, etc., a definite chemical compound is formed, differing from its constituent parts in many material respects, being harder, tougher, and more capable of resisting heat. The sulphur should be in just sufficient proportion to form this compound, as an excess would mix mechanically with the mass and render it too brittle for use. Difficulty is usually experienced in determining the proportion of sulphur, as it varies according to the hydrocarbon used. To overcome this difficulty and to avoid all danger of having an excess of sulphur, it is best to use in addition some metallic oxides (such as litharge, for example), which will combine with any free sulphur, forming a metallic sulphuret. The hydrocarbons are first heated till the water is entirely evaporated, and the sulphur, chloride of sulphur, or metallic sulphuret, is then added. The sulphur may be dissolved in bisulphide of carbon or any of the ethereal or fatty oils, or it may be mixed directly with the mass.

ANTIMONY BLUE.

C. Kraus obtains this color by boiling tartar emetic with yellow prussiate of potash, and adding hydrochloric acid. The antimony does not enter into the composition of this color but merely facilitates its formation.

WHITE COAL.

A new kind of fuel has recently been discovered on the Australian continent, which has received the name of white coal. It consists of felted vegetable fibers, like peat, which contain, interspersed between them, fine grains of sand. It is easily combustible and burns with a light flame. The white coal covers large tracts, requiring no mining, and is already used in large quantities as fuel.

CYMOGENE (? chymogene) writes to say that our correspondent, I. S. Peet, is wrong in adding rhigoline to the list of products of coal tar, as this body does not exist in the coal tar, but belongs to the highly volatile portions of petroleum, being second in the list.

PROFESSOR COFFIN.

Professor James Henry Coffin, LL. D., was born in Williamsburg, Mass., on the sixth day of September, 1806. He was sixty-six years old at the time of his decease, which occurred February 6, 1873, at Lafayette College, Easton, Pa., where since 1846 he had filled the professorship of Mathematics and Astronomy. He graduated at Amherst College in 1828.

While at Williams College, Professor Coffin erected, upon the Greylock peak of Saddle Mountain, at a hight of nearly 4,000 feet above the ocean, an observatory, where continuous observations were taken, even through the winter seasons when for three months it was impracticable to ascend the peak. In this interval the clockwork faithfully did its entire duty. The anemometer had been changed by substituting for the stream of sand a series of cards half an inch square, laid consecutively on a moving band that deposited one of them every fifteen minutes. Each card being inscribed with the day and hour it represented, when the receptacle marked "North," for example, was examined, all the cards found in it indicated the exact quarter hour in the past three months when the wind was from that direction.

The work of Professor Coffin's life was the development of his theory of the winds under the auspices of the Smithsonian Institution. But the great work to which he owes his celebrity, in all parts of the world, is his treatise on "The Winds of the Northern Hemisphere," published in the "Transactions on the Smithsonian Institution," vol. vi., in 1853. The materials on which it was based were derived from all accessible sources, including 600 different stations on land, and numerous positions at sea, extending from the equator to the 83d degree of north latitude, the most northerly point ever reached by man, and embracing an aggregate period of over 2,800 years. In this work Professor Coffin was the first clearly to establish the fact, by accurate comparison of observations, that there are three great zones of winds in the northern hemisphere The first belt is that of the region of the easterly trade winds, extending northward in the western hemisphere to about the 32d degree north latitude, and in Europe to the 42d degree. The second is the great belt around the world of the return trades, in which the predominant direction is from the west. This extends northward in America to 56°, and in Europe and Asia to about 66° north latitude. Beyond this, principally within the arctic circle, is a belt of easterly or northeasterly winds. The common pole of these belts or zones has not the same position as that of the geometrical pole of the earth. It appears to be in latitude 84° and longitude 105° west of Greenwich, and has been denominated by Professor Coffin the meteorological pole.

These results are in general accordance with the mathematical deduction from the theory of the winds of the globe, which considers them as due to the combined action of the movement produced in the air by the greater heat of the equator, and the rotation of the earth on its axis.

The researches of Professor Coffin also strikingly exhibit the fact of the influence of the seasons in modifying the direction of the wind, or in producing the results denominated monsoons. Thus, along the eastern coast of North America, as is shown on the maps, the tendency during the summer months, of the opposing forces, is to lessen the dominant westerly wind, and this effect is noticed even beyond the Mississippi, as well as in the Atlantic Ocean along our coast. The effect is, undoubtedly, due to the change of temperature in the land—the temperature of the ocean remaining nearly the same during the year, while that of the land is greatly increased in summer above the mean, and depressed in winter. From this cause the air will tend to flow toward the center of the continent from the ocean in summer, and from the same center toward the ocean in winter.

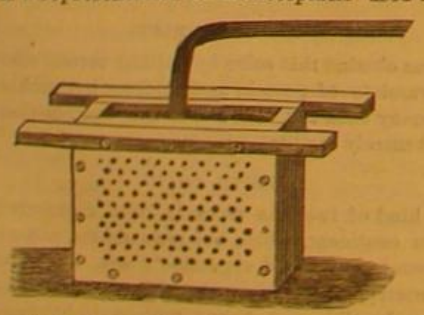
After the publication of the work on the winds, he continued to collect materials, at first with a view to an appendix, and finally extended his investigations to the winds of the entire globe.—*Popular Science Monthly.*

JAMES H. COFFIN.

UTILIZATION OF COPPER SCRAPS IN ELECTRO PLATING.

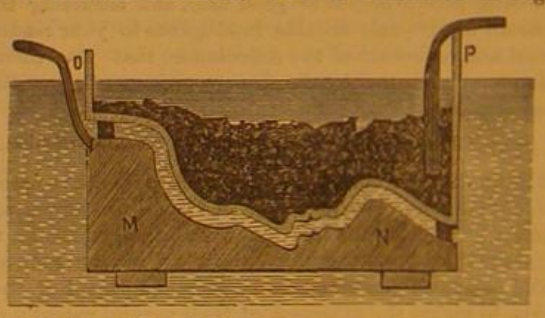
M. Charles Guérin has recently invented a mode of avoiding the use of a copper plate as a soluble anode in electroplating, substituting therefor a mass of pieces of the metal. By this means he utilized cuttings and other scraps, previously deposited films, and, in a word, all the metal which would otherwise be thrown aside as useless for such a purpose.

Fig. 1 is a representation of the receptacle used for holding the copper scraps. It is simply a prismatic box about 1½ inches broad, sustained in the bath by the two longitudinal rods shown at the top. The acting sides are pierced each with about 100 holes, of 0·1 inch in diameter, per 16 square inches, and are of oak or beech wood, and about 0·2 inch thick. Before it is put together, the apparatus is plunged in a bath of melted wax or covered with several coats of gum lac varnish, in order to protect the parts from the action of the acid, and brass screws are used to connect it together.



The following practical hints will be of use in selecting scraps to fill the receptacle: Choose pieces free from solder or rivets of brass or iron. Flatten out with a hammer such bits as are curled up, and divide with shears those of irregular form, so that all may fit closely upon each other. With these, pack the receptacle as uniformly as possible. For the band of copper, which serves as a conductor, choose a long piece so that it may bury anew in the mass as its lower end becomes dissolved. Every four or five days stir the pieces vigorously with a brass rod, so that they may be freed from any film of impurity which may form upon them.

The decomposing action of a current acts in inverse ratio to the distance, so that, under ordinary circumstances, the deepest portions of the molds are the weakest. This is a decided inconvenience in cases of objects in high relief and which are liable to prolonged rubbing or repeated shocks. The soluble anode, in its rectangular form as before described, acts exactly as a plate, and hence gives proofs of unequal thickness; but if the active surface of the receptacle, instead of being flat, be so disposed as to form a sort of counterpart, following the contour of the mold, the deposit will have a uniform thickness. This is illustrated in Fig. 2,



M N is the mold in section; over it, at a distance of 0·3 inch, is arranged a gutta percha box, O P, of which the bottom is perforated with a large number of small holes. This box first has its bottom covered with linen cloth, and is then filled with copper scraps, and the copper conducting band is inserted.

In order to localize or concentrate the galvanic action at certain places, it is only necessary to heap up the copper pieces at the desired points; and conversely, when a part has become covered with a deposit of sufficient thickness, it is obviously unnecessary to employ the protecting coverings of wax or gutta percha ordinarily used with plate anodes. The mode of forming the gutta percha counterpart, consists in coating the interior of the mold with several layers of fine thin plaster for a thickness of 0·3 inch. This is allowed to harden. Into the hollow cast the gutta percha, softened by warm water, is pressed with the hand, so as to cause it to conform to the indentations of the plaster, care being taken to keep it of uniform thickness. After cooling, it is easily removed and, after perforation, is ready for use as above described. It is of course a reduced copy of the interior of the mold.

A GOOD advertisement in a widely circulated newspaper is the best of all possible salesmen. It is a salesman who never sleeps and is never weary; who goes after business early and late; who accosts the merchant in his shop, the scholar in his study, the lawyer in his office, the lady at her breakfast table; who can be in a thousand places at once, and speak to a million people every morning, saying to each one the best thing in the best manner.—*Rowell's Reporter.*

PROFESSOR LE CONTE, in the *American Naturalist*, in his paper on economic entomology, gives an instance in which all the caterpillars in a nine acre piece of woods were destroyed by a disease which had been communicated to them by a sick silkworm. The same principle might be used in destroying the cotton worm and others of like nature.

Recent Meteors.

On the evening of December 24, 1873, a brilliant meteor was seen in the States of Pennsylvania, Maryland, and the District of Columbia. The Washington *Star* gives the following particulars:

"About 7.40 o'clock on Wednesday, December 24, one of the most brilliant meteors ever seen in this section of the country passed over the District. Its intense brightness strongly illuminated all terrestrial objects, and was visible even in gas-lit parlors, and it disappeared with a loud explosion. It was first seen a little south of east, and its course was about northwest by west. It seemed about half the diameter of the full moon, and left a track of light apparently extending thirty or forty degrees. Windows were rattled by the explosion, and one of the most dilapidated buildings in the district—the sixth precinct station house, corner of Ninth and K streets, was shaken so much as to throw down some of the plastering."

The Fairfax, Va., *News* says: "On Wednesday night, about the hour of 8 o'clock, an aerolite passed over this region, lighting up the country like midday, and is supposed to have exploded, from the sound which followed, which was equal to that of the heaviest artillery, jarring the houses all through this section of country."

The Alexandria, Va., *Sentinel* says: "About 7 o'clock on Wednesday evening, King street being at the time crowded with persons seeking the stores or enjoying the Christmas Eve sights, a meteor of most remarkable size and brilliancy shot athwart the sky from east to west, directly over the city."

From an occasional correspondent near Vienna, Md., we have received the following: "About 7.30 o'clock on Christmas Eve night, a very loud clap of thunder was heard, and a most vivid flash of lightning seen in the country around Vienna, Falls Church, Langley, and Lewisville, Va. Just before the report a shock like that of an earthquake was felt, shaking houses, etc. and the very earth itself."

Residents of Coatesville, Pa., and vicinity report that they also felt a severe shock about 8 o'clock on Christmas Eve. They attributed it to an earthquake. Houses were shaken, windows rattled, and a rumbling noise was heard. From Sandy Spring, Md., Mr. Henry C. Hallowell writes to the Baltimore *American* as follows: "It was my happy fortune, last evening, to witness one of the most magnificent spectacles I have ever beheld—the passage of a meteor of surpassing splendor. At 8 o'clock I was startled by a brilliant light encompassing me, and by the rapidly moving shadows. On looking up I saw a meteor, about one sixth the size of the full moon, of elongated shape, the body of it of an intense greenish white, and the head or front part red or blue, with some scintillations. A trail extended about three degrees. When I first observed it, it was due south, and of an elevation of about fifty degrees. The light was so brilliant that the family within the house were startled by the dimming of the lamps and by the greenish light upon the wall, and rushed to the window to see the cause. The whole landscape was illuminated for the distance of a mile. A laborer about two miles from my point of view was startled by the sudden light and the moving shadows of the trees, and thought some concealed boys were playing a Christmas trick upon him. On looking up, he says, he saw something a great deal brighter than the moon, that moved about a mile and a half through the sky. After the disappearance of the meteor, at times variously estimated from one half minute to four minutes, the latter being my own judgment, there was a sharp report that shook the windows, and some say the earth. From the length of time after the disappearance of the meteor, I supposed it the report of a cannon. I confess I was too much startled and too lost in admiration to make an accurate estimate as to hight and direction, but the above are approximately correct. My position is in Sandy Spring, Md., 600 feet above tide water, eighteen miles north of Washington, latitude 39° 9'."

A Meteor in Nevada.

A meteor of uncommon brilliancy was seen at Virginia City, Nev., about 6 o'clock on the evening of January 6, 1873. A spectator, describing it, says that suddenly there came a flash of light, so dazzlingly white and bright that it caused him, for an instant, to close his eyes. Opening his eyes, almost instantly he beheld, falling perpendicularly from the heavens, a ball of what seemed white fire, of intense brilliancy, about the size of a wash tub. The huge meteor descended as swiftly as a flash of lightning, apparently falling directly to the earth. Just before it passed down, the meteor divided into a great number of fragments, apparently about the size of a man's fist. These, darting and showering down from the main globe of fire, presented much the appearance of the ribs of an umbrella when stripped of its covering, the streaks of fire streaming down on all sides of where the main ball or nucleus had been seen. Although the meteor was of a pure, dazzling white color, it threw a bright blue glare upon the buildings.

A New Alkaloid from Morphia.

A new substance has been prepared, by G. Nadler, by the action of an ammoniacal solution of cupric oxide on morphia. Its chloride is of a brilliant white color, and is easily soluble in hot water, in which the ammonia throws down an amorphous precipitate, that remains unchanged in the air in the moist state. With concentrated sulphuric acid, it becomes of an intensely green color. From the potash solution, when boiled, the alkaloid separates in scales having the luster of silver. It is, moreover, distinguished from morphia by the trifling solubility of its sulphate, and from apomorphia by its stability in moist air.

NEW ENGLISH THRASHING MACHINES.

We are indebted to *Engineering* for the annexed engravings of some new thrashing machines, invented and manufactured by Messrs. Ransomes, Sims, and Head, of the Orwell Works, Ipswich, England, and which recently attracted considerable attention at the Vienna Exposition. The construction of the various forms of the apparatus will be readily followed from the details in the illustrations.

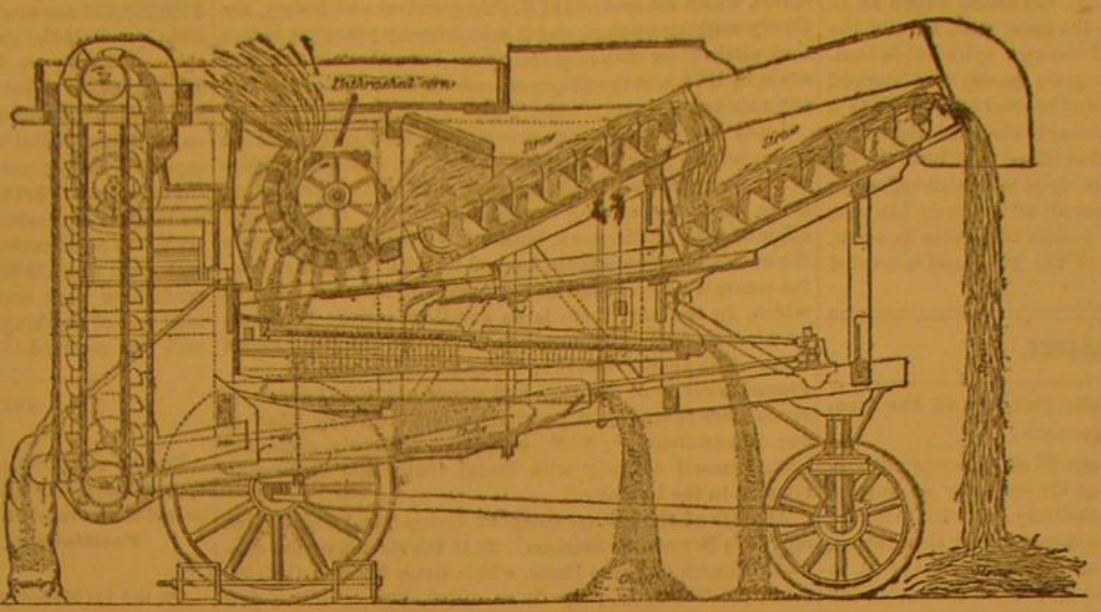


Fig. 1.—THRASHING MACHINES AT THE VIENNA EXPOSITION.

Fig. 1 is a quick delivering double blast implement, especially suitable for the large corn-growing districts of the West, and made of very great capacity. The sheaves are fed into the hopper as fast as they can be delivered (for a speed of 1,000 to 1,200 revolutions is the working rate), pass upon the drum, which is made very heavy and is fitted with the usual twisted beaters, and thence between it and the concave, which is made of malleable cast iron gratings, on to a wrought iron frame, the gratings being placed in sections, and secured so as to be easily removable. After being forced through the narrow space between the driver and the concave, and thus being relieved of the greater part of the grain, the sheaves pass out upon the first straw shaker, which extends from the concave with a considerable inclination upward, to about midway the machine, where they fall upon a second and similarly inclined series of shakers, placed at a lower level, and by these are carried to the delivery at the front end of the thrasher. The shakers consist of a number of short curved blades set on an endless band, a series of these being placed side by side, so as to occupy the whole width of the machine; and as the set of the blades is different in each row, the straw is seized by a very large number of points as it leaves the concave, and is so agitated that the grain is effectually removed.

The loose wheat shaken out passes between the spaces in the shakers on to close trays, parallel to and immediately below them, and thence falls upon the large top riddle or "jog shoe," extending for about two thirds the length of the machine. This is suspended in the usual manner, and the grain falls through holes in its bottom to the lower riddle, the larger bodies being shaken off the front edge of the top one. The lower riddle is driven off the same crank as the upper one, exposed to the blast from the fan, and the chaff and other impurities are blown off, falling in the front of the machine, and, mixing with the large waste, shaken off the upper jog shoe. From the lower riddle the grain falls into the elevator box; the elevator, which is vertical and inclosed in a box outside the frame, lifts it nearly to the top of the machine and to a point just behind the drum and concave.

From the elevator the the grain, if very smutty so as to necessitate hand winnowing, is delivered directly to the sacks, but ordinarily it passes into a barley awner and dhob cleaner, which consists of a conical drum, the inside of which is serrated; and the grain, being driven against these serrations, is effectually cleaned. From the cleaner the grain slides down an inclined plane to a sieve, the under side of which is exposed to a blast, which strikes the grain as it pours into a hopper. The latter is divided by a vertical plate, which is placed below the edge of the sieve, so that the cataract of grain would only just fall on one side if there were no blast; but the action of the fan is sufficient to throw out the dirt, light grains, chaff, etc., upon the other side of the plate, and effect a perfect division of the grain. A special feature may also be noted in the arrangement for discharging chaff at the front end of the machine, where it mixes at once with the ears, broken straw, etc.

Two other machines (not illustrated) are manufactured by the same firm, the object of which is rather perfect thrashing than quick work. The construction is essentially the same as above described; the straw shakers, however, being double, are provided with a puddler or transverse bar, which is armed with forks, and serves to distribute evenly the straw. The most novel feature is that the chaff can be delivered at the front instead of the back of the machine.

Messrs. Ransomes, Sims & Head have also recently exhibited machines of similar description, intended for use in countries where the straw is extremely hard and unfit for the consumption of cattle without being previously bruised and softened. One of these machines, shown in section in Fig. 2, can, when it is desired to deliver straight straw, be used as an ordinary thrasher, the crushing rollers in this case being covered up and the straw delivered in the usual way. But there are provided two drums of sheet iron with cast iron heads, with their spindles in long bearings in standard brackets. Both are driven off the main shaft, the upper one at a speed of 1,000, and the lower at 900, revolutions per minute. In the top drum, attached inside and projecting from the outer face, are three spiral rows of knives. The latter are straight and slightly tapering, with the edges sharpened on all their sides. They are grouped in pairs, each two blades being only so far apart as to permit a single blade of similar construction to pass between them. These single blades are attached to the concave in connection with which this drum works, like the main drum at the back of the machine. The straw, passing off the shakers between these knives, is effectually cut up into pieces of irregular size and form. Passing then upon the lower drum, it is still further bruised by the second set of knives; these latter, of which there are four rows attached in spirals around the bottom, are single and run between a double set of similar knives fixed in the concave, and these effectually complete the bruising operation. Connected with this machine is an independent apparatus for raising the chopped straw as it leaves the drum and depositing it away from the machine. This consists of an elevator on a separate carriage (Fig. 3), having at the lowest point a fan driven by the engine, and which communicates on the one side with the bruised straw delivery, and on the other with a long wrought iron tube, the length and angle of which may be varied at will. The tube is about 12 inches in diameter, and is connected at the bottom by a joint to the fan casing; and at the front end of the frame is a pair of light jibs, to which it is secured by a chain which passes over a winch, also mounted on the carriage, and by which the elevation of the discharge tube is regulated. The action of the fan drives the bruised straw through the pipe in a continuous stream.

In the fifth machine of the firm above named

Fig. 2.

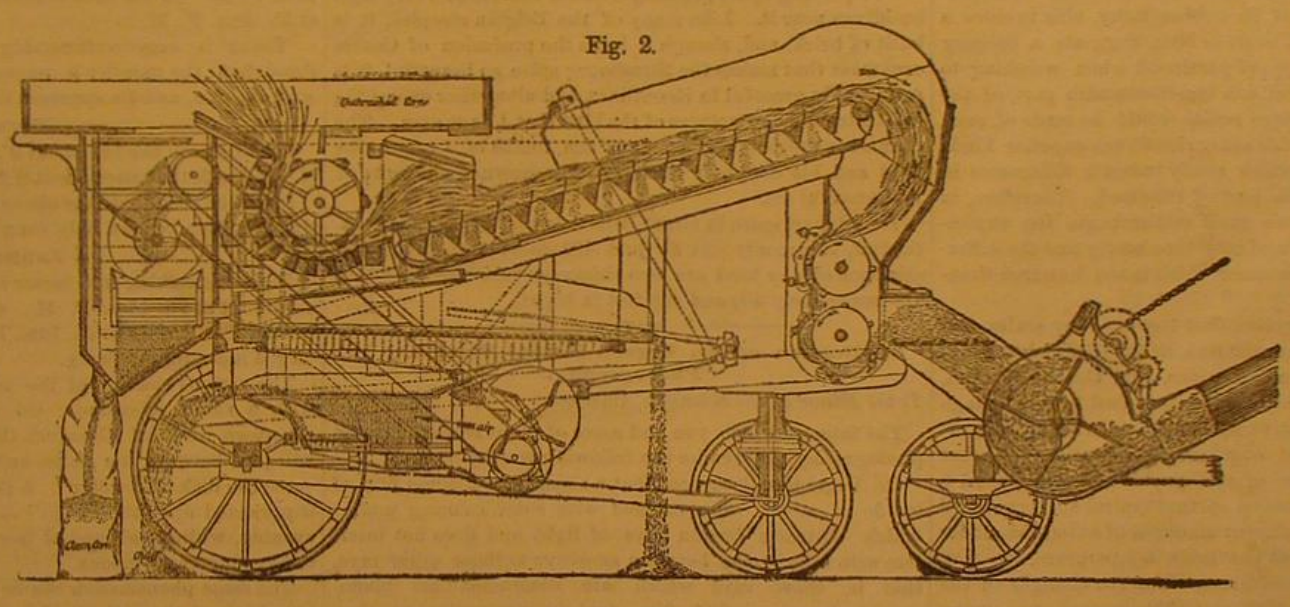


Fig. 3.

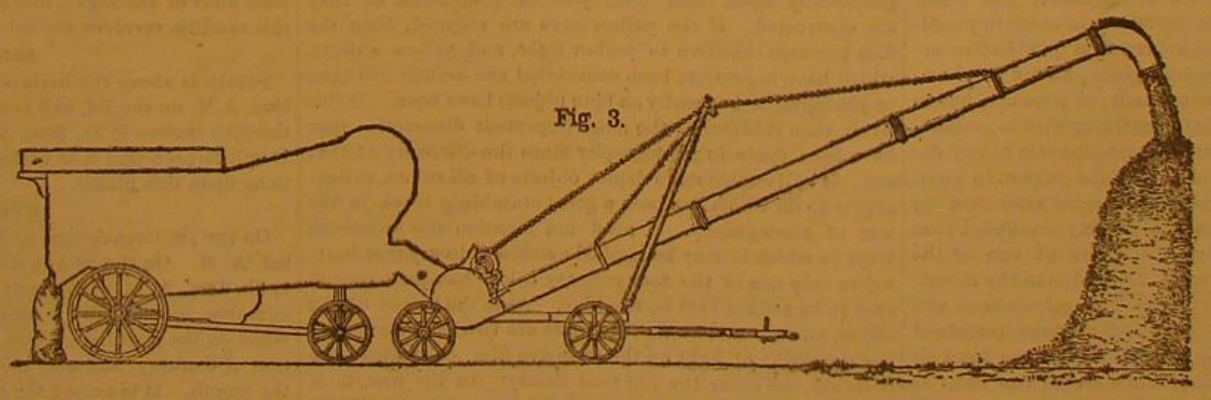
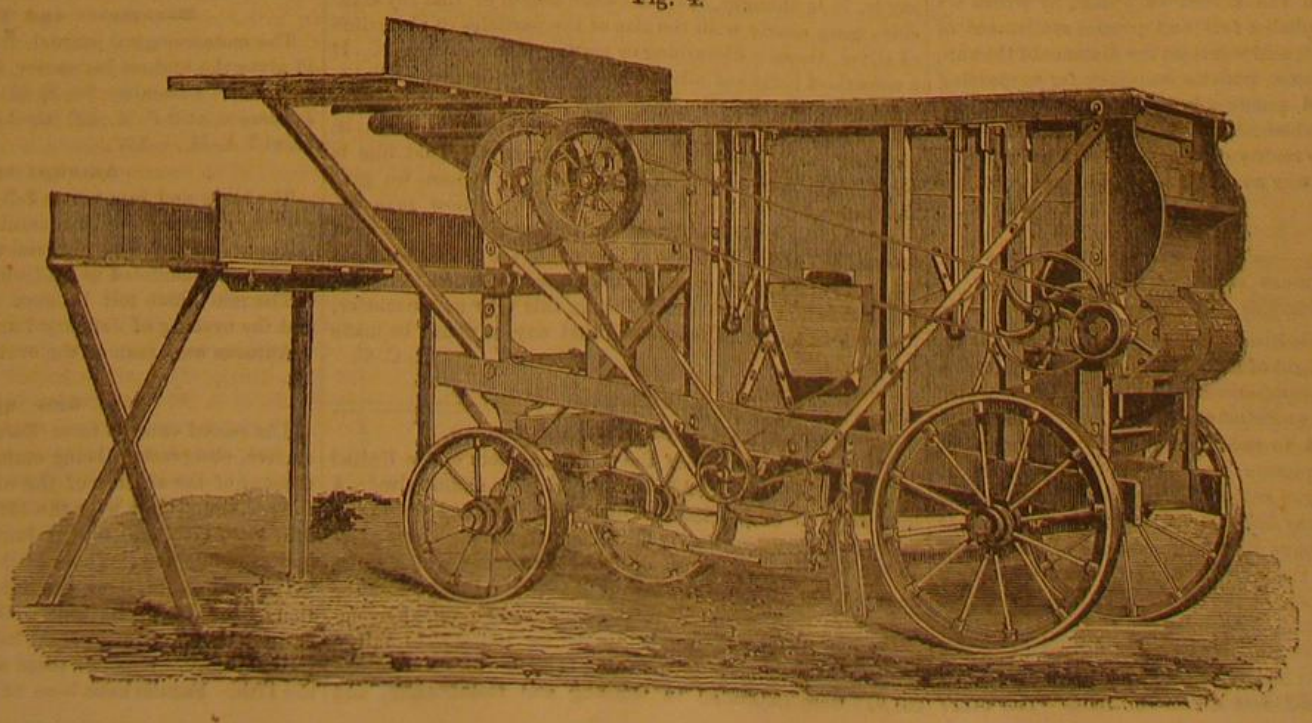


Fig. 4.



(represented in perspective in Fig. 4), the action is such as to cut and bruise the straw and, at the same time, extract the grain. The relative position of the two cylinders is horizontal, instead of vertical. The grain passes to a stepped riddle, from which the chopped and bruised straw falls to a second one, and travels forward towards the front end of the machine, dropping the grain still contained in it until (by the time it has reached the end, where there is a third roller for further bruising the straw, if desired) all the grain has been separated, and has fallen in the system of riddles beneath, where it is exposed to the action of the blast, and is treated as in an ordinary machine.

Correspondence.

The Relative Attraction of the Earth and the Sun.

To the Editor of the Scientific American:

A correspondent suggests, on page 68 of your current volume, the construction of scales, of the capacity of several tuns and of the utmost possible delicacy, in order to decide whether really the solar attraction causes, under the equator, a difference in weight at midday and midnight, and if so, to ascertain whether astronomers have not miscalculated the relative masses of the sun and the earth. This suggestion calls for a few remarks.

In the first place, most delicate scales are not those of great capacity, but those of comparatively small size. As the weight of any piece of machinery or structure in general increases as the cubes of the dimensions, very large scales have a great deal of their own weight to carry, which of course interferes with their relative sensitiveness. The proposition to make a scale of 10 tuns capacity, able to show a difference of some 24 lbs. more or less, suggests a delicacy of only 24 in 20,000, or $\frac{1}{833}$rd part, and when weighing to within drams, a delicacy of one ten-thousandth part, of the load. It is doubtful if large scales could be made of such sensitiveness: while, on the other hand, the superior kinds of large sized chemical scales easily indicate differences in weight of a one millionth part of the load. Therefore, in place of taking 10 tuns, we must rather make the experiment with 100 grammes, and may then easily find the difference to within a milligramme, which is the hundred-thousandth part of the load.

But it must not be forgotten that the ordinary scales cannot be used for such an experiment, as the diminished gravitation will act equally on both sides, and the equilibrium, when once established, will not be disturbed by any change in the amount of gravitative attraction. In order to ascertain the latter, we must counteract gravitation by other forces, for instance, those of springs; and if we suspend a weight by a proper system of springs (spiral springs would be best) and notice the different amounts of extension, under different conditions but at the same temperature, we may arrive at some kind of measurement of the changes in the attraction of gravity. Such an arrangement was many years ago proposed by Sir John Herschel in order to practically verify the existence of the increased gravitative actraction when nearing the terrestrial poles; he did not, however, propose to use it as an instrument of measure, but as a simple rough indicator; for mathematics applied to mechanics give all the *data* for calculating these amounts to any desired degree of accuracy. It is so with the subject in question; the difference in the amount of solar attraction on terrestrial bodies under the equator at midday or midnight has not only been settled, but, being the cause of one of the great tidal waves (the other wave being due to the moon), has been submitted to a series of rigorous calculations and observations. The result of these calculations, combined with some other considerations, has been that we have already come to the conviction that the mass of the sun, as thus far adopted, has been overrated nearly one tenth, and its distance one twenty-eighth part; and that therefore all our astronomical tables have to be reduced by these two coefficients, except the table of the elements of the moon, which is correct. The reason that this has not been done already is that there is still a slight uncertainty in these coefficients of correction, which will be definitely settled this very year by the observations on the transit of Venus, by which we shall be able to accomplish a full and precise settlement of this important question, and ascertain the distance of the sun, and consequently its mass, with an accuracy far surpassing anything which could possibly be accomplished by experiments on gravitation, which at the very best, can demonstrate nothing more than the reality of the changes in the solar attraction, but not, with any available degree of accuracy, the amounts of the same. P. H. VANDER WEYDE.

New York city.

Towers and Spires.

To the Editor of the Scientific American:

There is an admirable illustration in your paper of January 24, showing the hight of some of the most famous structures in the world, in comparison with the iron tower which it is proposed to erect at Philadelphia as a centennial monument. It has occurred to me, however, that your readers might infer from the picture, or from the description of it, that the spire of Cologne cathedral has already reached its projected hight of 501 or 507 feet. The fact is that it has risen (or rather they have risen, for there are to be two of these lofty steeples at the west front of the church) only a little above the ridge pole of the edifice, which is about 250 feet high. The only completed spire is a slender iron one at the junction of the nave and transepts. I do not know the exact hight of this light and graceful pinnacle, but it cannot much exceed a hundred feet above the roof. The other spires, which are marvels of Gothic grandeur and beauty, are slowly working upward, and it may be many years yet before they attain their stately perfection. I saw them in 1868 and again in 1872, and the progress made in the interim was apparently but slight.

I may add that there are several very lofty spires that do not appear in your picture. The hight of the central spire of Rouen cathedral is a little greater than that of Strasbourg, being 482 feet, according to good authorities. It is an ugly affair of iron lattice work, built a few years ago to replace the ancient wooden steeple, burned in 1822. It forms a fearful contrast to the beautiful old towers of the west front, of which, by the way, there is an excellent picture in Blackburn's "Normandy Picturesque," lately reprinted by Osgood & Co. The author remarks: "The central spire in the background is really of cast iron, and stands out, it is fair to say, much more sharply and painfully against the sky, than in our illustration; * * * our artist evidently could not bring himself to copy with literal truth this disfiguring element in the building."

Another of the loftiest spires of Europe, and a really fine one, is in Bruges, in Belgium. It is the steeple of the venerable church of Notre Dame, which dates back to the 12th century. The spire, properly so called, was rebuilt a few years since, the original one having begun to lean and threatening to fall. Its hight is given by Baedeker, in the first edition of his "Belgium and Holland," as 442 English feet; but in the second edition (1870) it is put at 468 feet. I have seen it elsewhere stated as 450 feet. Taking the most moderate of these figures, it is certainly one of the two or three tallest steeples in Europe or the world. It looks taller than the Strasbourg spire, probably because there are no very high buildings near it. Like many of the Belgian steeples, it is built of brick, and, though it lacks the profusion of Gothic ornament that makes the Strasbourg spire so beautiful, it is remarkably graceful in its outlines, and altogether one of the most admirable structures of the kind that I have seen. The chancel is the one that contains the tombs of Charles the Bold and his daughter Mary, world-renowned as works of monumental art.

The highest spire in Great Britain is that of Salisbury cathedral, commonly put at just 400 feet; but the tallest erections of any kind are two chimneys in Glasgow, which are respectively 450 and 468 feet in hight. R.

Application of Dr. Vogel's Recent Discovery in Photography.

To the Editor of the Scientific American:

The interest which you and some of your readers take in photography may render the following worthy of note:

Dr. Vogel has discovered that a sensitive collodion film of iodide of silver, when covered with some coloring matter which obstructs certain rays of light and does not interfere with other rays, becomes sensitive to those other rays, that is, those rays which are obstructed act photographically upon that film, just in proportion as they are obstructed. If the yellow rays are stopped, then the film becomes sensitive to yellow light, and yellow objects, which have heretofore been considered non-actinic, can thus be photographed as easily as blue objects have been. If this be so, then it is one of the most important discoveries that have been made in photography since the discovery of that art. It will enable us to depict objects of all colors, the inability to do which has been a great stumbling block in the way of photography. I need not mention the numerous ways in which it may be applied: suffice it to say that heretofore only one of the four primary colors has been considered to be actinic, that is, the blue. As to the theory of the above, you are well aware that there are two theories regarding the action of light on the sensitive film, one called the chemical, the other the physical theory. In the first, it is claimed that the reduction of the silver is done while the light is acting upon the film. In the second, it is claimed that a tremulous or vibratory motion is communicated to the film by the vibrations of light; and that when the developing solution is applied, the reduction takes place. In either case, it is the vibration of the light that does the work. The reason why iodide of silver is more sensitive to the blue ray is, it is thought, that the wave length of that ray coincides more nearly with the size of the particles of the iodide of silver, thereby disturbing or tearing them apart more. If a sensitized iodide of silver film be held before white light, it will be seen that the only color apparent is the orange; and that blue objects appear black when viewed through it, showing that the blue rays are all obstructed. That film is therefore sensitive to blue light. Again, suppose we give that film a blue color, then the orange or yellow rays are stopped. As action and reaction are equal, the amount of resistance exerted by the film is equal to the amount of light stopped; and the ray which is then most obstructed has the greatest action on the film. Taking this view of the matter, it seems to me quite reasonable that any ray may be made actinic. D. C. C.

New York city.

The Railways of Great Britain.

The leading features of the railway system of the United Kingdom, at the end of 1872, may be thus summarized: A total sum of $2,845,236,730 had been expended on 15,814 miles of railway, or nearly $180,000 per mile. There were 10,933 locomotive engines, or about 1 to every $\frac{3}{4}$ of a mile; and 337,899 vehicles, or about 21$\frac{1}{2}$ per mile, besides the wagons of traders and companies other than railway companies. By the running of trains for 190,920,719 miles, $256,520,570 were received during the year, of which $128,261,915 were expended in working and maintenance, and $128,258,655 remained as net profit, so that as nearly as possible one half the gross receipts were expended in earning them. There were 422,874,822 passenger journeys, besides 272,342 season ticket holders; and 179,302,121 tuns of goods and minerals were conveyed. The average rate of dividend on ordinary capital was 5·14 per cent, and upon the total capital 4·95 per cent, including $164,507,380 of ordinary capital, part of $212,913,135 of total capital, which received no interest or dividend. The average cost of working each train was 64·64 cents, per mile, and the average receipt from each train was 129·12 cents per mile; so that the average net profit from each train was 4·58 cents per mile; while the total cost of working was $8,110 per mile, and $16,220 per mile was received.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for February, 1874.

Mercury.

On the 1st Mercury rises at 7h. 24m. A. M., and sets at 4h. 58m. P. M. On the 28th, Mercury rises at 7h. 26m. A. M., and sets at 7h. 18m. P. M.

It should be looked for after sunset during the latter part of the month, as it reaches its greatest angular distance from the sun on the 2d of March.

Venus.

Venus rises on the 1st at 7h. 6m. A. M., and sets at 4h. 42m. P. M. On the 28th it rises at 6h. 50m. A. M., and sets at 5h. 48m. P. M.

Venus is very unfavorably situated for observation throughout the month; it passes the meridian very nearly with the sun, and its apparent diameter is very small.

Mars.

Mars rises on the 1st about 9 A. M., and sets before 9 P. M. On the 28th it rises about 8 A. M., and sets before 9 P.M.

It will be seen that it is above the horizon during the day time, and can be seen only for a few hours after sunset.

Jupiter.

Jupiter is coming into better and better position. It rises on the 1st at 9h. 15m. P. M., and sets at 9h. 25m. A. M. On the 28th it rises at 7h. 16m. P. M., and sets at 7h. 30m. on the morning following.

The various changes of the moons of Jupiter can be seen with a small telescope. On the 17th, (according to the *American Nautical Almanac*) the largest of these satellites will pass between the planet and the earth, and seem to traverse the disk of Jupiter. A powerful telescope will show it projected upon the planet's disk for several hours in the evening, while to glasses of low power Jupiter will appear to have but three moons.

The same phenomenon can be seen on the 24th, but at a later hour of the night, and again on the 3d of March, as this satellite revolves around Jupiter in about 7 days.

Saturn.

Saturn is above the horizon in the day time, rising at 6h. 59m. A.M. on the 1st, and setting at 4h. 35m. P. M., while on the 28th it rises at 5h. 20m. A. M., and sets at 3h. 5m. P. M. It will be seen that it is useless to attempt to make observations upon this planet.

Uranus.

On the 1st Uranus rises at 4h. 44m. P. M., and sets at 7h. 9m. A. M. On the 28th it rises at 2h. 52m. P. M., and sets at 5h. 16m. A. M. of the next morning. As its northern declination is about 19°, it attains an altitude of about 67° when on the meridian, which it passes at midnight on the 31st of January, and near midnight during the first half of the month. It is among the stars of *Cancer*, can be readily found with a telescope of moderate power, and will be known from a star by its showing a measurable disk.

Neptune.

Neptune can be seen well only by means of a powerful telescope at any time, and at present is not well situated. It comes to meridian on the 1st at 4h. 51m. P. M. and on the 28th at 3h. 7m. P. M.

Barometer and Thermometer.

The meteorological journal from December 14 to January 17 gives the highest barometer, January 17, 30·48, the lowest barometer, December 28, 29·33; the highest thermometer, January 4, at 2 P M., 52°; the lowest thermometer, January 17, at 7 A. M., —1·5°.

Amount of Rain.

The snow and rain which fell between the morning and evening of December 19 amounted to 0·27 inches.

The rain which fell between the morning and evening of January 2 amounted to 0·3 inches.

The rain which fell between the afternoon of January 5 and the evening of January 7 amounted to 3·2 inches.

Auroras were seen on the evenings of January 15, 16, and 17.

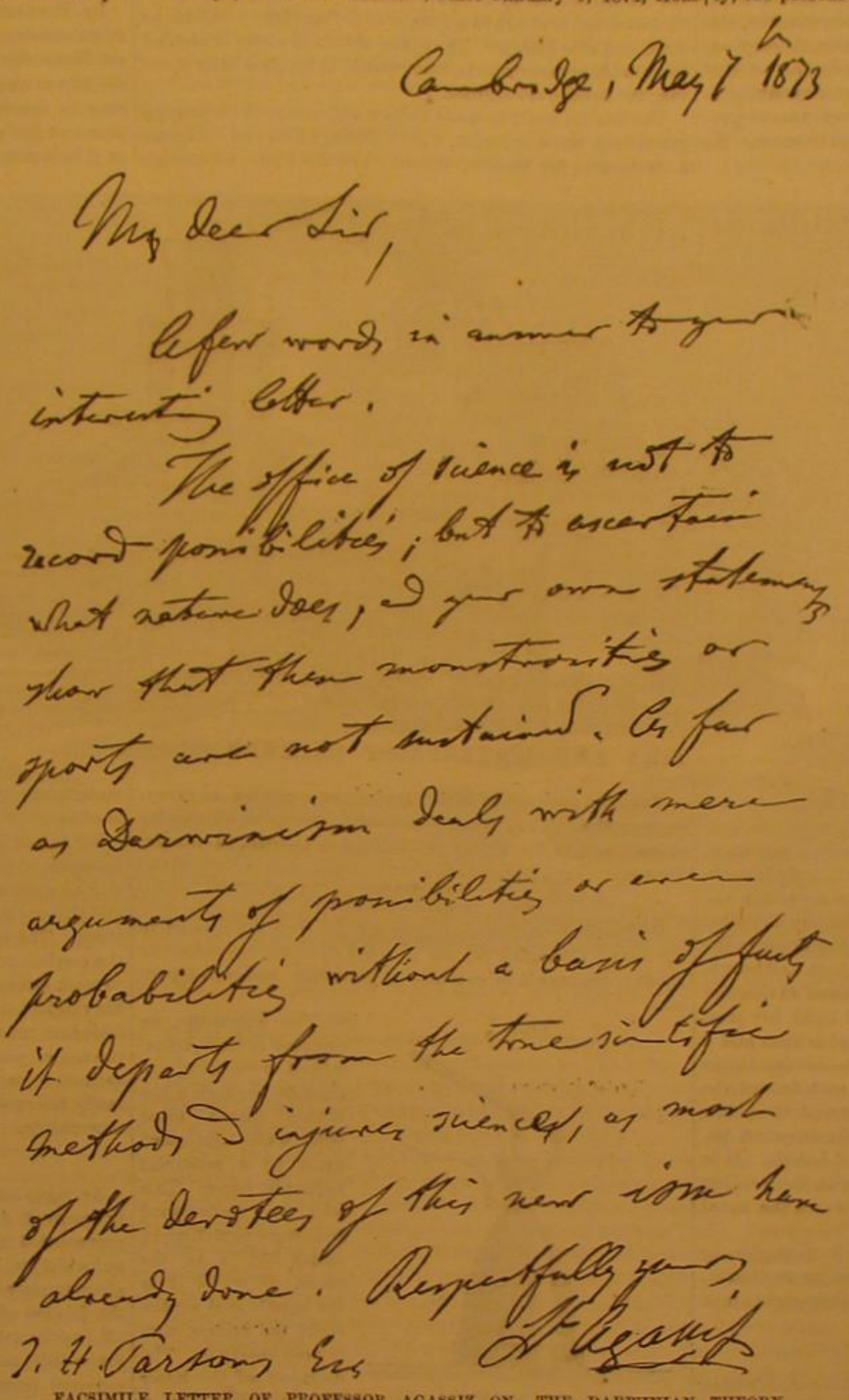
Sun Spots.

The record extends from December 17 to January 19, inclusive, observations being omitted during the holidays on account of the absence of the observer. The clear days of the remaining time were the 15th and 17th of December, the 9th, 10th, 17th, and 19th of January. Spots have been small and generally few. Those of the 9th and 10th were identical in appearance, their positions only differing by the motion of the sun on its axis. On January 19, eleven were scattered over the disk, eight being in pairs, the remaining three solitary. Some of these were identical with those of the 17th. Faculæ have been unusually scarce.

PROFESSOR AGASSIZ ON THE DARWINIAN THEORY.—INTERESTING FACSIMILE LETTER FROM THE GREAT NATURALIST.

The fact of the strong antagonism which the late Professor Agassiz always manifested toward the Darwinian theory is too well known to need any reiteration here. The recognized leader of the anti-evolutionists, during the latter part of his life no small portion of his efforts were directed toward combatting views which he believed not only merely erroneous, but both baneful and detrimental to true scientific advancement. In this connection the autograph letter, which we produce (by the photo-engraving process) in fac simile herewith, is invested with unusual interest, for in it, and in even fewer words than the concluding paragraph of the first essay of that series which it was his fate never to complete, the great scientist sums up his condemnation of the theory which to him was destitute alike of foundation and truth.

We are indebted for the letter to Mr. James H. Parsons, of Franklin, N. Y., who, in an accompanying letter, tells us that, after reading one of Agassiz's lectures on "The Egg," in which Darwinism suffered some heavy blows, he wrote to the Professor on the other side of the question, and described some monstrosities or "sports" which he had lately encountered. Our correspondent suggested that these "sports" might perpetuate themselves, that subsequent generations might depart still further from the original types, and so an entirely new species result. To which Agassiz replied in the letter we present. We need hardly add that to every inquirer into the secrets of Nature, to every seeker of scientific truth for its own sake, the words should remain indelibly impressed upon the memory.



FACSIMILE LETTER OF PROFESSOR AGASSIZ ON THE DARWINIAN THEORY

Air Supply for Miners and Divers.

Humboldt invented an apparatus, filled with compressed air, which could be carried upon the back and was provided with a breathing tube and a mouthpiece with double valves, so that the fresh air was admitted from the vessel and the consumed air discharged into the irrespirable atmosphere. This apparatus was then improved by Boisse and Combes, and later by M. Rouxquayrol, mining engineer, of St. Etienne, and M. Denayrouze, manufacturer, of Paris, to such a degree that we now possess an entirely reliable arrangement, both for diving in water and foul air, and which, at the same time, will supply a submarine lamp or a Davy safety lamp with fresh air. The apparatus used in German mines are of several kinds. A watertight dress, with helmet and the air regulator, serves for diving in water, or the latter is used alone in combination with a nose squeezer. In irrespirable or explosive air, the latter alone is employed, either as a low pressure apparatus, when the diver remains in connection with the air pump through a hose, or as a high pressure apparatus, when air compressed to 25 atmospheres (375 lbs. per square inch), is carried on a barrow in strong steel cylinders, which will make the diver and his light independent for three hours. The regulator is of a very ingenious construction, and expands the compressed air just as much as the pressure of the surrounding atmosphere will allow, and no high pressure air can ever enter in the lungs and endanger the life of the diver. The physiological effect of compressed air upon the human body has been noticed by Edmund Halley, who complained of pains in the ears when going too quickly under water. Some divers in German mines noticed below water a slight giddiness and pains in eyes and ears, at a depth of only 30 feet, though many have descended over 130 feet. Professor Rameaux, of Strasbourg, supposes that the blood gases, carbonic acid, nitrogen, and oxygen, are strongly compressed by the pressure upon the lungs and blood vessels, and when this pressure suddenly ceases they will at once expand and act just as air bubbles, which are introduced in the air vessels, namely, they will cause pains, fits, or death. Dr. P. Bert has confirmed this view through experiments which he made with animals. He concludes from them that a diver can be exposed without danger to a pressure of five atmospheres—75 lbs. per inch—or 130 feet of water, while at 230 feet to 280 feet danger becomes imminent; and Dr. A. H. Smith, of New York, examined quite healthy men with the sysmograph, after they had been exposed one to one and a half hours to 15 to 17 lbs. pressure of air in caissons; he found that the beats had increased from 82 to 84 up to 114 and 126 per minute, that the volume or intensity of the pulse, however, had greatly diminished. The men also perspired freely, which, however, was probably due to the very moist, almost saturated, air of the caissons. Under all circumstances, it is well established as a principle that only perfectly healthy persons should be admitted to work in highly compressed air.—*Engineering.*

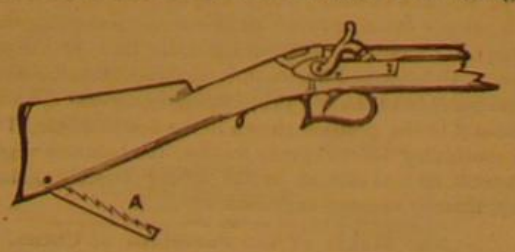
Machinists in the Navy.

Mr. J. O. Adams writes to inform us that an important improvement in the status and emolument of the machinists of the navy has recently been made. They are to be petty officers of a superior grade, and are to have a separate mess, which be under their own control.

The pay has been increased, since January 1, 1874, from $61.50 to $76.50 per month, which latter amount is still further increased, if the ration be commuted, to $84, or $1,008 per annum. The duty imposed is to take charge of the engine and fire room watches, under the direction of the engineer officers. The qualification is to have had some experience in running the engines of steamers. A candidate may enter the service by applying at any recruiting rendezvous, or to the commandant of any navy yard, for examination; or he may be examined by the chief engineer of a vessel going into commission.

Rifle Hook.

A correspondent of *The Field* describes an old rifle hook as follows: "The blade, A, made of hard brass, folds down into the stock; and when open, keeps so with a snap catch. In case of pursuit by a wounded buffalo, panther, or other dangerous game, you could hook the rifle—I cannot forbear from saying after hooking it yourself—on a branch of some friendly tree, and pull yourself out of danger. The catch was no doubt added to prevent the blade from closing by



the upward movement of the stock against a bough. The rifle I mention must have been seventy or eighty years old, and the workmanship and whole contour of the blade were evidently of coeval date."

WHEN taken in considerable quantities for a long time, alcohol is apt to produce deposit of fat and fatty degeneration of organs, rendering a person not only less capable of work, but liable to succumb to disease.

Latest News from the Sun.

At a recent meeting of the Royal Society, Mr. Lockyer gave the results of his recent studies in relation to the spectrum of the sun.

The previous researches having shown that the former test for the presence or absence of a metal in the sun, namely, the presence or absence of its brightest or strongest lines in the average solar spectrum, was not conclusive, a preliminary search for other metals was determined on; and as a guide, Mr. R. I. Friswell was requested to prepare two lists, showing broadly the chief chemical characteristics of the elements traced and not traced in the sun.

The tables showed that in the main those metals which had been traced formed stable compounds with oxygen.

The author therefore determined to search for the metals which formed strong oxides, but which had not been traced.

The result up to the present time has been that strontium, cadmium, lead, cerium, and uranium, would seem with considerable probability to exist in the solar reversing layer. Should the presence of cerium and uranium be subsequently confirmed, the whole of the iron group of metals will thus have been found in the sun.

Certain metals forming unstable oxides, such as gold, silver, mercury, etc., were sought for and not found. The same was the case when chlorine, bromine, iodine, etc., were sought by means of lines produced in tubes by the jar spark. These elements are distinguishable as a group by forming compounds with hydrogen.

It is observed that certain elementary and compound gases effect their principal absorption in the most refrangible part of the spectrum when they are rare, and that as they become dense the absorption approaches the less refrangible end; that the spectra of compounds are banded or columnar, the bands or columns lying at the red end of the spectrum; that the absorption spectra of chlorine, iodine, bromine, etc., are columnar, and that these are broken up by the spark just as the band spectra of compounds are broken up; and that it is probable that no compounds exist in the sun. The following facts, gathered from the work already accomplished by Rutherford and Secchi, are stated:

There are three classes of stars:

1. Those like Sirius, the brightest (and therefore hottest?) star in the northern sky, their spectra showing only hydrogen lines very thick, and metallic lines exceedingly thin.

2. A class of stars with a spectrum differing only in degree from those of the class of Sirius, and to this our sun belongs.

3. A class of stars with columnar or banded spectra, indicating the formation of compounds.

Fog Dispeller Wanted.

The City of New York has, on three or four occasions this winter, been enveloped in fogs, occasioning inconvenience to passengers by trains and ferry boats. A suffering correspondent of the New York *Herald* calls out lustily for the invention of some contrivance for the artifical removal of the difficulty. He says:

"Cannot man devise some way of dispelling these fogs, at least in a measure? Man's necessity and ingenuity have reduced almost every known force of Nature to subserve his ends, and can it be that men of science cannot lift the winding sheet from the public convenience on such a morning as this? Can you say if heavy concussions have ever been tried as a means of dispelling fogs? As heavy artillery practice is invariably followed by rain, the theory of which is, I believe, that the concussions serve to discharge the electricity which holds the particles of water apart in the atmosphere, would not the same cause produce the same effect on fogs and give them an honorable discharge on the earth in the shape of rains?"

ALLOY FOR DENTAL PLATES.—Edward Conway, of Dayton, Ohio, makes a dental alloy as follows: Bismuth, tin, and lead are purified by separately melting and pouring upon clean marble slabs until all dross is removed, and afterwards melting and pouring into lemon juice. The alloy is composed of platinum, gold, silver, bismuth, tin and lead.

DR. VEIEL, a prominent German dermatologist, has lately cured several cases of lupus by scarification, immediately following with cauterization of the diseased parts with a solution of chloride of zinc in alcohol (equal parts). This operation is repeated after 6 to 8 days.

Dim writing nearly effaced by age may be restored by the application of a solution of prussiate of potash in water. Wash the parts with a hair pencil, and the writing will appear if the paper has not been destroyed.

FIRE AND WATERPROOF CHIMNEY GUARD.

It is not an uncommon defect in a chimney, which is so constructed that the weight of its external upper portion is supported by the roof, that, when the lower part of the masonry within the building begins to settle, a separation in the brickwork occurs just at or a little below the point of junction of chimney and roof. The opening thus made, while serving as an entrance for water during rainy weather, also allows of the escape of soot, sparks, and flame, thereby exposing the adjoining woodwork to imminent danger of conflagration. The following description and accompanying illustration will explain how the inventor below named proposes, by means of a quite simple device, to overcome the difficulty.

Figs. 1 and 2 are respectively perspective and sectional views. The lower or roof cap, made of galvanized iron, is in two parts, A and B. The funnel, A, is at least one inch larger in length and breadth than the size of the chimney. Its top is horizontal and extends three or more inches above the peak of the roof, B; the flange is about three inches in width and supports the funnel, which is slipped over and soldered to the turned up ends of its inner margin, as represented in section, Fig. 2. The roof being shingled or covered, the roof cap is put in position when the chimney is built through. It is located so as to be free from contact with the latter and is finally nailed fast.

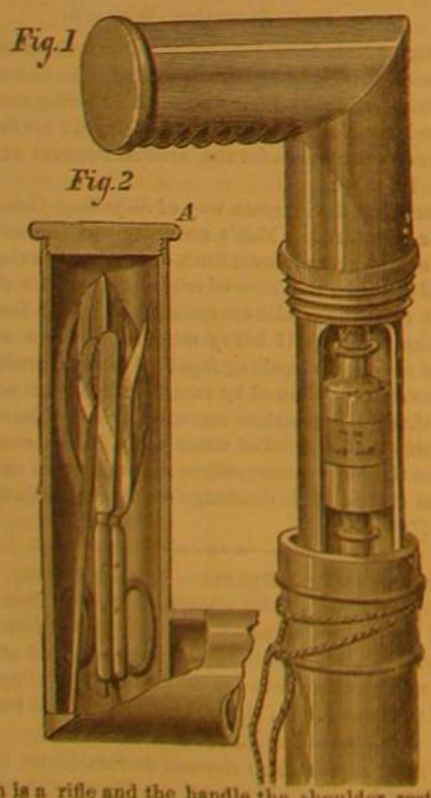
C is the chimney cap, made sufficiently large to slip over the funnel, A, and of similar material. Its sides are three or more inches in width, having flanges at least one inch wide, bent inward at right angles to the faces, forming a part to rest on the outer margin of a layer of brick, the top of which is from one to two inches above the funnel, A. By this arrangement, it is stated, when the chimney settles, the upper cap, C, slides down over the lower cap, A B, thus offering no obstruction to the settling, as will be readily understood from the sectional view. If the roof is shingled or covered after the chimney is built, we learn that the roof cap can be applied by soldering the parts after they are placed in position around the chimney. In chimneys, however, the base of which is low down in the building, and in others the tops of which are high and heavy, it is advisable to apply supports at the roof, and to this end the inventor proposes a staple, D, Fig. 2, of light bar iron, the points about one inch long and the crossbar four and a half inches in length, so as to allow it to straddle two layers of brick. One of these staples is placed in each face of the chimney, where the latter passes through the roof, the points entering between the courses of brick, and the crossbar, parallel with the face, taking against the roof boards. It is stated that these staples will not interfere with the settling of the chimney, and will hold it as firmly as in the usual way of shingling up close.

FIRE AND WATERPROOF CHIMNEY GUARD.

Patented December 2, 1873, by Josephus F. Schuyler, of Fostoria, Seneca county, Ohio, to whom letters for further information regarding sales of territory and shop rights may be addressed.

PHYSICIAN'S CANE.

We are familiar with sword canes, with canes with leaden heads for use as bludgeons, with walking sticks the staff of



which is a rifle and the handle the shoulder rest, and even with the hollow affairs used by smugglers, in which valuable laces or dutiable drugs are concealed, and others to which canvas seats are attached for artists; but our readers will generally agree with us in considering, as a genuine novelty, a cane which is, at the same time, a receptacle for all the paraphernalia of the healing art—an invention, in fact, which may fairly dispute with bread the title of "the staff of life."

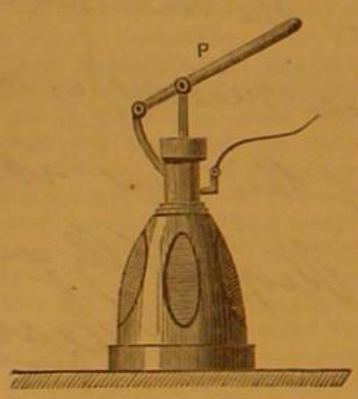
Much inconvenience, says the inventor, frequently arises from the breaking of phials in the usual pocket cases carried by physicians, and the contents are often entirely injured or ruined. It occurs to him, therefore, that all the contents of the offending case may be stowed away in the cane, as represented in our engravings. The staff is made hollow and the handle fits on by a screw thread. To the handle (Fig. 1), however, is attached a long case fitting closely within the staff, and also hollow. The space within the case is divided in suitable compartments, into which, through a long opening, the bottles are slipped.

The handle itself is made hollow and access to its interior given by a screw cover, A, Fig. 2, fitting in its end. It forms a receptacle for lancets, scissors, powder knife, a bistoury or two, and such other pocket instruments needed in everyday practice. The invention possesses the merit of novelty at least, and is the device of Mr. Milton Osborn, of Albion, Mich.

THE TOSELLI TORPEDO.

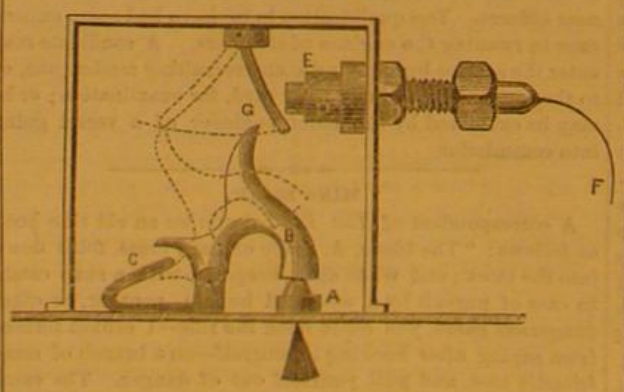
M. Toselli is an Italian inventor who does not believe in the use of electricity for the purpose of firing torpedoes or blasts. He says it is expensive, uncertain, and often perilous.

FIG. 1.



The substitute he proposes is force, transmitted to the firing mechanism through a fine hollow thread filled with water and acted upon by a powerful hydraulic press. This will be understood from our engravings, in which Fig. 1 is the press, of which P is the handle, and on the right the hollow wire is seen emerging. The diameter of the latter is about 0·06 inch. When this tube is once filled, one or two strokes of the piston, according to the inventor, are sufficient to determine an explosion. In Fig. 2, which shows the firing apparatus, A is the nipple, having a fulminating

FIG. 2.



cap; B is the hammer, and C a spring by which it is actuated; D is a cylinder in which moves the piston, E, through the power communicated through the tube, F. When the piston, E, is pushed forward, it strikes the spring lever, G, pushing it inwards, and this, impinging against the hammer, raises it to the position shown in the dotted lines. The lever continuing its retrograde motion, the hammer slips from under it, and is carried by the spring forcibly against the cap, thereby causing explosion.

The Home of the Porcelain of China.

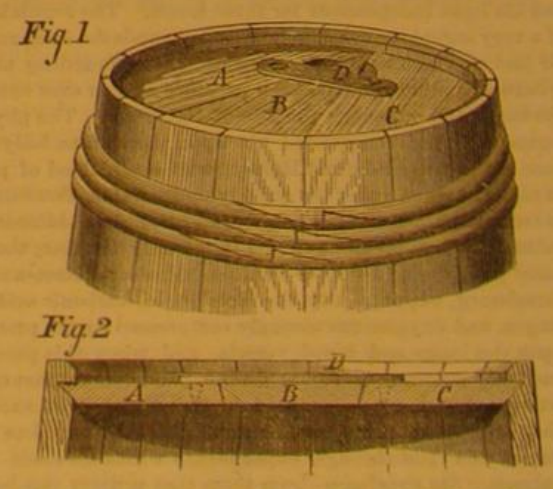
Baron Richthofen writes from China that he has discovered, near Hangtcheu, east of Lake Pajang, the material from which the Chinese have for nearly three thousand years manufactured their porcelain. He found to his great surprise that the material is a stone of greenish color, and of the hardness of felspar, and is placed in the strata between clay slate. The stone is ground into a fine powder, the finest particles of which are again separated and formed into small bricks. The Chinese distinguish between two kinds of the earth, which are obtained from different quarries, but appear to be almost alike. The country where Richthofen discovered the porcelain earth was covered with the densest vegetation of azaleas, rhododendrons, and numerous other flowers.

Science for Rum Drinkers---Effects of Alcohol on the Body.

Dr. Brunton remarked that the performance of the vital functions depended on oxidation of the tissues and Professor Binz's observation that this was lessened by alcohol was the key to an explanation of its physiological effects These may be nearly all explained on the supposition hat the power of the nervous system is diminished, different parts of it becoming successively paralyzed. First, the vasomotor nerves become affected and the blood nerves consequently dilated. After a glass or two of wine, the hands may be noticed to be of a very red color and plump, showing that arterial blood is flowing freely through the capillaries and at the same time the veins are dilated and full. All the vessels of the body, however, are not dilated at the same time. In some persons those of the stomach or intestines become dilated; and the blood being thus abstracted from the head, the brain becomes anæmic, and the individual dull and sleepy. In others the arteries of the head become dilated first, and in consequence the brain receives a full supply of blood, and the intellect becomes more vigorous. If this stage is not passed, the functions return to their normal condition, and no harm ensues; but if more alcohol is taken, the paralysis extends to other parts of the nervous system. Sometimes the cerebral lobes, which are the organs of the mental faculties, are first affected, and sometimes the center, for co-ordinated movements usually supposed to be the cerebellum, or, as it is often expressed, "one man gets drunk in his head, another in his legs." When the head is affected, the judgment becomes impaired, though memory and imagination may still be more active than usual. These faculties next fail, and the emotions become hilarious, pugnacious, or lachrymose. The spinal cord is generally unaffected even when the cerebellum is paralyzed; and a man who is utterly unable to walk can still ride, the mere pressure of the saddle upon his thighs being sufficient to cause reflex contraction of his adductor muscles and fix him firmly on his seat, although the upper part of his body may be swaying about like a sack of wheat. The cord itself next becomes paralyzed, and lastly the *medulla oblongata*, which regulates the respiratory movements.

PATENT BARREL HEAD.

An ingenious device for enabling barrel heads to be readily removed and repaired, without taking off the hoops, is represented in the accompanying illustration. The device is quite simple, and appears to be a really handy and convenient improvement. It is made in three parts, A, B and C, the jointed edges of which, as shown in Fig. 2, are beveled off (sections A and C on the top side and section B on the lower side) so as to form a solid head both as to inward and outward pressure, when the metallic plate, D, is properly affixed. Section B is of V shape, and its wide end enters the croze, while the point reaches near to the opposite side of the barrel, and is held in place by the plate, D, which is secured by screws to sections A and C. To remove the head from the barrel, one of the screws is withdrawn and the plate turned on the other screw until it clears section B, when the latter is easily removed by the thumb and finger



inserted in the notches, shown near the end. To place the head in the barrel, the above operation is simply reversed. Patented by Mr. Alexander Hanvey, of Steubenville, Ohio.

PROFESSOR JAMES ORTON, of Vassar College, whose interesting letters descriptive of his recent exploration of the great Amazon river have from time to time appeared in our columns, has arrived safely home and has resumed his duties in the class of Natural History and Zöology.

Professor Orton states that his travels extended from the mouth of the Amazon river through the Southern Continent to the Andes, and over them to Lake Titicaca in Peru. In this classic region, 12,000 feet above the sea, he found the SCIENTIFIC AMERICAN regularly received and highly prized

PROFESSOR PROCTOR'S ASTRONOMICAL LECTURES.

Professor Richard A. Proctor, the distinguished English astronomer, recently delivered a series of lectures in this city. The course began with masterly discourses upon the sun, the planets, and comets and meteors, which were illustrated with photographic views and diagrams thrown upon the screen by the magic lantern, and which consisted in clear explanations of the present state of scientific knowledge regarding these heavenly bodies. As the subjects above noted have, however, already found full and recent elucidation in our columns, notably in the published abstracts of the lectures of Professors Young, Morton, and others, we pass at once to the consideration of the very interesting topic of the fourth discourse—the moon.

The moon's diameter is 2,100 miles, and she is distant 238,828 miles. Her surface is less than our globe in the proportion of 1 to 13½, or, in other words, includes about 14,600,000 square miles, equal to the combined extent of North and South America. The volume of the moon is to that of the earth as 1 to 49½, and the relative masses as 1 to 81.

The speaker had heard that the observatory to be established on the Rocky Mountains will bring the moon within thirty miles of us; but that is impossible. The optical image formed by the object glass of the astronomer has defects, and if you magnify it you magnify the defects. When you get beyond a certain point it is useless to magnify the image as it appears, and there is no hope of any telescope larger than Rosse's to get a close view of the moon. It is hopeless to expect to find signs of life on our satellite, for the moon has no atmosphere. This is shown by the fact that shadows thrown by the lunar mountains are seen black, whereas, did an atmosphere exist, they would vary in intensity. Also, when the moon passes over a star, the latter flashes out suddenly; if there were an atmosphere, the star would be seen precisely as our sun when sinking.

The moon has no water, for if she had, and if even a shallow atmosphere existed, the water would be raised into the latter, and decrease or increase the streaks or markings which appear on the great floors. In answer to the question: Where then has the water gone? four suggestions are made. The first is that a comet carried away the lunar oceans and atmosphere. The second, that the surface is covered with frozen snow. The objection to the latter is that there is no sign of the whiteness which would then appear, for, in fact, the color of the moon is about that of weather-beaten brown sand. The third idea is that the lunar oceans have been withdrawn into the substance of the moon; and the fourth is that the moon is egg-shaped, and that the center of gravity, being displaced on the further side, has carried to that side the oceans and air of the moon, and that the side of the moon never toward us may be a comfortable abode of life.

Several photographic pictures of the moon were then exhibited and commented upon by the speaker. He said the photographic study of our satellite was commenced by Dr. W. H. Draper, in 1840. Mr. De la Rue, of England, subsequently made many lunar photographs, but the best are those of Dr. Henry Draper and Mr. Rutherford, of New York. From the craters called Copernicus, Kepler, and Aristarchus, there is a radiation, and it appears clearly to observers that the strata were upheaved at different times; the later ones seem to break through those of earlier formation. It is hoped that, by this characteristic, we can learn something of the order in which the changes in the moon's surface took place.

Other pictures were shown, to illustrate how far the appearance of the moon may alter from a mere change in the illumination, so that it is difficult to say what changes are going on, from those apparently taking place. The moon changes and shifts not merely with regard to the sun, but to the earth, and Professor Proctor calculates that 1,300 years must elapse before any part would be again presented in precisely the same view She is unlike our earth in general conditions. The total lunar day lasts 29½ of our days, but the year is very much less than ours, and is only 346 days. This is due to a slow tilting, corresponding to the precession of the equinoxes.

The two engravings which we present herewith show how the earth would look to an observer on the moon's surface, that is, about 13½ times as large as the moon appears to us. In Fig. 1 an earth-light scene is depicted; in Fig. 2 the sun is the direct source of light, the earth showing its dark side. There is a defect in these lunar pictures due to the imagination of the artist in introducing signs of weather.

Fig. 1.—PART OF THE MOON'S SURFACE AS SEEN BY EARTH LIGHT.

As to the cause of the lunar craters, Professor Proctor went on to state that on the moon's surface there is a pounding down of meteoric missiles, not necessarily solid ones, but a falling down of meteors on the plastic surface. At the present day it is estimated that over 400,000,000 meteors fall through the day, but the result is very slight indeed. The speaker found that the earth would require 400,000,000 years to have her diameter increased a single inch by them. While the earth was still in a form of vaporous matter, the moon was rolling on, still plastic, and these meteors, falling down upon her surface, would produce that pitted appearance.

THE STAR DEPTHS

was the title of Professor Proctor's fifth lecture. He said that the problem which astronomers have to solve, in determining the distance of the stars, is one of stupendous difficulty. A change of 383,000,000 miles in the place of observation causes no perceptible alteration in the direction of many stars. *α Centauri* changes its position in a year apparently less than the distance passed over by the minute hand of a watch in $\frac{1}{200}$ of a second. It is 210,000 times further away than our own sun is. The largest star presents no disk to the telescope, hence its light must be measured. The star above named shines three times as brightly, and its surface is five times as large as that of our sun. Sirius is 100 times brighter, and in volume 2,000 times as large. The spectroscope shows that these stars are all suns.

Some stars are found to be double and show very well marked colors, some red, some orange, some blue, and so on. These owe their colors not to the inherent nature of their inner light, but to the qualities of the envelopes that surround them; and the idea is suggested that we have there a process by which these stars are perhaps passing down to a cooler state. Probably Jupiter and Saturn at one time may have been visible as accompanying stars, small complements to our sun, and they at that time may have shown some colors well marked in comparison with his. Compared with the stars' distance, the whole orbit of our earth sinks into insignificance. And remember that the least of these stars—its mere disk—has enormous heating power; then remember how great the distance from star to star; and then consider that the nebulous matter is spread through these stars, and continues from one star to another, and then you have an idea of the wonderful extension of that matter. For a long time the theory was that this nebulous matter was far out in space from the stars, but it is now proved that there is a real connection between the nebulous matter and the stars seen in the same view.

Kepler imagined that the center of the universe was the solar system, and that the light and heat of the sun spread out and was caught by a shell 70 miles in thickness, inclosing the stars. Wright supposed that our starry system was one of several and like a cloven disk.

Professor Proctor stated that he hoped to take one telescope and survey the whole heavens, counting the number of stars in different directions (not a field here and a field there, as Herschel did), little square fields, side by side, in the heavens, counting the number and mapping the results; and then seeing where the stars shown by that telescope are richly or poorly distributed. The stars have a wonderfully rapid motion. The process of change in a block of granite is relatively greater than those processes in the still heavens, yet these stars are every one traveling 20 and 30 miles in a second, and not a star in the heavens but has some motion.

Fig. 2.—PART OF THE MOON'S SURFACE, THE EARTH SHOWING ITS DARK SIDE.

Five of the stars of the Great Bear are traveling in a common direction, and apparently at a common rate. It is a well known fact that if we approached a star or other source of illumination rapidly, the waves of light will be shortened, otherwise they will be lengthened; the lines in the spectrum will be displaced, and we shall know whether the star is approaching or receding. Dr. Huggins found that these stars were receding at the rate of 11 miles in every second of time.

There is another sign of change in the stars; a gathering in a certain region. There is, in point of fact, a vast variety where everything seems so regular. We see streams, and modules, and branches of brightness, and it seems that when the astronomer has penetrated into the recesses of the milky way, he has no more reached the bounds of the universe than he had at the beginning of his research.

He has only examined more and more minutely a particular corner of the star system. We find a group of suns of which our sun is a single member. Then again we pass to systems brought into view by the telescope, and find that the star system to which our sun belongs is only a part of that one—an atom in space.

The concluding lecture of the course was entitled the

BIRTH AND GROWTH OF THE SOLAR SYSTEM.

If we look around at the condition of the planetary system, we find much to lead us to the belief that it grew to its present state, that there was a process of its development. There are 8 primary planets and 134 asteroids, and all these bodies travel in the same direction around the sun. Then every one of the bodies, whose motion has been determined, turns in the same direction. There are in fact so many similarities that we are bound by the laws of probability to believe in the evolution process, for the chance of 142 planets going round in the same direction is 1 in 2,774,800,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000. Laplace, in his explanation of this motion, had the idea that there was a great nebulous mass having the sun in the center, extending on either side far beyond the present extension of the path of the uttermost planet, that is, a path of 5,000,000,000 miles diameter. That mass was intensely hot and vaporous, and it was rotating; and as the rotating mass contracted and it began to rotate more rapidly, a ring was thrown off, which would gradually break up, its parts would gradually amalgamate; many parts would have different rates of motion, and different parts would encounter each other, and in the course of millions of ages there would be an amalgamation into one mass, having the same direction of motion that the nebulous mass had, and traveling around a center which was the sun. That process would go on until one planet after another was formed. There was no light given by the La Place theory in reference to the questions connected with the asteroids; he simply stated the general facts and left them there. It seemed to the speaker that they were led to another theory, and he would adopt a method of illustrating it which he deemed suitable. If an insect of a few hours' existence endeavored to trace the history of the growth of a tree in which it lived, it could not during its own life arrive at the truth; but by transmissions of slight knowledge, the result of study for ages, the species would eventually arrive at the truth. We know that as one nebulous mass passes into another, by chemical means, light is produced. There is evidence that these nebulæ are gaseous. There would be one center of aggregation which would grow continually in size and power, gradually drawing more and more matter to it; and the more it drew in of these nebulous masses, the greater its power would become. Professor Daniel Kirkwood took the paths of the asteroids, and arranged them in their order of distance, and he found certain places where, for some distances, there were no asteroids. He noted where the gaps occurred, and he found them corresponding to the paths of asteroids having periods commensurate with the period of Jupiter. Jupiter would disturb the motion of the asteroids, if they had a period like his own, and would prevent them from travelling, his mass being so much greater. This supports the theory that the solar system arose from motion and aggregations, not from the contraction of a great nebulous mass. The rings of Saturn give further evidence of the same. In the star clouds we find a multitude of stars discernible with the telescope, and so closely clustered as to be irresolvable; and in these masses or cloudlets we see proof that the sidereal system is not a mere aggregation of stars, but contains all varieties, nebulæ, star cloudlets, and stars of all varieties; and that it resembles the solar system, not in uniformity, but in variety of structure. In studying its laws we have a problem of enormous difficulty, but one which must one day be solved. The lecturer then exhibited numerous beautiful diagrams, illustrating the existence and appearance of nebulous masses and stars under various circumstances around the great luminous bodies, and the immense variety of these nebulous masses. He concluded by portraying the glory of scientific study, which brought man into a nearer and closer knowledge of his Maker. After the conclusion of the lecture, complimentary resolutions were passed, to which Professor Proctor appropriately responded.

A Mexican Motor.

We are indebted to the Hon. Martin F. Hatch, U. S. Consul at Merida, Yucatan, for a copy of a local newspaper—*La Razon del Pueblo*—containing an account of "An Astonishing Motor," the invention of a young Mexican named Gonzalez. The Mexican editor is of opinion that the invention is of such extraordinary value that its mere fame will make Mexico great among the nations. The new motor, he says, enables mankind to navigate the air in the teeth of hurricanes blowing at the rate of three hundred miles an hour. It permits of locomotion over the earth or under the surface of the sea, in all directions, with inconceivable velocity. We regret to say, however, that, after giving us a column and a half upon the various wonderful capabilities of the new invention, the editor fails to present any clue to the principles or construction of the device. The only light given upon this point is that the use of the invention involves no expense, not even the employment of hand power, nor steam, nor air power, nor electricity. The inventor has put into operation an example of the device in the form of a small boat, hermetically sealed, which dives and moves in any desired direction under water, at any desired speed, as if guided by an invisible hand. The editor does not hesitate to say that it is the most astonishing work that, up to the present day, has ever been produced in the world. The many mechanics who have seen it declare themselves utterly unable to explain the phenomena.

Evidently, here is another example of "psychic force," which we hope will be included in the new investigations of Dr. Crookes, of London.

By the soundings of John McKinney, an experienced navigator and old resident in the vicinity of Lake Tahoe, Cal., the greatest depth of that remarkable body of water is found to be 1,645 feet.

PATENT OFFICE DECISIONS.

PATENT VENEER CUTTER EXTENSION.

In the matter of the application of Benjamin F. Sturtevant, for the extension of Letters Patent No. 26,627 granted December 27, 1859, for Improved Lathe attachment for Cutting Veneers.—Decided December 24, 1873.

THACHER, *Acting Commissioner:*

This invention consists in improvements upon machines for cutting veneers. It is designed to cut sheets thicker than common veneers without crippling or splitting them in the operation. It was well known that a thin sheet could be cut from the periphery of a solid cylinder of wood by circumrasion, or shaved from the surface of a plank, without disturbing the texture of its fibers, and that, where the conditions are the same, the danger of splitting or breaking is always increased as the thickness of the sheet is increased.

The applicant wanted to cut sheets thick enough to be used for picture backs and shoe peg blanks, which none of the existing veneer cutters would successfully do. The variation he had to make from existing veneer cutters was apparently slight, taking for comparison the machines of Humphrey, patented in the United States October 26, 1842, and Fontainemoreau, patented in England May 25, 1847, upon which the remonstrants mainly rely as anticipating Sturtevant's invention. It was such, however, as to accomplish the result he had in view, which, it is not satisfactorily shown, was, or could be accomplished before his invention was made. In every veneer cutter there is a knife for cutting the sheet, and a guide or presser bar to impinge against the block a little above the knife edge. In Humphrey's machine the presser guide is a roller, and in Fontainemoreau's it is a casting with a curvilinear face. The applicant simply beveled the front of his presser bar, giving it such a shape that when its working edge was pressed with considerable force against the periphery of the block opposite the cutting edge of the knife, it would slightly bend the wood fiber upward. Then the knife, instead of wedging and bending the sheet sharply at the cutting point, would find it already bent on the block, and would simply sever it and compress it, at and below the cutting point, perpendicularly against the lower face or bevel of the fixed presser bar. By thus bending the sheet on the block, just before the point of severance, by the action of the presser bar, instead of bending it by the wedging action of the knife in the act of severance, it was found that a most useful result was effected. While the latter process, which was that of veneer cutting, would cripple a thick sheet, the former would leave it as perfect as a ribbon unwound from its block. The experiments made at the hearing, as well as the testimony in the case, plainly establish the truth of this theory of construction and operation, and mark this part of the applicant's invention as distinctive and important.

The patented invention has been extensively used, the inventor retaining the business in his own hands, and receiving therefrom a large annual income. Yet the patent, so far as shown, has passed unchallenged. Considering the interests involved, it is incredible that Sturtevant should be left undisturbed in his business if the machine of Humphrey or Fontainemoreau would accomplish the same result; for the invention of the former was public property before the patent was issued to Sturtevant, and there is no evidence that the English invention was ever patented here. Either machine could have been put into operation by any one during the lifetime of this patent without tribute to any one. Yet there is not a particle of evidence that a single machine of either kind has been so used, and not a single specimen is produced of veneers or "peg wood" made by such a machine. This circumstance is significant, and fully as important as the ingenious theories of expert witnesses.

The first claim is not in such form as is required by the present practice of the Office under section 26 of the act of July 8, 1870, but in the light of the specification it would no doubt be held valid by the courts. The second claim covers "the cutters E E' E'', or their substantial equivalents, for the purpose specified." These cutters are placed above the main cutting knife, to divide the sheet into strips, and one of them, if desired, is placed flush with one end of the knife, to cut the edge of the sheet from the log. I do not see that they have any peculiar function to distinguish them from those shown in the patent of Humphrey, and to entitle the applicant to the broad claim of his patent. I must hold them as covered by the second claim without discussing the testimony relating to them, to be substantially anticipated.

The question of adequacy of remuneration is the only remaining one. The diligence of the applicant has been exemplary, and his success remarkable. The profit he has derived from this invention is large, even taking it at his own estimate. But nearly doubling it, as the remonstrants do in their estimate, which is not without some reasonable basis, it is unusually large, reaching nearly $130,000. The amount of money, however, which an inventor has received for his invention, has no relation to the question of granting an extension, except as to its correspondence with the labor and expense incurred by him and the ascertained value of the invention to the public. The mere fact that a great profit has been realized is not a sufficient reason for refusing an extension, if the sum is disproportionate to the public benefits derived from the invention through the labors of the inventor. Although the remuneration of this applicant is admitted by him to have been over $50,000, the advantage of his device to the public has been so many times this amount that I should not be warranted in holding him adequately remunerated.

The extension will be granted upon a disclaimer of the second claim and payment of the required fee in accordance with official rules.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

HARVESTER PATENT.—C. AULTMAN *vs.* H. C. HOLLEY AND E. H. FITTZ.

[*In Equity—Before Woodruff, Judge.*]

WOODRUFF, *J.:*

On the 20th of September, 1853, Philo Sylla and Augustus Adams received Letters Patent from the United States for an improvement in harvesters. On or about the 17th of May, 1859, on a surrender of the said patent, new letters were issued to C. Aultman & Co., assignees, intended severally to cover different parts of the same invention, or different devices included in the original machine. These reissues were numbered, respectively, 721, 722, 723, 724, 725, and 726. Thereafter reissue numbered 722 was assigned to the original alleged inventors, was by them surrendered, and on the 14th of May, 1867, new Letters Patent were issued to them, professedly for the same invention, which last named reissue is numbered 2,608. The several reissued patents numbered 2,608, 723, 724, and 726, were, on the 19th of September, 1867, extended for seven years from the expiration of the original terms—namely, to the 20th of September, 1874, and by assignment from the original patentees the title thereto is vested in the complainant in this suit, who charges the defendants with an infringement of these extended reissued patents. The defendants have raised the preliminary objection that the suit is defective for want of necessary parties; and on the merits they insist upon various objections to the relief sought, the chief of which are that the reissued patents are void, because they "are not for the same invention as the original patent from which they have sprung, but claim substantial and material matters not indicated, suggested, or described in that original patent;" that if the reissued patents embrace no devices but such as are shown or suggested in the record of the original, or if they can be sustained so far as to embrace what is shown in such original and nothing more, then the defendants' machine is no infringement; and, finally, that the invention shown or indicated by the original patent, its specification and model, in any particular in which the defendants can be deemed to use any device or devices shown therein, was not new when such original patent was granted.

The court held substantially as follows:

Under an agreement between the owners of conflicting patents, which defined their respective rights and provided a fund for maintaining them and for purchasing as joint property patents deemed necessary for their mutual protection, a patent does not pass which had been previously purchased by one of the parties and was subsequently assigned to the original inventors, and, after having been extended, was reassigned to the same party.

Such an agreement would operate at most as a license to all the parties to use a patent owned by one of the individuals composing one of them; and he alone could maintain a suit at law upon it, and the others need not join.

It is no objection to a suit brought upon an extended patent that the exclusive right under the original term for the territory where the infringements were perpetrated had been assigned to third parties, unless it appears that the extended term was embraced in the assignment.

A claim for "the combination of the finger beam" in a harvester "with the hinges by which it is drawn arranged above the plane of the cutter" is not enlarged because a description of a machine in which that combination is shown to be practicable is interpolated in the specification upon a reissue, neither is the patent invalidated.

A reissued patent is valid although the description of a machine to which the invention may be applied is substituted in the specification for the purpose of illustration instead of the description of another contained in the original, which was so imperfect that it failed to show the application.

Where a reissued patent claimed a feature which was not described in the original specification nor clearly shown in the drawings, and the model was so injured as to furnish no evidence respecting it, it was held on other proof that the model originally contained the disputed feature, and the patent was held valid.

The devices employed in abortive and abandoned experiments do not become public property, and are no bar to a patent embracing them obtained by an independent and successful inventor afterward.

A claim for the combination of a stop to prevent the finger beam of a harvester from falling too low with the mechanism for connecting it with the main frame, and allowing it to rise and fall, is not infringed by a machine so constructed as to require no such stop, and having none.

The gist of Sylla and Adams' invention, patented September 20, 1853, consisted in attaching the finger bar to the frame of a mower and reaper by a coupling bar hinged at one end to the frame at or near the crank shaft by which the sickle bar is operated, so that the end of the pitman attached to the sickle bar oscillates in nearly the same arc of a circle as the inner end of the finger bar; and their reissued patents of May 14, 1867, are infringed by any machine using that construction, however differently formed in other respects.

George Harding, for complainants.

Henry Baldwin Jr., and Benjamin F. Thurston, for defendants.

NEW BOOKS AND PUBLICATIONS.

THE PREPARATION AND MOUNTING OF MICROSCOPIC OBJECTS. By Thomas Davies. Enlarged second edition, edited by Professor John Mathews. New York: G. P. Putnam's Sons, 23d street, corner of Fourth avenue.

Any one who desires to become skillful in this most delicate species of handicraft, will find instructions here that are of undoubted value. The work was originally written *for* the help of students in microscopy. It contains the concise directions pertaining to every *branch* of the subject, derived from the experiences of the most eminent practitioners of the art. It shows what substances are to be employed to give transparency to this or that tissue, what coloring material will render desired parts more conspicuous, what will harden the soft membrane, or soften the hard. It describes the various solvents of various objects, shows how to clean them, how to cut, treat, place, and secure. Shows the uses of polarized light, and the changes which the same object, prepared by different methods, exhibits. In short, there is hardly a point in the whole range of the art of microscopic preparation that is not here explained. Not only those who wish to learn, but all who have acquired dexterity in the art, will find useful instruction in this book.

HALF-HOURS WITH THE MICROSCOPE. By Edwin Lankester, M.D. Illustrated by Tuffen West. Explanation of the Polariscope by F. Kitton. New York: G. P. Putnam's Sons, Fourth avenue, corner of 23d street.

This little volume is intended as a popular guide to the microscope, as a means of amusement and instruction. It most admirably fulfils its purpose. It is crowded with useful and practical information. We think it would be difficult to find elsewhere, in the same compass, so much microscopic instruction so clearly set forth. Beginning with an explanation of the construction of the simpler forms of the instruments, it goes on to those of more complicated structure, shows the arrangement of the lenses, the combinations of the binocular attachment, the various diaphragms, *camera lucida* for drawing the magnified objects, with explanations of sundry other tools and devices.

The chapter entitled "A Half-hour with Polarized Light" gives a clear and easy explanation of this curious subject. Instructions are given by which any person of intelligence may construct a practical polariscope of bits of thin glass, at the cost of a few cents. A list of various crystallizations, for the production of the most peculiar forms and gorgeous colors seen under the polariscope, is given, with directions for their preparation—all of comparatively simple nature.

The chapter, "A Half-hour with the Microscope in the Garden," describes some of the extraordinary and magnificent things that may be seen close at home. Plates delineating the forms of some two hundred of these wonderful things are given, including the structure of garden plants, berries, flowers, and vegetables, showing formations of astonishing beauty. Then follow: "A Half-hour with the Microscope in the Country," "A Half-hour at the Pondside," "A Half-hour at the Seaside," "A Half-hour Indoors," each chapter being illustrated with pictures of the many strange and interesting objects that are mentioned. The book closes with an appendix, by Thomas Ketteringham, upon the preparation and mounting of microscopic objects. The frontispiece is a beautifully executed plate in colors, of splendid polariscope objects. Some ten thousand copies of this little work have been sold in England, which is an indication that its intrinsic merits are equal to any thing that might be said in its praise.

FREE HAND DRAWING: a Guide to Ornamental, Figure, and Landscape Drawing. By an Art Student. 50 cents. New York: D. Van Nostrand.

Recent American and Foreign Patents.

Improved Artificial Stone.

Ernest L. Ransome, 10 Bush street, San Francisco, Cal.—By means of the process described in this patent, it is claimed that much of the chloride of calcium hitherto wasted is collected and saved, and the stone is washed in as many minutes as formerly days. The invention consists in the rapid removal of the calcium chloride from the pores of the stone, by a strong blast of air, followed by a blast of air containing water in a state of fine division. The inventor states that the operation is completed in a few minutes, and that the cost of the apparatus required is but small.

Improved Grain Car Unloader.

Mason W. Bosworth, Binghamton, N. Y.—This invention relates to an apparatus for unloading grain in bulk from railroad cars; and it consists in the employment of a movable endless chain or apron, passing over guide drums, and carrying a projecting gudgeon or arm, which operates in connection with a slotted sliding plate connected indirectly with the scrapers or scoops, arranged within the car. The invention further consists in attaching to the slotted sliding plate a reciprocating rod, traveling between guide pulleys, and connected with the movable unloading scoops or scrapers so as to draw the same to the door of the car for discharging the grain. The invention also consists in connecting the unloading scrapers, by ropes, to the reciprocating rod, said ropes passing over guide rollers, and so arranged that when one of a pair of scrapers is drawn to the door of the car for discharging its load, the draw rope of the other will be slackened for permitting it to be retracted for the purpose of filling it.

Improved Locomotive Furnace.

Andrew J. Stevens, Sacramento, Cal.—This invention is a boiler door provided with a damper on the outside, and an air deflector on the inside. The lining of the fire box door is angular in form, and projects from the inside of the door, the lower portion of the lining being cut away so that an opening is formed. The upper portion of the lining acts as a reflector to throw the air downward to the surface of the fuel, so that it can readily mingle with the gases inclosed, and thereby produce a more perfect combustion of the fuel.

Improved Till Alarm.

Egbert O. Wood, Nashua, N. H.—By suitable construction, when a number of tumblers are all turned forward so that their short arms project upward, the drawer may be moved out and in freely. Should one or more of the tumblers be turned back so that their long arms project upward, the drawer cannot be drawn out without first forcing the said long arm of the tumbler or tumblers downward by operating the keys of the tumbler or tumblers that were turned back. When the key of a tumbler that has been turned forward is operated, the short arm of said tumbler is raised, so as to prevent a lock plate from dropping down and passing out beneath lugs. When an attempt is made to open the drawer with one or more of the tumblers raised, a lug of the lock plate will strike against the lug of a ratchet, and, releasing the lever, will sound the alarm. As the till or drawer is closed, the lugs of the lock plate slide up the inclined rear sides of other lugs, and drop down in front of said lugs, the rear part of the said plate resting upon the upwardly projecting arms of the tumblers. The alarm is set by turning one or more of the tumblers to the rearward; and the combination is changed by turning one or more of the tumblers forward or back, as may be desired.

Improved Weather Strip.

Oliver A. Vorce, Kentland, Ind.—This invention consists of a weather strip, which is raised or lowered in a groove at the bottom of the door, by being connected to the spindle of the lock by a suitable lever, so that on opening the door the strip is raised and retained in position by a band spring at the top part, which lowers the strip on the closing of the door by being depressed.

Improved Draft Equalizer.

Elias H. Blake, Coatsburg, Ill.—This invention is an improved equalizer which is readily attached to a tongue or plow beam, so adjusted as to allow the horse to walk upon either side of the tongue, and to give an advantage to the single horse or to the pair, as may be desired. The invention consists in a triangular equalizer provided with clamps for securing it to the tongue or beam, and having its forward arm slotted and provided with adjustable perforated plates to receive the hammer or pin by which the tripletree is connected with it.

Improved Coffee Roaster.

William J. Lane, Millbrook, N. Y., assignor to himself and John G. Lane, of same place.—The drum is made of rectangular or other form, and one side is attached by hinges, so that it drops back, and is limited in its backward movement by the joist strap at each end. The roasting cylinder is revolved on central gudgeons supported by ears. One or both of these gudgeons may be hollow, through which the coffee in the cylinder may be inspected from time to time to determine its condition. The hollow gudgeons are closed by stoppers while the cylinder is revolving. While the cylinder is being revolved, and the roasting operation being performed, the hinged side is closed up to the drum, thus inclosing the roasting cylinder. When the coffee is sufficiently roasted, the side is drawn back and the cylinder is turned, so that by removing a slide the coffee will be discharged on an apron, and disposed of as may be desired. When not required for roasting coffee, the roasting cylinder may be removed and the drum closed up, which adapts the drum and stove for general heating purposes. Fuel is supplied by opening the drum, and may be introduced when the cylinder is in place, if desired. This roaster is more especially designed for dealers in coffee, where it is desired to roast it often, and have it fresh for customers at all times.

Improved Wash Boiler.

Oscar E. Culver and Leander E. Moseley, Eagle Bridge, N. Y.—The top is provided with a downwardly projecting flange, secured to said cover along its side edges, and at a little distance from its end edges. The top is made of such a size as to fit snugly into the boiler in which it is to be used, the lower edge of the flange resting upon the bottom of said boiler. The end parts projecting beyond the flange have a number of holes formed in them to allow the water to flow down freely into the spaces between the flange and the ends of the boiler. Partitions are placed a little distance from the end parts of the device, and with their upper parts inclined inward. The side edges of these partitions are attached to the flange, and their upper edges are attached to the top. In the upper part of the partitions are formed large slots or openings, to allow the water to pass through, which openings are covered upon the inner sides of the partitions with the valves, which are hinged at their edges to said partitions. By this construction the valves, when left free, will drop inward by their own weight. In the center of the top is formed a hole in which is secured the lower end of a tube, and to its upper end is attached a semicircular tube. By this construction, as the steam begins to form, the first effect is to close the valves and prevent the water and steam from passing toward the ends of the device. As the formation of steam continues, the steam and water pass up through the tube and are discharged upon the clothes. The water percolates through the clothes, flows down through the holes in the top, through the holes in the flange, presses open the valves and flows into the central space of the device, to be again heated and discharged through the tube, thus establishing a circulation. This arrangement of the valves prevents the back flow of the water, and at the same time allows the free inflow of the water.

Improved Churn Dasher.

Mrs. Herndon B. Robinson, Birmingham, Ala.—Four disks, made of tin or other sheet metal, are perforated with numerous small holes, and have a larger hole formed in their centers to receive a short tube in which the lower end of the dasher handle is secured. The disks are concaved or made saucer-shaped. The two middle disks are placed upon the tube with their concave sides toward each other, and are soldered to said tube with their outer edges in contact with each other, which edges are soldered together. The two outer disks are placed upon and are soldered to the tube above and below the two middle disks, and with their convex sides toward the said middle disks. The disks are so arranged upon the tube that their perforations may not be directly opposite each other. A dasher thus constructed will throw the milk into violent agitation, it is claimed, and will also introduce into the milk large quantities of air, so as to bring the butter in a very short time.

Improved Printers' Furniture.

Henry A. Hempel, St. Joseph, Mo.—This invention is an improvement in the class of quoins consisting of wedge-shaped blocks combined with an inclined bar or frame; and it consists in two quoins, straight on one side and inclined on the other, and provided with rack bars or toothed arms, with which a pinion or gear wheel engages in such a way as to move said quoins simultaneously toward or from each other. The arrangement is such that, when the pressure on one quoin is greater than on the other, the rapidity of movement of the one encountering less pressure will be accelerated until the pressure is equalized.

Improved Washing Machine.

John W. Tull and James W. Weston, Windsor, Ill.—This invention is an improvement in the class of washing machines formed of two or more rollers arranged to rotate in contact. The invention relates to an improved means of locking a sliding extension piece attached to the bottom or bed piece of the roller frame. The extension piece is made adjustable on the bed by means of slots and screws. Metallic pins in the ends of the bed and the extension piece enter holes in the sides of the tub when the bed is extended. The latter is held in position by means of a cam lever, which is pivoted to the bed, while the cam enters (when the lever is turned) a slot in the extension piece.

Improved Billiard Table Leveler.

David H. Hill, South Chester, Pa.—The object of this invention is to furnish, for the purpose of leveling billiard or bagatelle tables, pianos, clocks, parlor organs, and other objects, an improved evener, which is applied to the feet or bases thereof, and allows the quick and easy adjustment of these pieces. The invention consists of a button or caster, with a bolt screw, which works into a socket of the billiard foot to be adjustable therein by means of a small hand wheel.

Improved Machine for Making Clothes Pins.

Benjamin B. Ockington and Andrew J. Ockington, Stratford Hollow, N. H.—The strips of wood are fed by pressure feed rollers into the machine to be turned into shape by the roughing cutters on the end of a hollow mandrel, and a finishing cutter in a slot in the side of the said mandrel. The roughing cutters act while the strips are being fed along, but the finishing cutter acts during periods of rest which the feed rollers are caused to have by the lack of teeth on a portion of a pinion which drives said feed rollers. The finishing cutter acts on the pin throughout its whole length, at the same time being revolved around it, and having its edge pressed against it by a spring as a wedge withdraws from behind it, and allows said spring to so press it and turn it on its pivots. The wedge is shifted forward to raise the finishing cutter from the finished pin to allow it to be fed along, a blank portion presented for another pin, and also shifted back to allow the cutter to act. A cam on the pinion shaft is so adjusted, relatively to the toothless part of said pinion, that at the moment the feed rollers stop it begins to act and move the wedge backward to allow the finishing cutter to act, and it completes the withdrawal of the wedge, and allows the finishing cutter to complete its work just before the pinion sets the feed rollers in motion again. It escapes just in time for a spring to throw the wedge forward and raise the finishing cutter before the timber moves on again. The pins, still connected, pass in front of the cut-off saw, which is moved forward and cuts the pins apart. From the cut-off saw the pins are pulled along the way to carrier wheels, by which they are taken between stationary fingers and a movable finger, carried around, and presented to the slotting saw and finished.

Improved Animal Trap.

Hudson H. C. Arnold, Nicholasville, Ky.—The box of the trap is divided into two parts by a horizontal trip board pivoted to the sides. The outer or rear end of the lower part of the box is closed, and in its forward part is a hole of suitable size, leading into the chute or passage way. The rear end of the upper part of the box is left open, and its sides are partially cut away to form a large opening for the animal to enter upon the trip board or tilting platform. As the animal steps upon the rear end of a lever it disengages a catch, and the weight of the animal causes the forward end of the trip board to drop, when it is caught and held by the catch rod. As the animal drops into a chute he raises the pivoted wire gate, which hangs in an inclined position, and enters the middle part of said chute, the gate dropping behind him, and preventing his return. The animal now sees light before him, and, passing toward it he steps upon a lever the rear end of which extends back to the catch rod, so that the weight of the animal stepping upon said lever may disengage the catch rod and allow the trip board to again take a horizontal position, where it is caught and held by the catch as hereinbefore described, and the trap is again set. A cage or some other convenient receptacle should be connected with the end of the chute to receive the animal.

Improved Direct Acting Steam and Water Propeller.

John S. Morton, Philadelphia, Pa.—This invention relates to improvements in propellers for navigable vessels in which paddle wheels or screws, also pistons, piston rods, cranks and walking beams are dispensed with, and steam and water are brought in direct contact in suitably arranged cylinders or chambers, having openings at their lower ends through which the water is alternately admitted and expelled by the corresponding alternate steam pressure and vacuum therein, the rapidity of propulsion being directly dependent, other things equal, on the rapidity of the in and out flow of water, or the force with which it is ejected through the orifice in the cylinder or chamber into the body of water in which the vessel floats. The invention consists in introducing hot air from the furnace into the vacuum cylinders simultaneously with the steam, to prevent condensation and produce expansion of the latter; also in arranging adjustable stops on the float rods to vary at pleasure the length of time of admission of steam to the cylinders and the hight to which the water will rise in them at each pulsation; also in providing balance levers to relieve the floats of weight, and which serve to set the steam valves and put the apparatus in operation; also in various other mechanical arrangements for attaining the desired end.

Improved Concrete Pavement.

George Bassett, Syracuse, N. Y.—In making concrete pavements, side walks, etc., it has, up to this time, been considered necessary to use foreign Portland and other expensive manufactured cement, because it dries and hardens soon after being laid down, so that the public need not long be excluded from the places paved or covered. Our native Rosendale and other cements, are, as is well known, capable of making as hard and durable artificial stone by the mixture of sand, gravel, etc., as the aforesaid expensive cements; but owing to the long time (from three to six months) required for them to set and harden, it has been found impracticable to utilize them for pavements, roadways, etc., such as are made by laying cement while in a plastic state and allowing it time to set and harden before use. But owing to the great difference in the cost of the native and foreign cements, it is highly desirable to utilize the former in some way, inasmuch as they are equally as durable when sufficiently hardened.

The inventor proposes to get over the difficulty by using the native cements for about three fourths (more or less) of the pavement, placing the same at the bottom and about one fourth of foreign cement upon the top, which answers the purpose just as well for rendering the pavement capable of use as soon as the all Portland cement pavement is; for the upper crust of the latter cement dries as soon as when the pavement is wholly of such cement, and becomes sufficiently hard for surface wear; and the lower mass of native cement, being sustained by the surface of the roadbed, supports the crust so that it does not break while the slower drying process of the lower portion goes on.

Improved Reversible Stereotype Plate.

Marshall J. Hughes, New York city.—The plate is of about the usual thickness and weight, but has two letter faces or sides in place of one. Thus two kinds, and double the usual amount of reading matter, are furnished by means of a single plate. When one side or face has been printed from, the plate is reversed in the form and the other side or face is printed from in like manner. The invention also includes the use of a margin or edge lining of sheet metal, by which the plate is locked in the form. The margin is flexible, and is bent down and held by friction with the column rules. When the plate is to be reversed on the furniture, or block, the margin is bent in the direction opposite from what it was before. The marginal plate may be perforated or not, as preferred, to allow the melted metal to unite the two sides or faces of the plate more firmly together. The device is an important improvement in its class.

Improved Wash Board.

Jas. A. Cole, Northville, N. Y.—This invention relates to providing a reversible wash board, with a pivoted head, so constructed and arranged as to adapt it to be folded between the projecting ends of the side bars, and thus occupy little space, or to be extended and set at an angle to the board proper for supporting it in the tub. The board is reversible in that it presents a coarse or fine rubbing surface, according as one end or the other is uppermost.

Improved Earth Auger.

Frederick A. Barlow, La Dora, Iowa.—This invention relates generally to the class of earth borers formed of a hollow flanged cylinder or case into which the loosened earth is received as the boring proceeds, and by which it is elevated and discharged. The specific improvement consists in constructing the cylinder with vertical grooves, exteriorly, to allow the downward passage of air during the boring operation, and in making the body of cylinder separate from the bottom and frame thereof, and connecting said parts by means of devices which are easily manipulated.

Improved Window Sash Lock and Holder.

Joseph T. Craw, Jersey City, N. J.—This invention consists in a combination with sashes of a double cam sash fastener, pivoted to the inside of the window frame, and having arms of different length with cam faces, so that either sash of a window may be held securely at any point of the same fastening.

Improved Breech Loading Fire Arm.

Francis J. Fuss, Wiesbaden, Germany, and John Weck, Baltimore, Md.—This invention consists in the combination of the firing pin, made in two parts, and hinged together with a swinging breech block, having arms pivoted thereto near its front end, the loose ends of said bars working against the collar on the firing pin during the depression of the breech block, and thereby cocking the piece in the act of operating the breech.

Improved Wind Wheel.

Philipp Brand, Josiah Barrows and Alexander Armstrong, Jacksonville, Ill.—This is an improvement in the class of wind wheels mounted a little out of line with the regulating vane and adapted to be self regulating. The wheel is arranged on a tubular support, which is fixed above the vane support so as to turn on a hollow shaft, and has a horizontal arm with a friction roller on it, working in an ascending spiral slot formed in an arm of the vane support. By this arrangement the wheel may swing around parallel with the vane out of the wind when the latter is too strong, at the same time forcing the aforesaid arm up the inclined slot, so that the gravity of the wheel and its support will cause it to move back into the wind when the force of the wind decreases enough.

Improved Carpet.

Gregory Isklyan, New York city.—This improvement in carpets and blankets consists of a long thick nap raised up from a weft of felt and woolen yarn, or strips of felt alone, in any desired way, and then pressed and matted down smooth and compact upon the surface to hide the warp threads of cotton, linen, and the like, such as are used in the manufacture of carpets of list. It is also proposed to make fabrics for carpets and blankets of which the weft is wholly of felt with warp, as in the other case, and either press the nap down or not. The object is to cover and conceal the warp of coarse and cheap materials, and impart a finer finish to the surface than can be had without such surface dressing.

Improved Railway Crossing.

James Brahn, Jersey City, N. J.—This invention is an improved railroad crossing, so constructed as to guard and strengthen the parts of the rails where the notches are formed for the passage of the wheel flanges, and to prevent the notched rails from being battered by the wheels. The invention consists in slotted or hollow metallic blocks filled with wood, provided with wooden facing blocks, and with a metallic guard bar which projects above the top of the blocks to serve as a flange or guard to guide the flange of the wheel into the notch in the intersecting rail, and prevent it from hitting and injuring the head of the rail at the side of said notch. The bar is bolted to said rail in the manner of a fish plate, being bent to fit the angle. The rails are further strengthened and kept in line by braces, which cross said angles.

Improved Pie Marker.

Thomas S. Macomber, Hamilton, N. Y.—This invention consists of a rotary trimmer of concave shape placed with a serrated marker on the end of a handle, said marker being provided on its face with a stamping design and air hole cutters. The dough used for the pie is rapidly trimmed by the sharp edge of the trimmer, while the serrated wheel crimps it at the same time. The impress of the stamping device and cutters finishes the dressing of the pie before baking.

Machine for Removing Snow and Ice from Roadways.

Charles G. Waterbury, New York city.—An iron box of any suitable form is mounted on four wheels for drawing it along the street. A furnace is at the front end inclosed on the sides and top, but open at the bottom. The sides extend rearward the whole length of the apparatus, to confine the heat and form a long channel for the escape of the same, in such manner as to confine it to the work. A hood may be attached to the rear to prolong the channel, and arranged to raise and lower as required. The furnace is surrounded by an inner wall. Between these two walls is a water space which extends to the bottom of the sides, and is prolonged to the rear end of the box, under a floor in the rear part of the box, over which there is another floor to protect the operators and the contrivance above from the heat. The cover of the channel has several depressions to prevent the escape of the heat too rapidly, and throw it down on the snow and ice. The grate bars consist of tubes when the heat is blown down from the fire between them, and have connection with the water space, so that the water will circulate in them and protect them from the heat. The charger, consisting of a large vertical tube rising up from the top of the furnace, is provided with two slide doors so that, by having the lower one closed and the upper one opened, it can be filled without allowing the blast to escape, and, by closing the upper one and opening the lower one, the charge can be delivered into the furnace also without allowing the blast to escape. A coil of pipe, having small perforations, is arranged around the interior walls for injecting hydrocarbon fuel from a tank, with which it is connected outside of the furnace, said tank being arranged so that the oil will flow in, the pipe having a cock to regulate the flow. A rotary fan is arranged in the rear part of the box to blow the heat down to the surface of the ground. This fan is driven by belts and pulleys connected with the hind axle of the machine, or by a special steam engine. A pipe conducts the steam from the water space down to the fire below the grate, for adding its heat to that of the fire for melting the snow, etc.

Improved Locomotive Window.

John H. Dinsmore, Boston, Mass.—The object of this invention is to construct the doors and windows of the engineer's room of locomotives in such a manner that the glass is kept free from moisture, frost, or other obstructions to the sight, allowing the engineer a more perfect outlook on the track. The invention consists of a window or door with an outer and inner sash, between which one or more steam pipes extend along its circumference, so as to produce such a temperature in the space between the glass panes that no vapor or frost can settle thereon. Both sashes are hinged, the inner one to the outer, and the outer, by hinged joints, to the steam pipes, so that the windows may be thrown open, if desired.

Improved Bracelet Fastening.

Shubael Cottle, New York city.—The bracelet is made in two parts, hinged to each other at one end, and secured by an ordinary spring. A small cap, of such a size as to shut down over the knob of the catch, is hinged to the end of the part of the bracelet that contains the socket. To the inner surface of the free end of the cap is attached a small pin, which, when the cap is shut down, springs into a small hole in the knob of the catch and covers the knob, thus preventing it from becoming accidentally unfastened.

Improved Rubber Mat for Pitchers, etc.

Cornelius A. Price, Jersey City, N. J.—The part of the mat upon which the pitcher is to stand is circular in form. The portion for the tumblers is of such a width that the tumblers may stand upon it, and it extends partially or wholly around the pitcher. The upper surface of the two parts is ribbed with cross ribs, which are made of such a hight as to form deep square or diamond-shaped depressions over the entire surface of said parts, to receive the drip. An elevated hub is arranged so as to prevent the pitcher from being pushed against the tumblers.

Improved Churn Dasher.

David Boyd, Vevay, Ind.—This invention consists in a dasher composep of two cross bars and band. The two arms of each cross bar are beveled in opposite directions, and the side cross bars are so arranged that each two adjacent faces of the blades may both incline upward and from each other or both incline downward and from each other. To the outer ends of the blades is attached the band, which is so formed that the part which is opposite the faces of the blades that incline upward may incline inward and upward, and the part that is opposite the faces of said blades that incline downward may incline downward and inward. By this construction, as the dasher moves either upward or downward, four strong currents of milk will be formed, two flowing outward toward the wall of the churn, and two flowing inward toward its center.

Improved Wheel for Vehicles.

David Brown, Clinton, Texas.—Upon the end of the axle is formed an axle arm, made octagonal or of other polygonal form. A short cylinder has a hole formed through it of the same shape as the axle arm, and its outer surface forms the journal of the hub. The cylinder is placed upon the middle part of the arm, and upon said arm, upon each side of the cylinder, is placed a flange, made somewhat conical in form, which are secured in place upon said axle arm by a linch pin. A ring, which forms the hub proper, is made with a ring groove to receive the tenons of the spokes, which tenons are separated from each other by thin partitions, which may be made V-shaped. The outer edges of the ring have flanges formed upon them, which overlap the edges of the flanges first mentioned. The spokes may be further secured in place by bolts passed through the flanged outer edges of the ring.

Improved Fly Trap.

George W. Eichholtz, New Berlin, Ill.—The base plate is made of tin or other sheet metal, to which is attached the cylindrical body of like material. Within the latter a wire gauze cone is arranged, and hooks applied by staples to the body lock into short radial slots of the base plate, allowing the easy cleaning of the plate and cone, and the ready insertion of the bait. At the lower edge of the body, below the main cone, are arranged small wire gauze cones, through which the flies enter in search of the bait. The main cone is truncated, and provided with a small inverted cone, forming circular slots with it, through which the flies pass up into the upper part of the trap. This upper chamber consists merely of a common wire cloth dish cover, which fits tightly on the upper edge of the body, but is removable therefrom.

Improved Combined Stubble Shaver and Scraper.

Henry Von Phul, Jr., and James Mallon, Holly Wood, La.—The forward parts of the vertical side frames of the machine are rounded up to adapt them to serve as runners, and have shoes attached to them, which are extended upward, and are attached to the top bars of said frames. Knives are bolted to the horizontal arms of the angular bars, and have an edge formed upon both of their side edges, so that, when one edge becomes dull, the knives may detached and reversed. The bars are so formed that their horizontal arms may incline to the rearward to bring the knives into a good working position. Suitable construction enables the knives to be conveniently raised and lowered, as desired. A triangular or V shaped block, the sides of which are made slightly inclined and are faced with metal, is constructed so as to push or scrape from the ridge the stubble and soil cut by the knives. By proper arrangement, the knives and scraper are raised and lowered at the same time and by the same operation. Guards are attached to the frames to overlap the inner ends of the knives and prevent them from becoming choked with stubble or other rubbish. A cutter is also provided, the shank of which is designed to split the ridge in advance of the knives and scraper, to enable them to operate more easily and with better effect.

Improved Spring for the Seats of Vehicles.

Conrad Duecker, Lively Grove, Ill.—The object of this invention is to provide simple, durable springs for wagon seats; and it consists of a circular hook spring, which is attached to each corner of the seat, the springs resting on the edges of the wagon box.

ANSWERS TO CORRESPONDENTS

A. O. F. asks: Is it ever necessary for a locomotive slide valve to lift from its seat, either on sud, denly reversing the engine, when running down grade, or from any other cause? And if it does lift from its seat, what causes it to do so? How much must it lift under the most extreme circumstances? 2. I have lately made improvements on the balanced slide valve which I had patented through your agency. Will it be necessary in order to secure the improvements by a patent, to have a reissue of the original patent, or can I secure the improvements by a separate patent? A. 1. The valve may rise from its seat whenever the pressure underneath is greater than that on top. A very slight lift would equalize the pressure on the two sides. 2. It is not necessary to have a reissue.

S. G. F. asks: With what substances can I pack a filter to run about fifty barrels of water per day? We are much troubled with muddy water and have tried charcoal and gravel with no effect, as they soon clog up on passing this amount of water daily. A. If your water is very dirty, it will be well to have two filters, so that one can always be kept in operation. It may be that your present filter is not large enough.

H. L. R. asks: 1. How can I take the gold off a silver watch and chain which have been gilded? 2. How can I harden brass, silver or gold wire? 3. What will give gold its natural color after being heated? 4. What will eat steel screws out of a brass or nickel watch movement, without injury to the movement? A. 1. Probably by friction. 2. By hammering. 3. Polishing. 4. We do not know of anything that will answer. You might dissolve the other metals away from the screws.

M. H. P. says: In our old almanacs, we always found the sun to rise and set at 10 o'clock twice during the year, in March and September. But in the almanacs of the last two or three years it has varied 15 or 20 minutes. Is this variation due to a fault of the almanac maker, or has there been variation in the sun's rising and setting during the last few years? How much variation is there in the time of sun's rising and setting on the dates of January 1, 1866, and January 1, 1873? A. A calendar year exceeds the true solar year by 12·38 seconds, so that there is an error amounting to one day in 3,866 years.

W. J. B. asks: 1. Why should a fast motion engine have lead, and why not use the cam instead of the eccentric? Does not the lead work against the engine? 2. If a boiler is not large enough, will a steam drum of 24 inches diameter and 8 feet length increase its capacity more than one 18 inches diameter and 4 feet length? A. 1. Lead has the effect of preventing shocks and jars. The eccentric is a cam. 2. Increasing the size of the steam drum would increase the steam room, but would probably have no effect on the steaming capacity.

J. E. H. L. asks: 1. Why does extending the arms above the head stop bleeding from the nose? 2. Why does pressure on the upper lip just below the nose prevent sneezing? 3. Why does a woolen string tied around the leg above the calf prevent cramps? A. We are not sure that these statements are facts.

P. J. D. asks: 1. Can I learn phonography without assistance? 2. What instrument must I use to engrave letters on coffin plates and other plated goods? 3. How can I make gold leaf stick to glass? A. 1. Yes, with constant practice. 2. A burin specially made for engraving on metal. 3. Use best rum ½ pint, isinglass ¼ oz. Make a solution of these, add ½ pint distilled water, and filter through linen. This size required 24 hours to dry, after the gold leaf is applied.

E. J. O. says, in reply to A. D., who asks how to fill a dent in an iron cylinder with lead: Clean it well, and tin it over in the usual way (using muriatic acid) with a soldering iron, and melt in a little solder. "I frequently stop holes in cast iron patterns in that way with good success."

T. D. H. and several other correspondents ask: How can I make a cement for use in putting an aquarium together? A. Use equal parts, by measure, of litharge, plaster of Paris, fine beach sand, and powdered rosin. When wanted for use, make into a putty with boiled linseed oil.

J. asks: 1. What is the best and most effective plan of furnace which a poor man could erect in order to smelt from fifteen to twenty tuns of lead ores per week, and run the same into pig? The lead ore contains from forty to sixty per cent silver. A. We cannot give you definite advice without knowing more of the matter. It is better for parties who have professional work of this kind to take it to men who make a specialty of such matters.

W. T. V. asks: 1. What kind of material or sizing can I apply to cloth or woolen goods to smoothen the surface, stiffen the fabric, and, at the same time render it waterproof? 2. How can glue be prepared so that it will remain liquid and fit for use when cold? A. 1. Moisten the cloth on the wrong side first with a weak solution of isinglass and when dry with an infusion of nut galls. 2. A little nitric acid added to a solution of glue will prevent its gelatinizing.

R. N. asks: How much power is gained by using steel packing instead of rope packing for a cylinder, if any? 2. Can steel packing be used instead of rope after having used the latter for several years without having the cylinder bored? The cylinder appears to be pretty smooth and true. A. 1. We could not answer the question without more data. 3. We suppose so, but cannot tell definitely, as persons' ideas may differ about the meaning of "pretty smooth and true."

R. L. asks: 1. How can I cement whalebone to wood? 2. In what is the Fahrenheit thermometer superior to the Réaumur and centigrade instruments? A. 1. Take isinglass ½ oz., water 4 ozs., let stand for 24 hours, and evaporate in a water bath to 2 ozs.; add rectified spirit 2 ozs., and strain through linen; mix while warm with a solution of 4 ozs. best gum mastic in 2 ozs. rectified spirit: triturate with powdered gum ammoniac 1 dram, until perfectly incorporated. 2. The use of the different kinds is a matter of custom only. Fahrenheit believed his zero to be the point of absolute cold, an idea which is now known to be widely erroneous.

J. A. F. will find the following composition good for journal boxes: Copper, 24 lbs.; tin, 24 lbs.; and antimony, 8 lbs. Melt the copper first, then add the tin and lastly the antimony. It should be first run into ingots, then melted and cast in the form required for the boxes.

J. W. and other querists for books on atmospheric electricity will find the subject treated in any good text book on physics. Lyon's "Treatise on Lightning Conductors," and Phin's "Lightning Rods, and How to Construct them," will probably be useful to you. See our advertising columns for bookseller's addresses.

A. N. asks: How can I solder broken chisels, files, etc., together? A. Clean off the ends by filing, and upon the joint lay a thin strip of sheet brass. Cover the part with a paste of clay, free from sand, to the thickness of one inch, the coating being 4 inches along on each side of the joint. Dry slowly near a fire, and then heat to a white heat in a blast, whereby the clay vitrifies. Cool very slowly, and knock off the clay.

J. P. asks: 1. Is silver coin pure enough to plate with without refining? 2. What is rotten stone? 3. What is Bath brick, such as electroplaters use for cleaning work? 4. What is water of Ayr stone? 5. Is there anything that I can put upon the surface of glass to render it a conductor, so that I can plate it? I want the surface of the plate when removed from the glass to be as smooth as the glass upon which I have plated. I can use plumbago, but I am afraid it will make the surface rough. 6. What is the best composition for brass gun barrels? A. 1. Yes. 2. It is a native polishing powder, composed of infusorial silica. 3. A polishing material, made in England, and sold in bricks. 4. A kind of hone, found in Scotland. 5. Try gilding, as described on p. 250, vol. 29. 6. Copper 90·5 parts, tin 9·5 parts.

Smoker can mend his amber mouthpiece by smearing the parts which are to be united with linseed oil, hold the oiled part carefully over a hot cinder or a gas light, being careful to cover up all the rest of the object loosely with paper; when the oiled parts become a little sticky, press them together, and hold them so till nearly cold. Only that part where the edges are to be united must be warmed, and even that with care, lest the form or polish of the other parts should be disturbed: the part joined generally requires a little repolishing.

J. H. S. asks: What are the dimensions of the interspaces of the wire gauze used in the manufacture of Davy's safety lamps? A. One thirty-sixth of an inch = 1,296 holes to the square inch.

J. H. M. says: 1. I think there is some mistake in the answer to Y.E.'s question on horse power of an engine in No. 22 of your vol. 29. You say 63·6×70×63×2×16÷33000×12. I think the last sign should be to divide. 2. Two of us are in dispute about the horse power of an engine. Diameter of cylinder is 16 inches, length 30 inches, working at 100 revolutions per minute with a pressure of 50 lbs. to the square inch. We leave it to your decision. A. 1. In the example mentioned, the stroke of the engine is taken in inches. These must be reduced to feet—or, in other words, the fraction must be divided by 12. It is a general principle that multiplying the denominator of a fraction by any number has the effect of dividing the fraction by that number. 2. If an engine should give an indicator diagram in accordance with the data sent, the indicated horse power would be 201·06×30×5×100÷33,000 = 91$\frac{1}{11}$.

F. M. H. asks: How can I find a rule for the heating surface and horse power of steam boilers? I think the following is incorrect; it applies to tubular boilers only: Two thirds the circumference of all the tubes, multiplied by the length, will give the heating surface, and every 15 square feet of heating surface will be equivalent to one horse power. A. The practice of different makers varies so much, and there are so many ways of rating the horse power of a boiler, that we cannot give you any definite rule.

W. A. C.—We cannot answer your question as to pumps in a coal mine from the above *data*. Under some circumstances, we think that the pressure in the 3 inch pipe would be increased.

E. M. J. asks: How can I gild a small wooden flower stand? How can some portions be made bright, the rest remaining a dead color? A. Rub the wood smooth and prime with glue size, then put on two coats of oil paint and one of flatting. Smooth over, when dry, with wash leather. Put on gold size; and when it is sticky to the touch, it is ready for the leaf, which put on carefully and dab with cotton wool. A thin transparent glazing can be used to deaden the gold in places.

W. T. says: 1. We have in our factory a sectional boiler which has been in constant use for about three and a half years. The capacity is fifty horse power, and it is at all times under a pressure of ninety-five pounds. It has commenced to leak badly in three or four of its connections. The leaks are directly over the fire. What can I use to stop them? 2. Is there any danger of rods which run through tubes rusting off? If so, what would be the effect? 3. Do you consider such boilers perfectly safe? 4. We blow off once a week. Should the boiler be examined internally? If so, how often? The water is taken from a natural reservoir, and is both soft and clean. A. 1. Probably it will be necessary to replace the leaky sections, though possibly you may be able to face them off. It would be well for you to address the makers of the boiler. 2. We scarcely think there is much danger. 3. As safe as any similarly constructed boiler. 4. We should suppose that once every three or four months would be quite sufficient.

A. L. A. asks: Are not portable engines much more liable to get out of order and give trouble than stationary, and does not the heat from the boiler cause unequal expansion of the different parts of the work, hence loosening the joints, etc.? A. If proper provision is made for expansion, we think that portable engines can be made quite as durable as stationary engines. It is true, however, that there are difficulties in the arrangement, and hence some builders place their portable engines on a separate support.

C. D. C. asks: 1. Where can I get a very powerful magnet? 2. Are magnets durable? 3. Which has more attraction for a magnet, a point or a flat surface? 4. What is the farthest distance at which a powerful magnet will lift an ounce weight? 5. What difference is there between a magnet and a lodestone? A. 1. From any good maker of philosophical apparatus. 2. Yes, with proper usage. 3. We suppose the magnet will attract either with equal intensity. 4. This could only be determined by experiment for any particular case. 5. One is a piece of metal which has received its magnetic force from another magnet, the other is iron ore which has magnetic polarity.

W. asks: What is the rule for computing the number of tuns of ice contained in an ice house, the length, width, and depth being given? A. Calculate the number of cubic feet in the ice house, and divide by thirty-five. This gives the number of tuns of ice that the building will contain if it be closely packed.

G. A. R. asks: How do you determine the diameter of a steam chest for a roll valve engine? 2. Is the roll valve more economical than the slide valve? 3. Do you know of a good book which treats on the roll valve? A. 1. It will depend upon the width of ports and travel of valve. You will find dimensions of these laid down in any standard work on valve motion. 2. We do not know of any tests which have been made to determine the relative merits of the two styles of valves. 3. None that treats of this, specially.

G. O. asks: Has any account of the government boiler tests at Sandy Hook and at Pittsburgh been published? A. The experiments are incomplete, and probably the detailed report will not be rendered until further tests have been made.

H. P. asks: Is there any known substance that can be put in with hard cast iron when it is being melted, to make a soft casting? 2. Has there been a rotary steam engine invented that is practicable? If not, would the invention be of use? A. 1. We think not. 2. Yes, but there is great room for improvement, and the invention would be of great value.

E. B. asks: 1. By what means was accurate alignment of the Hoosac tunnel attained? 2. It is proposed to cut a tunnel between England and France. As the opposite shores are not in sight of each other, will you explain the manner of making the survey? A. 1. We suppose it was done by running the line accurately across the mountain, and then transferring it by means of angles or bearings. 2. In running a line between England and France, if stations suitable for triangulation could not be found, it might be necessary to use buoys, or some similar device, to locate intermediate stations.

G. S. T. says: I wish to line steam boxes, for steaming stave bolts, with some material, such as roofing felt or sail canvas, and would like to know if there is any kind of paint which I can apply to it which will resist the action of the steam. I use both exhaust and live steam. There will be a lining of boards to protect the canvas from injury. A. Perhaps marine glue will answer. In reply to your other question, see our advertising columns.

W. T. T. asks: What is the greatest power that can be attained by a steel spring, as used in clocks, watches, etc., and the greatest number of evolutions that could be applied to such power, before it becomes exhausted? A. This question is too indefinite. Springs could probably be made of any desired power.

W. L. asks: In burning the cotton dust produced in extracting wool from cotton fabrics, which is impregnated with oil and sulphuric acid, will the fumes have a tendency to harm the tubes of a boiler? A. We suppose this is a matter that could be best determined by experiment.

C. McC. asks: 1. If I place my engine on either center, should the eccentrics be set so that the lead will be the same when the link is shipped to back, as it is when shipped to go ahead? 2. Is tallow the best lubricant for cylinders, if steam is made from alkaline water? 3. What is the best packing for expansion joints? 4. What is the best thing to put on an engine to keep it from rusting when shut down for winter, it being exposed to damp? 5. What will wrought iron pipe expand in length in proportion to size? A. 1. This cannot generally be done. 2. Probably oil would be better. 3. Hemp is commonly employed. 4. A mixture of white lead and tallow. 5. Wrought iron expands about $\frac{1}{81}$ of its length, on being heated from 32° to 212° Fahrenheit.

J. B. H. asks: 1. What is peat and how can it be distinguished? 2. If anything without fertilizing properties is spread on the ground, why does it improve the soil? A. 1. Peat is a mineral fuel, retaining many of the characteristics of its original vegetable structure. 2. Nearly all organic matter furnishes nourishment to the plants by its decomposition, and hence cannot be said to be without fertilizing properties.

J. S. S. asks: Has a locomotive any greater pressure or weight upon the track when exerting her full force to bring a train into motion, than she has when standing at rest? A. No.

J. N. P. says: Auchincloss, on page 33, gives the description of setting the eccentric to cut off at an angle of 150°, and says: "By carrying the crank to the 150° position we observe that the port, S, remains open a distance, C," (which, by the way, is wrong; for the valve ought to be as near the seat, C, on the right as it is now to the bridge on the left) "and the most ready means of closing it is to lengthen the valve face the distance, l." Further on, he says: "But on referring to Fig. 6, it is clear that no such addition can be made without necessitating a change also in the eccentric location, for it would render the admission 30° too late. Hence we must unkey the eccentric, advance it 30°, and refasten it." It is to this that I want to call your attention. He says he wants a cut-off at a crank angle of 150°; and he carries the crank to that angle and lengthens the valve face whatever it lacks of meeting the seat. I would ask if he has not got the cut-off where he wants it to be without advancing the eccentric at all. I am not taking the admission into consideration. Now if he moves his eccentric forward 30°, in order to get the admission at the proper time, does he not get a cut-off 30° before the crank gets to 150°? It certainly seems so to me. A. We have looked over the passage in question, and the author's statement appears to be correct. Make a model with two pieces of paper and try the rule.

J. P. Jr. asks: How is plumbago applied as a lubricant on wood? A. Mix it with tallow.

G. S. asks: 1. Is there any work on hydraulics wherein I can find rules to calculate the diameter of pump plungers, suited to any diameter of water ram? I have a 20 inch ram and a 1 inch plunger; will the same plunger do for a 3 inch ram, keeping the pumps at the same rate of speed, etc.? 2. I have had occasion to change a large ram for a small one, and I do not get half the power. Why is this so? A. 1. You will find the subject treated under the head of hydrostatics in any good work on physics. See our advertising columns for bookseller's addresses. 2. Your small ram is not so powerful as the large one because the pressure, other things being equal, depends on the relative sizes of the ram and plunger.

G. M. W. says: I have a twelve horse power portable boiler, which I use for heating purposes and running a small engine. I only run the engine once a week. Do you think that, if I brick the furnace up with one layer of fire brick inside, I could keep steam up easier and keep the fire all night? A. You might keep up steam more economically.

J. H. F. says: I have two boilers 5×16 feet, each containing 39 four inch flues. The grates are 4 feet 7 inches in length. The water that supplies the boilers is heated by the exhaust steam from engines, passing through a heater and lime extractor, and then introduced into the front end of boilers. The latter are perfectly clean, and yet the plates over the fire bag down from 1 to 3 inches. They have bagged the same way when water was pumped into the mud drum. Boiler makers here do not seem to know the cause, and their opinions vary accordingly. One thinks the iron too thick (⅝); another that there is too much heating surface, not allowing the water to circulate freely; and another, who thinks his opinion infallible, claims that the oil from the engine causes all the trouble. What is your opinion as to the cause? Do you think oil would have any such effect? A. If there is no scale deposited on the crown sheet, we imagine that the bracing is insufficient.

J. & T. G. say: In burning bricks, we find that, by mixing anthracite coal dust with the clay, the bricks are liable to swell, many of them presenting the appearance of large doughnuts. When broken, they have a dark gray metallic appearance, and are hard and brittle. It is usually said, when this happens, that the fire has been pushed too rapidly. No doubt this is true to a certain extent; for if the fires are kept low until bricks are well heated, there is little or no danger of it happening. But it is not absolutely true, because bricks that are in immediate contact with the fire will usually escape this swelling, while others, farthest removed from it, will swell. We think that it is caused by want of a sufficient amount of air to support combustion properly. Our chief reason for this view is that much of the coal in these swelled bricks is not consumed, and yet their appearance indicates that the inside of them must have been in a molten state. They look as if the material of which they are composed had been in a boiling condition, so great has been the heat generated within them. Moreover, in the individual brick, the swelling is greatest at the center; and when set close together, they will swell, while all the bricks around them that are set with space between them will be free from swelling. This exists in various degrees in in some bricks; it can hardly be seen in others, as above stated. The discoloration of bricks where they rest on each other, is another objection to the use of coal dust Hence we cannot use it in our front or pressed bricks. Those parts of the brick where they rest on each other will be of a purple color, while the rest of the brick will be red. What we want to know is: Can any substance be mixed with the coal dust and clay that will supply the place of oxygen for the coal dust, so that it will not swell or discolor the bricks while burning, or cause them to become discolored when exposed to the weather? When we speak of coal dust, we mean the refuse of the coal yards. If this were ground fine, we think it would lessen the liability to swelling, but would not prevent the discoloration. A. The swelling of your bricks is due probably either to the escape of moisture in the baking, or the gases generated in the combustion of the coal. The red color of bricks is due to the red oxide of iron, which is formed during the intense heat of the kiln Where they press against one another the heat is less intense, and not sufficient to cause complete decomposition of the iron compound and the formation of the red oxide. This is the cause of the purplish color where the bricks were in contact in the kiln. There is no cheaper source of oxygen than the atmosphere. Grinding the coal very fine might obviate some of the difficulty.

F. E. says: 1. I have two small rooms, about 14x15 feet, which are separated by a closet 5 feet wide. I keep in each room a stove, but I think that perhaps one stove could heat the two rooms, if a drum could be put in one room and the pipe from the stove in the other room be led through into the drum. I wish the drum to be as near the floor as a stove. In order to do this, the pipe from the top of the stove must be lowered about 2 feet, instead of going upwards. Would the draft of the stove be the same? Would the escaping heat of the stove sufficiently heat the room by going through that drum? Is so, of what size and how constructed should the drum be? 2. By what kind of an attachment or connection, can a lever and a wheel be so arranged that, by turning the wheel always in one direction, the lever would move up and down? 1. Probably such an arrangement would answer. Any reliable stove dealer will fit it up for you. 2. A cam and yoke would effect the desired object.

T. D. Q. Jr. says: 1. I have usually cleaned my miniature engines with emery cloth: what is the best way to clean out any emery which may have fallen into the cylinder, steam ways, etc? I usually pour alcohol or benzine to kill the oil, and then let running water through. Is there anything better? 2. Is water, charged with oxalic acid until it will take up no more, too strong for cleaning brass? 3. Is it necessary to clean and polish with whiting, or will leather alone be sufficient? 4. What is about the proportion of muriatic acid and alum in gold coloring? Will the brass require to be washed with water when colored with muriatic acid and alum? 5. What kind of bronzing can be easily applied to brass like that used on gas fixtures? 6. What kind of gilt wash can be easily and firmly applied to iron? 7. What coloring or lacquer is applied to the brass snaps and window raisers which we see in cars, and which look as if they were taken out after being cast, the rough edges filed off, and then dipped into something? What is a good lacquer to apply to brass, already polished, to keep it bright? A. 1. Take them apart, cover the pieces with oil, and wipe clean. 2. We think not. 3. The addition of whiting will probably be an improvement. 4 6, 7. You will find directions about gold coloring, on page 43, current volume. 8. 5. See p.331, vol. 29. Dissolve 8 ounces of seed lac in one quart of alcohol.

J. B. G. asks: In an article in your No. 24, volume 29, on the ventilation of the Senate Chamber, it is said that the exhaust apparatus takes the air from the upper part of the room, which is contrary to the philosophy entertained by many in this part of the country. Indeed, all the buildings I know of have the air taken from openings in the floor, the idea of course being that the vitiated air, being heavier than pure air, is more easily taken from the floor; besides the warm air from the registers, rising immediately to the upper part of the room, is not drawn out before having performed its work. What is your opinion? A. It is impossible to give a general rule as to where the foul air of a room is to be drawn off, independently of all other considerations. The air may be heated before it is forced into the room; and if a current is established from the bottom, there is no objection to removing the air from the top.

H. J. asks: 1. Is it common for persons to lose their memory by fright? I was blown up on a steamboat some years ago, but not injured, and have not had my memory since. 2. I was on board a boat and she was blown up; I am positive there was a full supply of water in her boilers. There were some persons standing within 8 feet of the boilers, and some immediately over them. Some 25 were killed and wounded, yet no one was scalded. What became of the water? A. 1. Such action occasionally takes place, but we hardly think that it is common. 2. The hole may have blown out in the lower part of the boiler.

B. F. T. asks: Has any person a patent on the application of paper pulp to heated surfaces, as nonconductors of heat, as on steam boilers, pipes, etc? 2. Can india rubber be dissolved in water so as to be mixed with other substances and become dry and hard? A. 1. We believe there is such a patent. 2. No.

R. H. asks: How is paper prepared so that, when written with an iron stylus, the electrical current will discolor it? A. Dip common printing paper in a solution of ferrocyanide of potassium. The passage of electricity through the paper, thus prepared, makes blue marks, the salt being converted into Prussian blue.

N. O. J. asks: 1. If I have a round timber, out of which I want to cut a rectangular beam, how can I find the sides of the beam expressed in function of the diameter of the timber? 2. What is the formula for the expansion of water by heat? 3. In Ganot's "Physics" there are the following formulas, by Dr. Matthiessen: $Vt = 1 - 0{\cdot}00000253\,(t-4) + 0{\cdot}0000085389\,(t-4)^2 + 0{\cdot}0000000{\cdot}7173(t-4)^3$ between 4° and 32° C., and $Vt = 0{\cdot}999925 + 0{\cdot}00000547\,24\,t^2 + 0{\cdot}0000000126\,t^3$ between 33° and 100° C.; but it is not explained what is meant by V and t. A. The side of the greatest square that can be inscribed in a circle is 0·707 of the diameter. 2. The first formula may be thus translated: If we call the volume of a given weight of water, at a temperature of 4° centigrade, unity, the volume at any other temperature, t, between 4° and 32°, is equal to one, minus 0,00000·253 times the given temperature, diminished by 4, + 0·0000008389 times the square of the given temperature, less 4, + 0·000000007173 times the cube of the given temperature, less 4. The translation of the other formula is similar. Vt in the first member of the equation means the volume at the temperature, t, which temperature is to be substituted for t in the second member.

A. R. asks: How small in size did Newton say that our globe could be pressed or squeezed to free it of its molecules? A. We do not remember that Newton ever made such a statement.

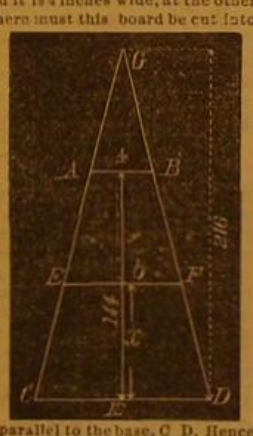
P. P. asks: What is the principal difficulty in running band saws in ordinary lumber mills, and why are they not used more extensively? Is not the power required to drive a band saw less in proportion to width of kerf, the rate of sawing being the same? A. The band saw is comparatively a recent invention, but already it is being largely introduced. We do not think there are any great difficulties in its use. The power required is not less than with a properly arranged saw of the ordinary kind.

W. R. G. asks: 1. In calculating the power of water wheels, is there anything allowed for friction? A. Generally, yes.

R. S. F. asks: Is there such a thing as a recording dynamometer for use on steam engines, water wheels, and other motive powers? A. We believe there are such machines, but they have not come into general use on account of their complications, expenses, etc. The field is still open for the inventor who can produce a better device.

D. M. L. asks: 1. How is the monthly average of a thermometer obtained? On some days, at the hour of observation, it indicates above zero and at others below. 2. What is the mean average of the following record for ten days: 1st, 10° above; 2d, 8° above: 3d, 3° below; 4th, 4° below; 5th, 2° above; 6th, 5° above; 7th, 1° below; 8th, 8° below; 9th, 9° above; 10th, 4° above. A. 1. Take the algebraic sum of the readings, and divide by the number. 2. The mean temperature, as shown by these observations, $= (10° + 8° - 3° - 4° + 2° + 5° - 1° - 8° + 9° + 4°) \div 10 = 2{\cdot}2°$ above zero.

D. M. A. says: A board is 12 feet long and 1 inch thick. At one end it is 4 inches wide, at the other end 12 inches wide. Where must this board be cut into between the ends so as to have the same amount of lumber in each piece? A. Let A B C D represent the board. Suppose the problem to be solved, and that E F, or b, drawn at a distance, x, above C D, divides the board into two equal parts. It is thus required to find the value of x. It is easy to see that if the sides of the board were continued upwards until they met, as at G, the length would be 18 feet. We then have a triangle, G C D, with a line, E F, parallel to the base, C D. Hence 216 : 216 − x :: 12 : b, and $b = 12 - \frac{x}{18}$. Having found the top and hight of the piece, E F C D, we can calculate the area, in terms of the sides, and make this equal to half the area of the board. Then $\left(12 - \frac{x}{36}\right) \times x = 576$. Solving this equation for x, we find the hight above C D, at which the board must be cut, is 4 feet, 7 inches, nearly.



A. L. asks: Can you tell me how to stain hard wood in imitation of ornamental kinds? A. This subject is a very complicated one, and a full description of the processes would occupy too much of our space. Your best course would be to obtain a good book on the subject.

M. asks: What is a good metal that can be melted over a charcoal fire, be easily dressed up for making models, and will be quite stiff when cold? I have been using lead, tin, and antimony, but think that perhaps I do not get right proportions. A. Increase the lead to make the alloy softer, and *vice versa*.

A. B. P. asks: How can I make an amalgam for an electrical machine? A. Take zinc 1 oz., grain tin 1 oz., mercury (hot) 3 ozs. Stir well together, and powder when cold. Mix with a little tallow.

A. Z. B. asks: 1. What treatment should paint brushes be subjected to so as to keep them from getting hard and matted together after using? A. Soak in linseed oil and wash the oil out with soapy water.

F. A. R. asks: 1. What are the meanings of the terms, golden number, solar cycle, and epact, found in an almanac? 2. How is coal tar made? 3. How is apple whisky made? A. 1. The cycle is the period of time after which the same days of the week recur on the same days of the year. This period of the sun (solar cycle) is 28 years, and of the moon's changes 19 solar years. The golden number is the number of the year in the cycle. To find the golden number add 1 to the date, and divide by 19. The remainder is the number. Thus 1874 + 1 = 1875 ÷ 19 = 98 and 13 remainder. The epact is the moon's age at the end of the year; and if we take the epact corresponding to the year's golden number, we can obtain the dates of the new moons, and thence the dates of Easter, Lent, and Whitsuntide. 2. It is a by-product of the distillation of coal, as in making illuminating gas. 3. By the distillation of cider.

L. J. O. asks: What are the use and meaning of the marks over certain letters, as in Professor Orton's letters? A. The marks you refer to are the accents on the letter n (ñ) in the Spanish language. The effect of the accent is the same as if g were before the n in French, as in Bologna (pronounced Bolonya). Thus in Spanish, cañon is pronounced canyon, peñas, penyas, etc.

J. S. asks: What has become of the boiler testing board? "I sent them a safety valve for trial, and would like to know what they are doing." A. They have suspended operations until spring.

S. H. asks: On what day of the week did September 21, 1817, fall? A. Sunday.

P. asks: How can I remove oil from a printed paper? A. Apply powdered French chalk, made into a paste with water and allowed to dry on the spot.

F. A. B. sends the following recipe for blackboard composition; Alcohol, ½ gallon; gum shellac, ½ lb.; lampblack, ½ lb.; Venice turpentine, 4 ozs. Dissolve the shellac in the alcohol, and add the other ingredients. If it gets too thick, thin with alcohol.

P. P. P. asks: 1. What makes a person shake when having a chill? 2. What causes the cold and hot feelings during a chill? 3. When death is caused by a congestive chill, what part of the body is so affected that it causes death?—G. B. asks: 1. How is the deep scarlet color of the geranium flower produced on wax? 2. How can I prevent white wax from turning yellow?—S. B. R. asks: How can I dye furs?—A. G. P. asks: Which is the largest pump in the world?—J. S. asks: Can any one estimate the annual cost of the artificial light used all over the world?—T. F. asks: How can I remove the smell of cod liver and castor oils?—J. H. asks: How is a hygroscope (a paper altering its color with the humidity of the atmosphere) made?—G. P. Z. asks: Is there any remedy that will remove hair from any part of the face, without leaving any permanent mark or signs of its application?

COMMUNICATIONS RECEIVED.

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

On a Specific for St. Vitus' Dance. By A. S

On the Phonetic System. By A. F. S.

On a Mathematical Discovery. By T. F.

On Ventilating a Church. By R.

On a Theory of the Origin of the Solar System. By C. D.

On Lunar Acceleration. By J. H.

On Minerals in Tennessee. By A. D. M.

On Steam Power in Philadelphia. By L. B. Jr.

Also enquiries from the following:

T. R. & S.—C. T.—J. J. K.—J. D. B.—G. W. B.—S. M. D.—Z. T. D.

Correspondents in different parts of the country ask: Who makes the best breech-loading shot gun? Who sells machines for making buttonhead rivets? Who makes kilns for burning charcoal? Who makes millstone dressing machines? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

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January 6, 1874,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

27,781.—CLOTHES WRINGER.—E. Dickerman. March 25.
27,821.—EXTENSION LADDER.—G. B. Mickle. March 25.
27,822.—HARVESTER.—L. C. Reese. March 25.
27,829.—SWEEPING MACHINE.—R. A. Smith. March 25.
27,846.—BELTING.—H. Underwood. March 25.
27,852.—HARVESTING MACHINE.—B. F. Witt. March 25.
27,855.—NIGHT LIGHT REFLECTOR.—J. Wyberd. March 25.
27,860.—LOOM.—J. C. Cooke. March 25.
27,866.—COTTON BALE TIE.—J. McMurtry. March 25.
28,105.—FRUIT BASKET.—J. K. Park. April 15.
28,175.—SCARRARD FROG.—W. Hoffman. April 22.
28,488.—RATTAN MACHINE.—L. Hull. May 13.

EXTENSIONS GRANTED.

26,785.—WASTE COCK.—G. W. Robertson.
26,822.—TENON CUTTING TOOL.—L. A. Dole.

DESIGNS PATENTED.

7,083.—STAND AND BRACKET MATS.—L. Bushnell, New Bedford, Mass.
7,084.—CHILDREN'S CARRIAGES.—J. L. Brown, Boston, M.
7,085 to 7,092.—CARPETS.—R. R. Campbell, Lowell, Mass.
7,093.—KNOB AND ROSE.—W. Gorman, New Britain, Conn.
7,094 to 7,096.—CARPETS.—A. Heald, Philadelphia, Pa.
7,097.—TEA CANISTER.—E. Huntington, New York city.
7,098.—CARPET.—C. S. Lilley, Lowell, Mass.
7,099.—CARPET.—D. McNair, Lowell, Mass.
7,100.—HANDLE SOCKET.—J. S. Ray, East Haddam, Conn.
7,101 & 7,102.—TYPES.—R. Smith, Philadelphia, Pa.
7,103.—HANDLE SOCKET.—W. M. Smith, West Meriden, Ct.

TRADE MARKS REGISTERED.

1,591.—GAGE TUBES.—E. H. Ashcroft, Boston, Mass.
1,592.—WHISKY.—Kryder & Co., Philadelphia, Pa.
1,593.—SHOES.—T. C. Wales & Co., Boston, Mass.
1,594.—SAWS.—Wheeler & Co., Middletown, N. Y.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
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On filing a Disclaimer	$10
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On application for Design (7 years)	$15
On application for Design (14 years)	$30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, JANUARY 13 TO JANUARY 20, 1873.

2,997.—T. Piper, Hamilton, Ontario. Improvements on treadles for sewing machines, called "Piper's Improved Spring Clutch for Sewing Machines." Jan. 13, 1874.

2,998.—I. Grant, Shubenacadie, Hants county, Nova Scotia. Improvements in machine for cleaning tracks from snow, called "Grant's Snow Plow." Jan. 13, 1874.

2,999.—W. W. Byan, S. Grose and M. Harper, all of Whitby, Ontario county, Ontario. Machine for manufacturing the slats of door and window weather blind rolling slats with metal clip bearings, called "Byan's Blind Slat Machine." Jan. 13, 1874.

3,000.—W. W. Byan, S. Grose and M. Harper, all of Whitby, Ontario county, Ontario. Improvements on window and door weather blinds, called "Byan's Improved Venetian Blind." Jan. 13, 1874.

3,001.—T. Ney, Glenallen, Wellington county, Ontario, assignee of J. Small, of same place. Improvements on horse pokes, called "Ney's Improved Dexter Horse Poke." Jan. 13, 1874.

3,002.—W. Sellers, Haverhill, Essex county, Ontario. Improvements on lawn mowers, called "Sellers' Lawn Mower." Jan. 13, 1874.

3,003.—A. Rodgers, Muskegon, Muskegon county, Mich., U. S. Improvements on machine for sawing laths. Jan. 13, 1874.

3,004.—A. Rodgers, Muskegon, Muskegon county, Mich., U. S. Improvements in balance cranks, called "Rodgers' Balance Crank." Jan. 13, 1874.

3,005.—A. Rodgers, Muskegon, Muskegon county, Mich., U. S. Machine for canting logs, called "Rodgers' Log Canting Machine." Jan. 13, 1874.

3,006.—I. S. Adams, West Roxbury, Norfolk county, Mass., U. S., assignee of I. Collcott, of same place. Improvements on kaleidoscopes, called "The Adams' Automatic Kaleidoscopes." Jan. 13, 1874.

3,007.—M. Hine and H. P. Dibble, New Haven, New Haven, Conn., U. S. Improvements on machine for threading bolts, called "Hine and Dibble's Bolt Threader." Jan. 13, 1874.

3,008.—T. F. Conklin, Fond du Lac, Fond du Lac county, Wis., U. S. Improvements on the construction of smoke stacks of locomotive engines and other engines, called "Conklin's Fuel Economizer and Spark Arrester." Jan. 13, 1874.

3,009.—I. Parkyn, Montreal, P. Q. Manufacture of bran for transportation, storage, etc., called "Parkyn's Compressed Bran." Jan. 13, 1874.

3,010.—D. T. Casement, Painesville, Lake county, O., U. S. Improvements on pressure regulator for fluids, called "Casement's Pressure Regulator for Fluids." Jan. 13, 1874.

3,011.—S. McGee, Madison, Morris county, N. J., U. S. Improvement on oil preserving nave on box for axles in combination with his improved axle to be used in metallic hubs or bearers, called "McGee's Hub for Vehicles." Jan. 13, 1874.

3,012.—J. Hally, Valleyfield, Beauharnois, P. Q. Apparatus for the excavation of peat, called "The Ironclad Peat Excavator." Jan. 13, 1874.

3,013.—F. Culhan, Widder Station, Bosanquet, Lambton county, Ontario. Improvements on machinery for operating semaphore signals, called "Culhan's Patent Semaphore Signal." Jan. 13, 1874.

3,014.—B. Barter, Faribault, Rice county, Minn., U. S. Improvements on machine for dressing flour, called "Barter's Flour Dressing Machine." Jan. 20, 1874.

3,015.—J. Davis, J. Armstrong and D. Davis, all of Pittston, Luzerne county, Pa. Improvements on process for tanning, called "Davis and Armstrong's Tanning Process." Jan. 20, 1874.

3,016.—E. E. Brewer, Douglas, York county, Ontario. Improvements in churns, called "Favorite Churn" Jan. 20, 1874.

3,017.—J. Slater and H. S. Blatt, Sandy Lake, Mercer county, Pa., U. S. Improvements on sled brakes, called "Slater's Sled Brake." Jan. 20, 1874.

3,018.—A. D. McMaster, Rochester, Monroe county, N. Y., U. S. Improvements on stove boards, called "McMaster's Improved Stove Board." Jan. 20, 1874.

3,019.—W. H. Rogers, New London, Conn., U. S., and D. L. Caven, Stratford, Ontario. Combined check nut, called "Roger's and Caven's Combined Check Nut." Jan. 20, 1874.

3,020.—W. Wilson, Hamilton, Ontario. Improvement in railway switches, called "Wilson's Safety Railway Switch." Jan. 20, 1874.

3,021.—N. Johnson, Jasper, Steuben county, N. Y., U. S. Improvements in insertable saw teeth, called "Johnson's Insertable Saw Teeth." Jan. 20, 1874.

3,022.—C. Kinney, London, Ontario. Improvements on nut lock, called "Kinney's Lock Nut." Jan. 20, 1874.

3,023.—R. Elmsley, Toronto, Ontario. Indicator for registering the time occupied in playing games upon billiard tables, called "Elmsley's Billiard Marker." Jan. 20, 1874.

3,024.—D. T. Casement, Painesville, Lake county, O., U. S. Improvements on a method of burning fuel and generating steam, called "Casement's Method of Burning Fuel and Generating Steam." Jan. 20, 1874.

3,025.—J. W. Bookwalter, Springfield, Clark county, O., U. S. Improvements on steam generators, called "Bookwalter's Steam Generator." Jan. 20, 1874.

3,026.—L. Cote, St. Hyacinthe, P. Q. Improvements on a machine for forming boot and shoe stiffeners, called "Cote's Rotary Machine for Shaping Stiffeners." Jan. 20, 1874.

3,027.—F. H. Whitman, Harrison, Cumberland county, Me., U. S., assignee of E. H. Woodsum, South Boston, Mass., U. S. Improved block fitting machine, called "Woodsum's Block Fitting Machine." Jan. 20, 1870.

3,028.—J. Hewitt, Grimsby, Lincoln county, Ontario. Improvements on sad and fluting iron, called "Queen Iron." Jan. 20, 1874.

3,029.—I. Hewitt, Grimsby, Lincoln county, Ontario. Improvements on fluting plates, called "Universal Iron." Jan. 20, 1874.

3,030.—I. Hewitt, Grimsby, Lincoln county, Ontario, Improvements on glossing and fluting iron, called "Home Iron." Jan. 20, 1874.

3,031.—H. Frank, Pittsburgh, Allegheny county, Pa., U. S. Improvements on regenerative gas furnaces, called "Frank's Regenerative Furnaces." Jan. 20, 1874.

3,032.—H. Frank, Pittsburgh, Allegheny county, Pa., U. S. Improvements on file for constructing furnaces, called "Frank's Furnace Brick." Jan. 20, 1874.

3,033.—H. Frank, Pittsburgh, Allegheny county, Pa., U. S. Improvements on hot blast ovens, called "Frank's Hot Blast." Jan. 20, 1874.

3,034.—I. P. Magoon and H. Fairbanks, St. Johnsbury, Caledonia county, Vt., U. S. Improvements on locomotive feed water heater, called "Magoon's Improved Locomotive Feed Water Heater." Jan. 20, 1874.

3,035.—J. West and O. M. Parker, Creston, Union county, Iowa, U. S. Improvement on steam bell ringers, called "West's and Parker's Steam Bell Ringer." Jan. 20, 1874.

3,036.—E. R. Whitney, Bolton, Broome county, P. Q. Improvement on veneer cutting machine, called "Whitney's Improved Veneer Cutter." Jan. 20, 1874.

3,037.—E. R. Whitney, Bolton, Broome county, P. Q. Improvements on printing types or blocks, called "Whitney's Glass Type." Jan. 20, 1874.

3,038.—J. McCullum, Nepean, Carleton county, Ontario. Improvement on potato diggers, called "McCullum's Improved Potato Digger." Jan. 20, 1874.

3,039.—W. S. Hunter and C. C. Colby, Stanstead, Stanstead county, P. Q. Improvement on the manufacture of paper, called "Hunter's Fabricated Paper." Jan. 20, 1874.

3,040.—L. Scofield and J. B. Wait, Grand Haven, Ottawa county, Michigan, U. S. Improvement on ironing tables, called "Scofield's Ironing Table." Jan. 20, 1874.

3,041.—J. W. Whitney, Cleveland, Cayuhoga county, O. U. S. Improvement on shoulder braces and suspenders combined, called "Whitney's Shoulder Brace and Suspender Combined." Jan. 20, 1874.

3,042.—I. Hewitt, Grimsby, Lincoln county, Ontario. Improvements on smoothing band, glossing and fluting iron, called "King Iron." Jan. 20, 1874.

3,043.—I. Lyons, Chippawa, Welland county, Ontario. Improvements in metal plates for wearing on the heels of boots and shoes, called "Lyons' Reversible Heel Plate." Jan. 20, 1874.

3,044.—J. Morris, Liverpool, England. Improvements on machines for finishing printed sheets of paper, called "Morris' Printers' Finishing Machine." Jan. 20, 1874.

3,045.—W. Corris, Rochester, Monroe county, N. Y., U. S. Improvements on carriage hubs, called "Corris' Improved Carriage Hub." Jan. 20, 1874.

3,046.—C. Wolf, Rochester, Monroe county, N. Y., U. S. Improvements on bedstead fastenings, called "Wolf's Improved Bedstead Fastening." Jan. 20, 1874.

3,047.—P. Huerne, San Francisco, San Francisco county, Cal., U. S. Improvement on a Water Filter, called "Huerne's Water Filter." Jan. 20, 1874.

3,048.—P. Bruce, Aurora, York county, Ontario. Improvement in the construction of buildings, called "Bruce's Improved Construction of Buildings." Jan. 20, 1874.

3,049.—J. J. Howell, Brantford, Ontario. Improvement on outside shutter hinge, called "Howell's Outside Shutter Hinge." Jan. 21, 1874.

3,050.—N. Clement, *dit La Riviere*, Montreal. *Ameliorations aux ferrures pour pendre les portes de chars*, called "*Ferrures Ameliorees de Noel Clement, dit La Riviere pour Portes de Chars.*" Improvements in iron fixtures for hanging doors to cars, called "Noel Clement *dit La Riviere's* Fixtures for Hanging Doors to Cars." Jan 21, 1874.

3,051.—E. A. Goodes, Philadelphia, Pa., U. S. Improvements on sewing machines, called "The Goodes' Fancy Stitch Sewing Machine." Jan. 21, 1874.

3,052.—L. S. Johnson & M. G. Johnson, Cortland, Cortland county, N. Y., U. S. Improvements on articles of food, to wit: the preparation of beef for table use, called "Johnson's Beef Compound." Jan. 21, 1874.

3,053.—E. P. Richardson, Lawrence, Essex county, Mass. Improvement in machine for sewing hose, called "Richardson's Improved Machine for Sewing Hose." Jan. 21, 1874.

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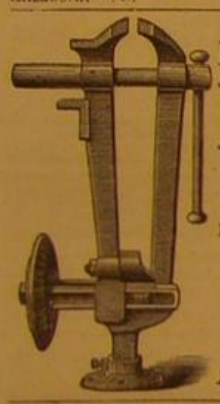

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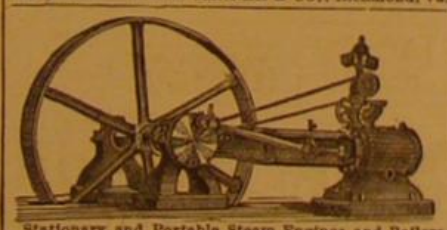

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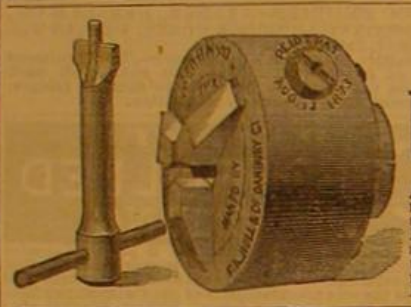

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