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IN ADVANCE.

THE EAST RIVER BRIDGE.

The rapid progress made during recent months, in the construction of the great suspension bridge between New York and Brooklyn, indicates that no very extended time will elapse before its stupendous network will have bound the sister cities together. The fine engraving which we present below affords an excellent idea of how the grand work will look when it is finished, to an observer stationed in front

of the new ferry house on the Brooklyn side. Each of the massive towers is to be 278 feet high, eight feet less than Trinity church steeple. Two hundred and twenty-five feet of the Brooklyn tower, and about one hundred and twenty feet of that on the New York shore, are thus far completed. Work on the anchorage located in James street, Brooklyn, at about 800 feet from the tower, is advancing and the masonry is already several feet above the ground. The New

York anchorage will probably be commenced early in the spring. At the present time but a small force of workmen are employed, as the prevalent cold weather interferes with continuous labor upon the masonry.

The length of the great span, which is represented across the river, is 1,600 feet, and its approach on the New York side is to start from near the City Hall, and ascend gradually the intervening distance of 238 feet. The elevation of the



center of the bridge above the water will be 180 feet, and the roadway 80 feet wide. The view from the latter will be one of the finest in the world, both in beauty and extent.

It is believed that this thoroughfare will, when completed, command an independent travel equally great with the existing ferries, which will retain their own business; and that even these two immense means of communication will ere long be insufficient to accommodate the rapidly increasing demands of the multitudes yet to line the shores, so that the building of submarine tunnels will eventually become a necessity.

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INDICATING STEAM ENGINES.

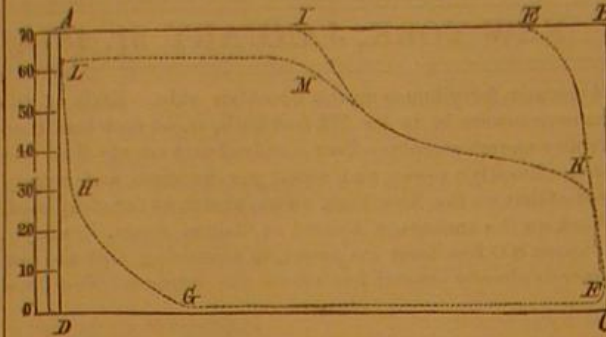
Questions from our correspondents, in relation to the power of steam engines, recur so often that we think it may be timely to devote some space to their general consideration. We are frequently asked what is the power of an engine of a given size, making a certain number of revolutions per minute, with a specified steam pressure. Most of our readers know that the horse power of an engine is equal to the mean effective pressure on the piston, in pounds, multiplied by the piston speed in feet per minute, and divided by 33,000. Hence those who send us queries of the nature mentioned above doubtless think that it will be an easy matter for us to determine the horse power. As a matter of fact, we suppose that very few of the answers we have rendered to these questions have been anything but rough approximation to the true solutions. We have been careful to hint as much, in working out each example; but perhaps it may be well to give a more definite explanation.

Referring to the rule for finding the horse power of an engine, it will be seen that the mean effective pressure on the piston is required. This, we believe, has never been sent to us. True, our correspondents give the pressure in boiler per steam gage, and sometimes mention the point at which the steam is cut off in the cylinder. They have never sent, however, to the best of our recollection, the amount of back pressure resisting the movement of the piston, the initial pressure of steam in the cylinder, the amount of steam and exhaust lead, and the point at which the exhaust cushion commences. We will endeavor to show how all these things affect the solution of the problem.

The following, taken from a back number of our paper, is a fair specimen of questions of this character: "What horse power has an engine of the following dimensions: Cylinder 9x16 inches, working at 63 revolutions per minute, with a pressure of 70 pounds to the square inch?"

Accepting our correspondent's statement as the correct one, we can readily represent the action of steam in the cylinder during the stroke by a rectangle, A B C D. Thus, while the piston is being acted upon by the steam, A B, 70 pounds above D C, on any convenient scale, will represent the steam or pressure line, the point, A, corresponding, to the commencement of the piston's stroke, and the point, B, to the end. When the piston has reached the end of the stroke, the exhaust valve opens, and the line, B C, represents the fall of the pressure from 70 pounds, per gage, to nothing. The piston then returns, and C D represents the pressure during exhaust. When the piston has returned to the starting point, the steam valve is opened, and the line, D A, shows that the pressure rises to 70 pounds again, for the next stroke. This, we say, is the graphical representation of the action of the steam, according to the data given by our correspondent. Our readers do not need to be told, however, that it is not usual to work engines in this manner, as it produces violent strains, and is far from being economical. The piston moves to and fro, and requires, of course,

to be brought to rest before the direction can be changed. If it worked as represented in our diagram, the shocks that would occur each time the motion was reversed would be very severe. It is probable, then, that the exhaust valve commences to open, as at E, before the end of the stroke is reached. There will probably be some back pressure also, so that the exhaust line will be represented by F G, instead of C D. It is quite likely that the exhaust valve closes before the end of the return stroke, so that a cushion line, G H, is produced, and that the steam valve is set with lead, so



that it opens at H. It would appear, then, that perhaps a figure, A E F G H, may represent the action of the steam, instead of A B C D, and it will be seen that, if such is the case, the mean effective pressure per square inch will be considerably less than 70 pounds.

In the majority of engines, the steam valve has some lap, so that it is closed before the end of the stroke, and the steam is allowed to expand, producing an expansion curve, I K, on our graphical representation, in which case, A I K F G H, giving a still smaller mean effective pressure, will represent the action of the steam.

In general, the initial pressure of steam in the cylinder is less than the boiler pressure, from which it would appear that L M K F G H more probably represents the state of affairs, in our correspondent's engine, than A B C D.

Those who have followed us thus far will doubtless accept our original statement, that the best answers we can give to questions like the one under consideration will only be rough approximations. But it is possible to arrive at the truth, in cases of this kind. If a gage were attached to the cylinder, it would mark the varying pressure at different points of the stroke. The steam engine indicator performs this office admirably, recording the pressure at each successive point, thus forming essentially such a diagram as we have already represented. This is the only accurate method by which the mean effective pressure of the steam can be ascertained. The indicator shows, in addition, many things of interest and importance which our space will not permit us to consider at present. The importance of knowing the true power developed by an engine must be apparent to all our readers, and we need not enlarge upon it. The test of an engine with the indicator frequently discloses derangements and imperfections that could not be otherwise discovered. The indicator, however, is an exceedingly delicate instrument, and must be carefully manipulated to secure accurate results; hence tests of this character should be made by those who are truly experts.

We can readily perceive, from the numerous inquiries on the subject, that many of our readers realize the importance of knowing the power developed by their engines, and perhaps our remarks will be useful in showing them the means by which they can have their questions correctly answered.

DR. HENRY DRAPER'S RECENT DISCOVERIES IN SPECTROSCOPIC ANALYSIS.

In a recent number of the *American Journal of Science and Art*, there is an important paper on "Diffraction Spectrum-Photography," by Dr. Henry Draper, which is being reprinted in England, France, Germany, and Italy. Until quite recently, spectroscopic investigation has been conducted almost entirely by the aid of prisms; but the prismatic spectrum is far less suitable for exact inquiry than the diffraction spectrum produced by a grating of fine lines ruled on glass; because in the former case, the red end of the spectrum is contracted and the violet dilated, while in the latter the rays are presented in the true order of their wave lengths. Moreover, no two prisms give spectra that are exactly alike in the amount of this contraction and dilatation; and hence various observer have great difficulty in comparing their results together.

As all diffraction spectra are exactly alike, and, to use a technical term, they have no "irrationality of dispersion," it seems singular that prismatic observation has not long since been abandoned. But gratings have hitherto been very difficult to obtain; and, besides the spectrum produced by a grating is much fainter than that by a prism. Our distinguished townsman Mr. Rutherford has, however, constructed a machine which makes better rulings on glass than any heretofore produced, and it is with one of these that Dr. Draper has worked.

The main object of the present research has been to furnish a photographic map of the violet and ultra violet rays of the spectrum, to serve as a permanent reference map and to complete the great work of Angström, whose "*Spectra Normal du Soleil*" is unquestionably the most laborious and exact contribution to spectrum analysis made in recent times. Angström has, up to the present, failed in his attempts to do the very thing that Dr. Draper has succeeded in accomplishing so thoroughly. In many respects, indeed, Dr. Draper's work at the violet end of the spectrum exceeds in exactness that of Angström in the visible regions, as is well seen in the part between the fixed lines G and H, where the

map of one observer overlaps that of the other. Many lines that Angström has omitted or misplaced are corrected by Draper; and in one place alone, 17 new lines are added.

By an ingenious device, the wave lengths of rays entirely invisible have been measured with an exactness exceeding that of those that are visible; and errors have actually been detected in some of the fundamental wave lengths of the standard test books.

The photograph which accompanies the paper is of beautiful definition and large size. If the whole solar spectrum were presented on the same scale, it would be about 10 feet long.

GAIL BORDEN.

Upon a shady knoll in the beautiful cemetery of Woodlawn near this city, in full view from the windows of the New Haven railway cars, stands a substantial family monument in granite, which at one time attracted the attention of the passing traveller by the peculiarity of the emblem by which it was surmounted. That emblem consisted of a milk can, cut of solid stone, representing in form and size the familiar utensil so commonly used here in our streets, for the transport and sale of milk. This was the chosen monument by which our friend Gail Borden, inventor and originator of the great industrial product now known as Condensed Milk, had desired to mark his last earthly resting place, when he should have been gathered to his fathers. The desire thus expressed was honorably characteristic of the individual. He was emphatically a man of the people; and although in process of time, by the success of his most excellent and useful inventions, he acquired great wealth, he ever regarded himself as one of the humblest of workers in the family of man; and the possession of riches never led him to put on aristocratic airs. He despised that sort of pride which makes some people ashamed of the humble origin of their progenitors, and wished that, in this respect, the very stones above his grave should teach a useful lesson. Surely they commemorate the truth that honest industry is better than titled birth.

Gail Borden was born in Norwich, N. Y., in 1801, his parents being New England people. In 1829 he removed to Texas, where he was always esteemed for his probity of character and earnest efforts for the public good. He was at one time a United States Surveyor, afterwards a newspaper conductor, then the Collector of the port of Galveston, when Texas was known as the Lone Star Republic. In 1853 he succeeded in producing Condensed Milk, as a permanent article of manufacture, which he accomplished by concentrating in vacuo. We well remember his early efforts in this direction, which were most persevering and arduous. The Patent Office for a long time refused to issue his patents, but finally yielded, and the new manufacture then received its first impulse. Mr. Borden's patents were obtained through this office. For over twenty years we enjoyed the uninterrupted friendship of this truly excellent man. Genial, kind-hearted, benevolent, his life was a most useful one and his memory blessed. He died on the 11th of January, 1874, aged 73 years, at Bordenville, Texas, where he had established a large factory for the production of concentrated foods, chiefly meats. He leaves a large and interesting family. His remains are to be brought to Woodlawn. The trustees of the cemetery have removed the granite milk can from his monument, as an infringement upon the rules of fastidious taste. But no one can blot out the record of his noble life, nor the splendid results of his long and useful labors.

Gail Borden was the inventor and first introducer, in merchantable form, of Condensed Milk. He may be said to have supplied the world with a new article of food. Medical authorities give it the highest place in the nourishment of the sick and the young. He lived to see the use of this most valuable product extended over the globe. Nearly all civilized nations, following his patterns and instructions, now have their factories for the supply of the article, which, as the years roll on, will be still more highly valued, while the work of its production will employ the industry of thousands of people. Gail Borden may be truly styled a benefactor of his race.

STEAM ON CANALS.

We have before us a report of the trial trips of the steam canal boat, William Newman, through the Erie canal, in the seasons of 1872 and 1873. We have also the report of Engineer Greene on the trials of 1872. His report on the trials of last season has not yet been received. The figures in these reports only confirm what has frequently before been shown by experiment: that it is not sufficient to put a good engine into a boat to ensure success; the boat must also be modeled to suit the engine. The ordinary canal boat, built in the form of a box in order to obtain great carrying capacity, cannot be propelled directly by steam power as cheaply as it can be towed. Thus it appears, from Mr. Greene's report, that the engine of the William Newman, in the trip made in 1872, developed an average indicated horse power varying between 30 and 35, to produce an average speed of 2.727 miles per hour. This same speed could probably have been effected by towing with from 3 to 4 horses, and it is easy to see that the steam power is much the most expensive. The power developed in the trial trip in 1873 is not stated; but from the data given, it probably exceeded 50 horse power, to produce a speed of 3.691 miles per hour. It is because such slow speeds are required on the canals that the inefficiency of this mode of propulsion is not at once apparent. If an ocean steamer only utilized about 12 per cent of the power developed by the engines, probably the vessel would not be large enough to contain the machinery that would be required to produce a speed of 14 knots an hour. It appears to

us that the prize offered by the Legislature has stimulated invention in the wrong direction. It is scarcely possible to give a canal boat the form required for a steamer, without seriously reducing the carrying capacity. It would seem better, then, to place the engine on a separate vessel, which could be properly designed, letting this vessel take the place of horses to tow the canal boats.

A YEAR'S INVENTIVE PROGRESS.

The following schedule indicates the progress of invention in the United States during the year 1873, and consists in a list of the number of patents issued by the United States Patent Office to citizens of each State and Territory, to foreign subjects, and to members of the Army and Revenue-Marine Service. The table also shows the relative ratio of patents obtained to the population of each political division:

To citizens of	Number of patents.	Population: one to each	To citizens of	Number of patents.	Population: one to each
Alabama.....	43	23,185	Montana Territory..	3	6,831
Arkansas.....	11	44,041	Nebraska.....	28	4,393
California.....	251	2,232	Nevada.....	19	2,299
Colorado Territory..	8	4,983	New Hampshire.....	127	2,306
Connecticut.....	62	860	New Jersey.....	614	1,473
Dakota Territory..	30	7,090	New Mexico Ter....	1	91,774
Delaware.....	43	31,250	New York.....	2,826	1,531
District of Columbia	109	1,208	North Carolina.....	58	18,472
Florida.....	8	20,468	Ohio.....	832	8,203
Georgia.....	53	22,541	Oregon.....	19	4,785
Idaho Territory.....	1	14,929	Pennsylvania.....	1,659	2,143
Illinois.....	844	3,009	Rhode Island.....	197	1,301
Indiana.....	311	5,404	South Carolina.....	25	28,224
Iowa.....	246	4,854	Tennessee.....	105	11,868
Kansas.....	75	4,820	Texas.....	109	7,510
Kentucky.....	114	11,590	United States Army	8	8,750
Louisiana.....	86	7,515	U. S. Rev. Marine..	1	10,848
Maine.....	139	4,510	Vermont.....	8	9,914
Maryland.....	191	4,088	Virginia.....	76	16,120
Massachusetts.....	1,379	1,037	Washington Ter....	6	3,992
Michigan.....	356	3,326	West Virginia.....	42	10,524
Minnesota.....	110	3,997	Wisconsin.....	217	4,890
Mississippi.....	55	15,053	Wyoming Territory	2	4,559
Missouri.....	288	8,975			

Total to citizens of the United States 12,371, or one patent to each 3,116 of the population. Total granted to citizens of foreign countries, 491. Grand total, 12,862, which includes reissues and designs, but not trade marks.

With reference to sectional distribution, the foregoing schedule reduces itself to the following:

Middle States.....	5,119	Territories and the District of Columbia.....	140
Western States.....	3,538	United States Army and Revenue Marine.....	9
North Eastern States.....	3,521		
Southern States.....	1,374		
Pacific States (Cal. & Oregon).....	270		
Total.....	12,371		

By inspection of these data it is shown that, as compared with the number of patents issued in 1872, the aggregate of 1873 is smaller by 140 for citizens the United States, and by 31 for dwellers abroad. Considering numbers merely, New York stands first, with 2,826, and New Mexico and Idaho last, with but 1 each. Connecticut, however, fairly heads the list, as relative population must also enter into the calculation; her ratio is 1 patent to every 860 souls. The District of Columbia is next, with a proportion of 1 to every 1,208. Arizona and Alaska are entirely unrepresented, and New Mexico has but a single patentee for 1873 among her whole population of 91,874. The Southern States still present a low average; and in proportion to their population, fall behind all the rest of the country. A slight increase of four patents is noticeable over the aggregate of 1872. The list of States which show an increase over last year includes the following: Alabama, California, Iowa, Kansas, Louisiana, Maryland, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, North Carolina, Pennsylvania, Tennessee, Texas, and Washington Territory, also the United States Army. The remainder have decreased or else remained stationary.

It may be added as an interesting and perhaps significant fact that, in the four political divisions in which the least number of patents have been granted, the circulation of the SCIENTIFIC AMERICAN is the smallest; and in other States, the ratio increases in proportion to the circulation of this paper among its inhabitants. Thus in New York, the State having the largest number of patents, our patrons exceed those of any other State; while in New England and the West, whence, as the statistics show the most inventions emanate, the SCIENTIFIC AMERICAN has the greatest circulation.

PROCEEDINGS OF THE PATENT CONVENTION.

The Patent Convention, the call for which was recently alluded to in our columns, began its labors at Washington, on January 15th. Some two hundred delegates were present. The following is the organization:

President, J. M. Thacher; Vice Presidents, N. B. Graham, W. W. Wood, H. E. Towle, Miles Pratt; Secretaries, J. C. Bancroft, W. C. McIntyre, and C. F. Stansbury. The resolution of the Vienna Congress, declaring that the protection of inventors should be guaranteed by the laws of all civilized nations, for the reasons given, was adopted. The second resolution, declaring that an effective and useful patent law should be based on the principles set forth was modified by adding:

"A patent should be granted for a term of seventeen years, with a privilege of extension for the benefit of the inventor or his heirs for a further term of at least seven years." Several resolutions were offered touching upon the inventors' interests and the patent laws of the United States. C. M. Parks presented a resolution, recommending that Congress make use of the surplus fund of the Patent Office, now in the United States Treasury, for the erection of a suitable building in Judiciary square, for the exhibition of the models of inventions. This fund is stated to be over \$1,000,000. Further reports in our next.

VERMIN KILLER.—Doré patents the use of the following mixture for the destruction of bugs, fleas, ants, etc., and their eggs: Bisulphide of carbon 80 parts; petroleum essence 20 parts. The liquid is to be applied to furniture, etc., by a brush.

PSYCHIC FORCE.

Some time ago we published an account by Dr. William Crookes, the distinguished scientist of London, editor of the *Quarterly Journal of Science, Chemical News*, etc., of his experiments and observations in connection with the phenomena of Spiritualism. We gave engravings of the special apparatus designed by Dr. Crookes for the purpose of detecting the fraud, if any existed, and of measuring the actual degree of invisible force that was alleged to be exerted. This apparatus consisted of a self-registering balance, which, to the surprise of the Doctor and his friends, went down before their eyes and registered a considerable degree of force, when the medium, Home, simply pointed his finger at the balance, but did not touch it. The force thus manifested was designated psychic force by Dr. Crookes. The publications of the learned Doctor attracted much attention at the time, and subjected him to the severest ridicule among the learned. He however promised to pursue the investigations and publish further reports. This he has now done, and announces his intention to give still further details. Most of the wonders which he now describes took place in his own house, and were witnessed by parties of friends, all of whom give concurrent testimony as to the actuality of what is stated.

These spiritual performances seem to involve something which, as Lord Dundreary would say, "no fellow can find out," and the Psychic Force theory of Dr. Crookes is perhaps as acceptable as any, while none of them tell us how the thing is done. None of the doings here recited surpass the tricks of the magician Hartz of this city—the box trick, for example, recently mentioned by us. The box is first tied up and sealed, then entirely folded up within a canvas sheet, and again tied and sealed, all being done by a committee of detectives before the audience. Into this box, in the course of two minutes time, Hartz then introduces a man, without disturbing the canvas envelope, ropes or seals. Other equally curious performances might be mentioned, which, we believe, have never been explained.

A correspondent of the New York *Tribune* says that, in classifying the various phenomena that have presented themselves to him in the course of his enquiries, Mr. Crookes refers, first, to the movement of heavy bodies, with contact but without mechanical exertion. This he states to be one of the simplest forms of the phenomena observed, varying in degrees from a quivering or vibration of the room and its contents to the actual rising into the air of a heavy body when the hands of the medium are placed upon it. These movements, and indeed most of the phenomena, are preceded by a peculiar cold air, sometimes amounting to a decided wind, sufficient to blow a sheet of paper about the room and to cause a lowering of the thermometer by several degrees.

The second class manifested themselves as percussive and other allied sounds; sometimes as delicate ticks; sometimes a cascade of sharp sounds, as from an induction coil in full work; detonations in the air, sounds like scratching, twittering as of a bird, etc. The third class of phenomena consists in the alteration of the weight of bodies. The fourth class, namely, the movement of heavy substances when at a distance from the medium, he has seen in many instances. An empty arm chair, at his request, moved to where he was sitting, and then slowly back again, a distance of about three feet. He has seen the movement of a heavy table, and chairs turned with their backs to the table, about a foot and a half off, each occupant kneeling on his chair, with hands resting on the back, but not touching the table. The fifth class is that of the raising of tables and chairs off the ground, without contact with any person.

The sixth class is that of the levitation of human beings, which has occurred in four instances in his presence. He has seen Mr. Home raised completely from the floor of his room in several instances. The accumulated testimony, establishing Mr. Home's levitations, Mr. Crookes considers overwhelming; and he thinks it greatly to be desired that some person, whose evidence will be accepted as conclusive by the scientific world, shall seriously and patiently examine these alleged facts. The seventh class of phenomena consists in the moving of various small articles without contact with any person, which he has very frequently observed, and where there could be no suspicion of trickery. He thinks that when he is in his own dining room, seated in one part of the room, with a number of persons keenly watching the medium, the latter could not, by any trickery, make an accordion play in his (Mr. Crookes') own hands, when the keys are held downward, or cause the same accordion to float about the room, playing all the time. He thinks it impossible to introduce machinery which shall wave a knot in a handkerchief and place it in a remote corner of the room; sound notes on a distant piano; cause a card plate to float about the room; raise a water bottle and tumbler from the table; make a coral necklace rise on end; move about a fan so as to fan the company, or set in motion a pendulum when enclosed in a glass case firmly cemented to the wall. The eighth class is that of luminous appearances. He has seen a solid self-luminous body, of the size and nearly the shape of a turkey's egg, float noiselessly about the room, being visible for more than ten minutes, and striking the table three times, with a sound like that of a hard solid body, before fading away. He has seen a self-luminous crystalline body placed in his hand by a hand which did not belong to any person in the room, and a luminous cloud floating upward to a picture. In the daylight he has seen a luminous cloud hover over a heliotrope on a side table, break off a sprig, and carry the sprig to a lady; and on several occasions he has seen a similar luminous cloud visibly condense to the form of a hand, and carry about small objects.

The ninth class consists of the appearance of hands, either self-luminous or visible by ordinary light. In one case a small hand rose up from an opening in the dining table and gave him a flower. The hands and fingers do not always appear solid and life-like, sometimes indeed seeming like a nebulous cloud, partly condensed in the form of a hand. He has more than once seen first an object move, then a luminous cloud appear to form about it, and lastly, the cloud condense into shape and become a perfectly formed hand. At this stage it was visible to all present. Sometimes it was life-like and graceful, the fingers moving and the flesh apparently as human as that of any person in the room. At the arm or wrist it became hazy, and passed off into a luminous cloud. To the touch the hand appeared sometimes icy cold and dead, at others warm, grasping his own with the firm pressure of an old friend. In one instance he retained one of these hands in his own, firmly resolved not to let it escape. There was no struggle, no effort to get loose, but it gradually seemed to resolve itself into vapor, and faded in that manner from his grasp. The tenth class comprised direct writing, exhibited sometimes in darkness, sometimes in light, sometimes without any apparent agency, at others through the medium of a hand. The eleventh class embraces the rarest phenomena, namely, those of phantom forms and faces, which he witnessed in a few instances only. The twelfth class covers phenomena that seem to point to the agency of an exterior intelligence, other than that of the medium or some person in the room. Although the hypothesis has been suggested that the medium is the source of this intelligence, by those who think they see in this an explanation of many of the facts, yet Mr. Crookes has reason to believe that, in certain instances at least, they result from the agency of an outside intelligence not belonging to any human being present.

SCIENTIFIC AND PRACTICAL INFORMATION.

EXTRACTION OF QUICKSILVER AT NEW ALMADEN, CAL.

The mineral is treated as at Idria, that is, it is roasted in great cylindrical furnaces in which it is placed between successive layers of wood. The mercurial vapors are condensed in walled chambers. The presence of time in the minerals greatly facilitates the disengagement of the metal. 4,400,000 pounds of mercury are thus yearly obtained at an expense of about \$27 per 100 lbs. At Almaden in Spain the annual product is 2,300,000 pounds, costing from \$90 to \$180 per 100 pounds.

A NEW USE FOR INFUSORIAL SILICA.

Infusorial silica has been strongly recommended for surrounding ice, ale, and beer cellars, fireproof safes, steam boilers, and powder magazines. A firm in Germany have recently made a series of experiments on a large scale, and they assert that the use of this earth has reduced the melting of ice in a cellar during the summer from 23,500 to 10,000 pounds. This material is not inflammable, and is not in the least affected by the hottest fire, and it prevents the entrance of rats and mice.

ELECTRIC DISCHARGES IN AIR.

By allowing a series of sparks from an electromagnetic induction apparatus to be discharged between platinum electrodes in perfectly dry air, Böttger noticed the formation of yellow vapors; and after the lapse of a few minutes, nitrous acid was recognized by the smell. If the sparks are passed through very moist atmospheric air, or if the sides of the glass vessel in which the experiment is conducted are moistened with distilled water, and some is allowed to collect at the bottom, no yellow vapors are formed; but the air, in a few minutes, acquires the characteristic odor of ozone, while in the water the presence of hyponitric acid can be detected. Iodide of potassium and starch paper, the test in common use for the detection of ozone in the air, is thus shown to be an untrustworthy reagent, as it must in many cases turn blue by nitrous acid. It behoves meteorologists, now that their attention has again been directed to these facts by Professor Böttger, to ascertain the exact condition of moisture under which the acid is produced, and to establish a process for the estimation of ozone, which shall be of absolute certainty.

Dr. Dotch of New York, who has for years occupied himself with the artificial generation of ozone, states that strips of paper saturated with the tincture of guaiacum afford a more sensitive and certain reagent or test for the presence of ozone than either the iodide of potassium and starch or paper containing protoxide of thallium; and that such an ozonometer can be relied on to show at least 10 gradations or shades.

SCIENTIFIC GHOULS.

The tomb of Petrarch was recently opened on the occasion of the centenary of the poet. The bones were found in quite perfect condition and of an amber color; other than which, we fail to note a single fact of the slightest interest in the long account of the ceremony published by a foreign contemporary. It strikes us that the spectacle of a body of scientists, calling themselves the "Academy of Bovolenta," breaking open the grave of a great man, pawing over his bones, and glaring at his dust through their eyeglasses, with apparently no other object than to make him share his coffin with a bottle contain' list of their names, must be refreshingly idiotic.

OZONIZED WATER.

Ramelsberg states that some of the substances sold as ozonized water owe their action to the presence of chlorine. Behrens and Jacobsen, on the other hand, find that some ozonized water is only a dilute solution of hypochlorous acid.

ELECTRO-PLATING BALANCE.

In the operation of electro-plating with gold or silver, a convenient means of regulating the exact amount of metal to be deposited on the articles is afforded by the automatic apparatus herewith illustrated, the invention of M. Roseleur, of Paris.

The objects are suspended in the bath, as shown, from one arm of a scale beam. A horizontal rod, fixed to the standard, supports at one extremity the soluble anode in the bath, and at the other connects with the positive pole of the battery. The opposite arm of the beam carries two scale pans, in the upper of which is placed a weight sufficient to produce equilibrium in the apparatus. In this position, the current does not pass, since the rods carrying the objects which form the negative pole are not in connection with the battery. But if in the lower pan of the balance are placed weights, corresponding to the amount of precious metal which it is desired shall be deposited, the equilibrium is destroyed. Necessarily the beam descends to the right, and, at the same time, plunges a metallic point into a cup filled with mercury which is in communication with the negative pole of the battery. The circuit being thus established, the operation progresses and continues without necessitating attention, until a quantity of the anode is deposited on the objects, of sufficient weight to cause equilibrium with the weights in the lower scale pan. The beam then becoming once more horizontal, the point is withdrawn from the mercury, the current is broken, and the action ceases.

Fecundation of Vegetables.

M. Beer announces that he has put Hooftbreuk's process for the fecundation of vegetables in successful practice in the Botanic Garden of Vienna.

This process, which, it would seem, achieves important results, consists simply in touching the extremity of the pistil (the stigma) of the flower, just before it blooms, with a pencil dipped in honey or, better still, with honey mingled with the pollen of the same plant on which the operation takes place. The process has succeeded admirably, it is stated, on fruit trees, and even on certain particular branches of trees which had never borne. On the portions thus treated, fruit formed in natural course, while other parts remained in their normal condition.

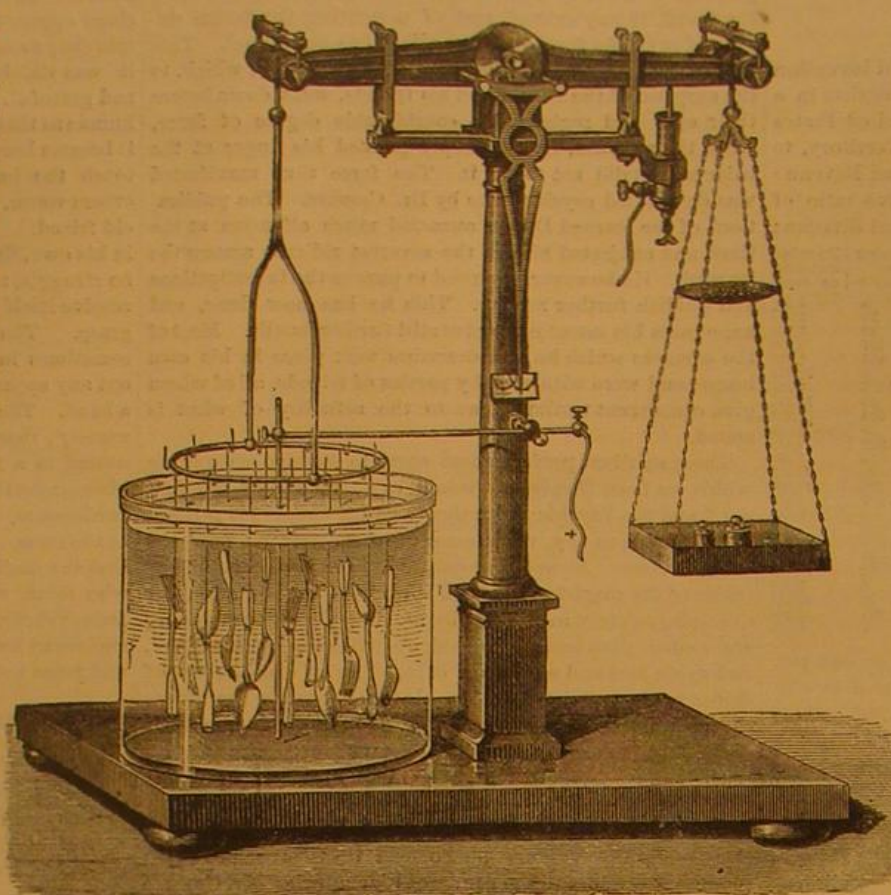
THE YAMA-MAI, OR OAK TREE SILKWORM.

The Yama-mai is a species of silkworm common in Japan, which derives its sustenance from the leaves of oak trees. It has recently been introduced in Europe with considerable success, and is readily acclimated. In Austria, it is stated that Baron Bretton has obtained from a third generation 4,000 cocoons and 300,000 eggs. Our illustration, for which we are indebted to *La Nature*, shows the worm fully developed and in its natural size, the young enlarged (1), and also the egg considerably magnified (2). The egg is round and slightly flattened in form, of a brown color, more or less dark, and is covered with black granules. Its greatest diameter is 0.09 inch, and its thickness varies according to the state of incubation. As soon as the young worm emerges, it rapidly attains, owing to its contact with the air, a size greater than it had in the egg. In a short time it grows to a length of 0.21 inch, as indicated in the lower portion of our engraving. The head, first thoracic segment, and the legs, are of a reddish mahogany tinge, without spots, and the rest of the body is a golden yellow, the color of gamboge. All these segments, from the second to the eleventh, are traversed by five longitudinal and sharply distinguished black lines. At the end of the first age, which lasts sixteen days, the caterpillar, after its change of skin, is 0.45 inch in length and of a subdued green color, slightly yellowish underneath. At the third age, after a second change of skin, the length increases to 1.1 inches, and the green color becomes brighter. Subsequently, during the fourth age, the body grows to 2.7 inches, and finally to 3.2 inches, when it becomes fully developed. The color at this period corresponds very closely to that of the leaves on which the worm feeds.

The caterpillar now begins its cocoon, uniting two leaves with several threads, which are, in turn, secured to branches. Its nourishment consists in the tenderest branches, contrary to the ordinary habits of other worms. Finally, it ejects a large drop of transparent liquid and begins to spin. The chrysalis, which is the sixth age of the caterpillar, is

contained in a closed cocoon. In order to open the latter, a reservoir of liquid is supplied at the rear end, which fluid has the property of softening the silk, so that the butterfly can readily break its way out. The cocoon strongly resembles that of the ordinary mulberry leaf silkworm, and the raw silk is readily mistaken for the work of the latter.

After a repose of fifty days the butterfly appears, and is

**ROSELEUR'S ELECTRO-PLATING BALANCE.**

of a bright golden yellow tinged with orange on the wings and body. The head is reddish, with light colored antennae, and the under sides of the wings are brown with gray spots.

The importation of silk worm eggs from Japan to Europe is now in extensive progress, and it is an interesting fact that, in place of transporting them *via* the Isthmus of Suez, as heretofore, the transcontinental route is preferred. The first shipment ever thus made, consisting of nine tons of eggs, valued at \$200,000, recently arrived at San Francisco, from Japan, and were dispatched in a freight car to the Atlantic coast for transmission to Milan, Italy. They were packed in leaves, in layers, in airtight tin boxes, which, in turn, were covered with matting. The interior of the car was kept below the freezing point, and light carefully excluded.

**THE YAMA-MAI OR OAK TREE SILKWORM.**

A variation of seven degrees of temperature, it is said, would be sufficient to kill the germs. By this route the time required to reach Milan, from Yokohama, is forty-two days; while, by the passage through the Indian Ocean and the Suez canal, it could be effected in thirty-nine days. The number of transshipments would be the same in both cases; but the American route passes through temperate latitudes, while the other would expose the eggs to the extreme of tropical heat.

A solution of pearl ash in water, thrown upon a fire, extinguishes it instantly; the proportion is 4 ounces, dissolved in hot water, and then poured into a bucket of common water,

Preservation of Vegetables by Drying.

The vegetable designed to be acted upon is first picked and washed, then placed in a large drying room, fitted with shelves and sieves for the spreading, shaking, and turning of the vegetables during the drying, and supplied with dry air at a temperature of from 95° to 100° Fah., and from which the moist air is discharged through the chimneys.

After this they are subjected to pressure, formed into tablets of a certain size, wrapped in tin foil, and then packed in tin cases for preservation and for sending away. To prepare this for use, it is only necessary to steep it for one hour in warm water, and then cook the same as fresh vegetables.

The following is an extract from the *Annals of the Central Horticultural Society of France*: "It appears that there is established in Paris, at No. 5 Rue Marboeuf, under the direction of Messrs. Chollet & Co., a manufactory for the preparation, by the process of M. Masson, of vegetable substances, with which the French navy and commercial marine are furnished. The Horticultural Committee pronounced the opinion that the desiccating process of M. Masson preserves vegetables without altering their constitution, and reduces them to a small bulk without impairing their flavor or nutritive qualities. M. Masson's processes are applied with entire success to most vegetables and several fruits. Thus all cabbages, spinach, parsley, cress, chervil, succory, and sorrel, are dried and pressed to a very small volume. It is the same with carrots, turnips, parsnips, celery, salsify, and viper's grass, which are cut in thin slices and into small pieces, to make Julienne. Cauliflowers, Brussels sprouts, asparagus, and string beans, in order to resume their natural appearance, should not be pressed. Potatoes are perfectly preserved in thin slices. Peas and beans, in a green state, are succeeded with very well. Lastly, various fruits, and especially apples and pears, in slices, are also dried, and keep perfectly."

Charcoal and Tar as a Surgical Dressing.

The London *Lancet* strongly recommends the use of a mixture of charcoal and coal tar, containing 33 per cent of the latter, in pulverized form, as a dressing for wounds. The powder exercises no irritative action, and is easily removed by lotions of cold water. The charcoal absorbs gases due to fermentation, coagulates the albumen, and prevents decomposition, in this respect materially aiding the action of the carbolic acid contained in the coal tar. For wounds which cannot bear the contact of the powder, 100 parts of pulverized coal tar are macerated for some hours in 400 parts of rather weak alcohol. The solution is said to be very efficacious.

Salt in Sickness.

Dr. Scudder remarks: "I am satisfied that I have seen patients die from deprivation of common salt during a protracted illness. It is a common impression that the food for the sick should not be seasoned, and whatever slop may be given, it is almost innocent of this essential of life. In the milk diet that I recommend in sickness, common salt is used freely, the milk being boiled and given hot. And if the patient cannot take the usual quantity in his food, I have it given in his drink.

This matter is so important that it cannot be repeated too often, or dwelt upon too long.

The most marked example of this want of common salt I have ever noticed has been in surgical disease, especially in open wounds. Without a supply of salt the tongue would become broad, pallid, puffy, with a tenacious pasty coat, the secretions arrested, the circulation feeble, the effusion at the point of injury serous, with an unpleasant watery pus, which at last becomes a mere sanies or ichor. A few days of a free allowance would change all this, and the patient get along well."

New Method of Preparing Aluminum.

The oxide of aluminum is first prepared by any of the processes now in use, either from kaolin or clay. It is then mixed with wood charcoal in the proportion of 40 parts charcoal to 100 of alumina, and heated to a red heat. While still hot, the mass is placed in retorts heated to dark redness, and chlorine gas is passed over it from a gasometer. The volatile chloride is condensed in the receiver, and afterwards decomposed by the battery; the chlorine which is set free is returned to the gasometer to be used over repeatedly. Garnier employed a magneto-electric apparatus.

HYDRAULIC ENGINEERING EXTRAORDINARY.

An iron conduit has recently been constructed which, according to the *Mining and Scientific Press*, sustains the greatest water pressure in the world, namely, 1,720 feet, or 750 pounds to the square inch. It carries the water supply of Virginia City and Gold Hill, Nevada, from Marlette lake, situated at an elevation of about 1,500 feet above the former town, over a valley seven miles in width, the sides of which are steep and precipitous, and through a route presenting engineering difficulties of unusually troublesome nature. The most awkward feature of the undertaking begins at an elevation of 1,885 feet above the track of the Virginia and Truckee railroad, at a point about two miles west of Lake View Toll House, and thence follows by an easterly course the crest of the spur from which it starts; crosses the valley, at the toll house referred to, and gradually ascends to its outlet end, making the entire length 37,100 feet. The water at present is taken from Dall's Creek by an 18 inch flume four miles long, to the inlet, or western end of the pipe. From the outlet or eastern end of the pipe, the water is conveyed through a flume of the same size, nine miles long, into Virginia and Gold Hill, where it connects with the present city pipe system. In the future the water from Marlette lake will be conveyed to the inlet of the pipe, and be added to the supply from Dall's Creek.

All the iron pipe used is coated, inside and out, with a mixture of asphaltum and coal tar, thoroughly boiled together, each separate piece being plunged and rolled about in a bath of this mixture for from seven to ten minutes before being shipped to its destination. The average diameter of the pipe is 11½ inches, and its entire weight about 700 tons. Nearly one million rivets were used to manufacture it, and some 35 tons of lead were required in making the joints. At the point of heaviest pressure the iron is No. 0 thick, and is hot riveted with five eighths inch rivets, there being a double row on the straight seam and a single row on the round seam. The pressure gradually decreases as the ground rises to the east and west, and the iron decreases in thickness from five sixteenths to one sixteenth of an inch toward both inlet and outlet. But on its course to the outlet, it having to cross a great many spurs and sags, the iron varies of course according to the pressure.

The inlet has a perpendicular elevation above the outlet of 465 feet, but just now only 300 feet is used, as this head will supply ten times as much as the two towns have heretofore had. This head carries into Virginia about 2,000,000 gallons every 24 hours; and by increasing the head to its fullest capacity, the supply can be increased to 2,350,000 gallons per day.

Fig. 1 will convey an idea of the country over which this undertaking was carried out as it shows the profile of the pipe. The remaining engravings represent various ingenious plans adopted in the construction.

Fig. 2 shows a lead joint in detail, said to be perfectly tight and safe. One of these joints is made between every two lengths of pipe of 26 feet 2 inches in length each; *a* is a wrought iron collar, always one sixteenth thicker than the thickness of iron in the respective pipe, leaving a play of three eighths of an inch between the inside of the collar and the outside of the pipe. The collar is five inches wide. *b* is the lead which is run in and caulked up tight from both sides three eighths inch thick; *c* is a nipple of No. 9 iron, riveted in one end of each pipe.

Fig. 3 shows the method of tightening leaky joints. At *A* is the clasp the application of which, for forcing back the lead where it works out on account of the longitudinal expansion and contraction of the pipes, is clearly evident. A clamp is used to keep the lead afterwards in place. Fig. 4 is the elbow used for making short curves in the line of the pipe around rocky bluffs, through sharp cañons, etc. At *B* are angle irons riveted on the pipe on the outside of the curves which, by means of iron straps, are connected with the corresponding angle iron on the next pipe. Fig. 4 shows the manner in which the pipes and elbows were strapped together, wherever the curve was sufficiently short to require this precaution against an outward movement. The iron strap is put on the outside of the curve to strengthen the pipe. Fig. 5 shows the self-acting air or vacuum valve, used at each high point on the line of pipe. When the water is on, the valve, *A*, is kept wide open; the small valve, *C*, is shut, while the valve, *B*, is shut by the

pressure. If any air accumulates in the pipe, on the elevation where this air cock is placed, it is occasionally blown off, by opening the cock, *C*. Should a break occur in the main pipe line at a point lower than the air cock, and within its district, the valve, *B*, falls down and admits the air into the main pipe so as to prevent a vacuum. Should the valve, *B*, get out of order, the valve, *A*, is shut, and the other valve, *B*, taken off and repaired. After a break on the main line is repaired, and the water let on again, the valve, *B*, being down or open, the air rushes

stone of Canopus is almost as perfect as on the day it left the sculptor's hand. This inscription was accidentally discovered about seven years since at the southwest corner of Lake Menzaleh, one of the lagoons on the coast of Egypt; and on the old Tanitic branch of the Nile are the ruins of San, the Zoan of Scripture. It is a place very little visited, being remote and not easy to reach. But to judge from the numerous obelisks, statues, and remains of temples still existing there—especially that of Rameses II.—San must once have been a place of much importance. About five years

ago a portion of the west wall of the temple of Rameses fell, and exposed the corner of a stone covered with Greek characters. In this state the inscription remained some time; at length its value was perceived, and it was removed to the Viceroy's museum at Boulac. It is of fine grained limestone, of light gray color, about seven feet high, two and a half feet broad, and the same deep, and bears three inscriptions, each on a separate side, in hieroglyphic, in Greek, and in the Hieratic (or Egyptian) characters.

It is a copy of a decree made in the ninth year of the reign of

Ptolemy III. (Ptolemy Euergetes) by the priests of Egypt, assembled in solemn conclave at the great temple of Osiris, in Canopus, which is called, in the decree, the "Temple of the Euergetæ."

Of this magnificent temple not a fragment now remains; indeed, its very position can only be conjectured. As to the town of Canopus itself, the visitor may trace its site by the high mounds of rubbish over it. It was built on a high promontory (a little to the west of the bay of Aboukir), about fourteen miles to the east of Alexandria. For many years past, nothing of its buildings above ground could be seen, and lately the very foundations have been dug up to provide stone for the fortresses now building on the spot, by order of the viceroy, Ismail Pasha.

The position of Canopus, on one of the large canals or mouths of the Nile, and on the highest ground to be found for many leagues along the coast, must have made it healthy and pleasant; and it was a very flourishing, but, at the same time, a most dissolute city. There was an open space, planted with trees, in front of the temple. On either side of it were altars belonging to the temples of the first order. After offering sacrifice upon these, and performing the necessary ceremonies for the apotheosis of Berenice, the assembled priests made the decree recorded on the stone.

One of the most remarkable points in this decree is the assigning Divine honors to a living person.

To the Egyptians, not the least esteemed prizes of their King's victory, were the images of their gods, which Cambyzes, the Persian conqueror of Egypt, had carried off; and in gratitude for their recovery, his subjects conferred upon Ptolemy the title of Euergetes (the benefactor).

It praises the King's great care for the sacred animals, especially for the worship of Apis and Mnævis.

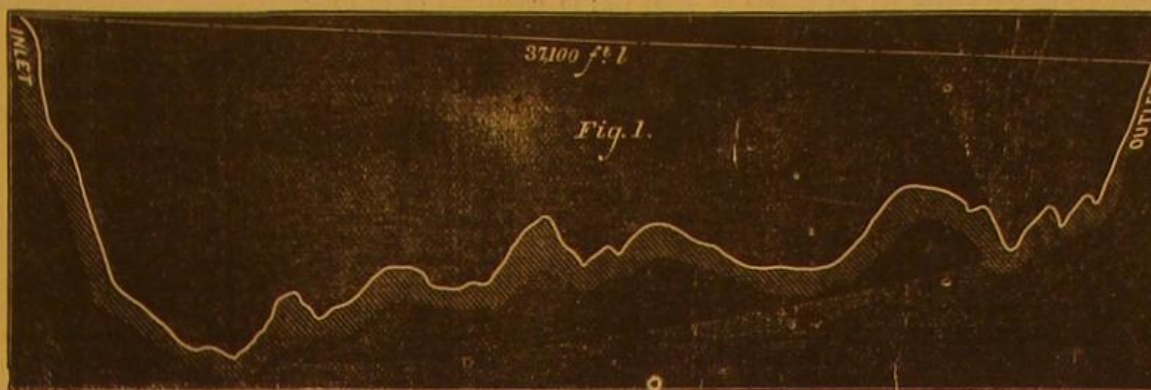
After setting forth the merits of their rulers, and proclaiming the extraordinary honors to be offered to them, the priests established a fifth priestly tribe, for no other apparent reason than because the king's birthday was the fifth of the month Dios. And then they pass on to the real business of the meeting.

In addition to the three monthly festivals of the Euergetæ, on the 5th, 9th, and 25th days, "decreed in a former proclamation," they ordain that a general public festival for five days shall be held every year, in honor of the Euergetæ, commencing on the day "on which the star of Isis rises," "which in the sacred writings is considered New Year's day." Now in this 9th year of the reign of Euergetes, the rising of "Sirius" occurred on the 1st of Payni (July 19th) and they decided that this 1st Payni, reckoned according to the common

computation, should be the first day of the Euergetan festival for four years. And that every fourth year, one additional day (besides the usual five intercalary days) should be kept as a public festival in honor of the rulers; thus introducing on every fourth year six instead of five intercalary days.

By the former of these two provisions, the priests introduced the Sirius year of 365½ days, in place of the common year of 365 days; and by the latter means, placing their reform under the protection of the monarch, they provided for the surplus six hours in every year, while by making the extra intercalary day a general festival, "both in the temples and throughout the whole country," they kept it in the people's memory.

The inscription does not inform us in what year this sixth intercalary day

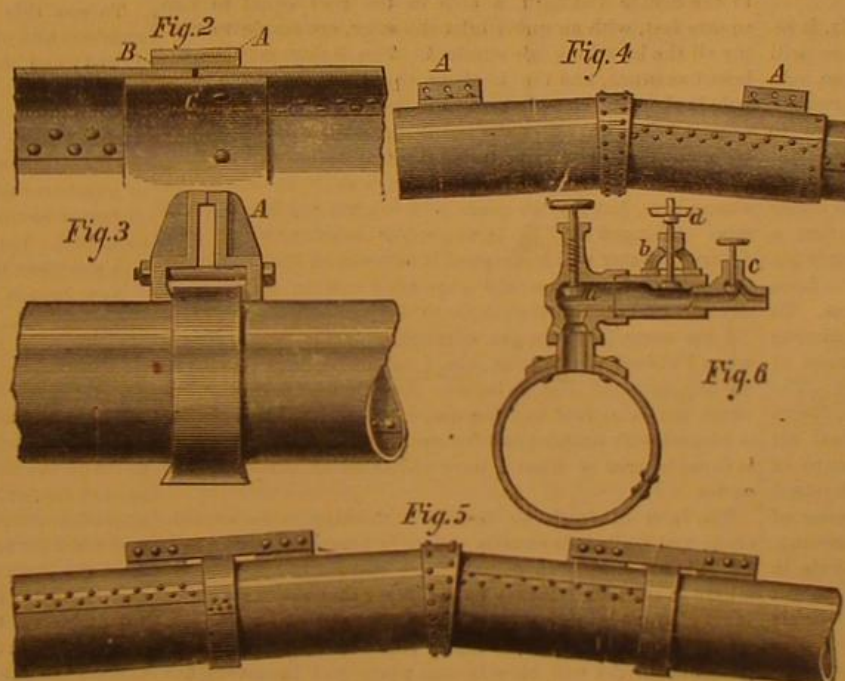


HYDRAULIC ENGINEERING IN NEVADA.

out at *B*, its stem being weighted by the weight, *D*, so as only to close when the water begins to escape.

From the time of commencing the manufacture of the pipe until the water ran into Virginia City, only five months elapsed, ending in August last. The Risdon Iron and Locomotive Works constructed the pipe, and the credit of the accomplishment of the undertaking is due to the engineer, Mr. Herman Schussler.

It is difficult to say which characteristic of our Western engineers is the more remarkable, the courage with which they attack the most stupendous and difficult problems, or



HYDRAULIC ENGINEERING IN NEVADA.

the promptitude and celerity with which they carry out their ideas. There is a great future for a country which produces such men and such achievements.

THE CANOPUS STONE.

Hitherto, almost the only guide for interpreting the hieroglyphics with which the monuments of Egypt are covered has been the Rosetta Stone, brought to England by the British army, after the expedition of 1801, and now in the British Museum.

But this is in every way inferior to the stone of Canopus. Half the lines it contains are incomplete, in consequence of the stone being broken and the fragments lost; and of the remaining lines many are defaced or illegible; whereas the



THE CANOPUS STONE.

was first to be kept, but it is natural to suppose that the new arrangement would be brought into force as soon as possible, that is, in the then existing year.

It is probable that this reform of the calendar was not effected without much opposition. It lasted through the reign of Ptolemy III. But in B. C. 229-1 he died; his son Ptolemy Philopater succeeded him, and then this sixth intercalary day was no longer kept. There seems to have been a reaction. Sirius the year was no longer observed, and the common year, of 365 days only, again prevailed. The old irregularities gradually became apparent; and the reform, which in consequence became necessary, was effected during the reign of Augustus in the year B. C. 26.

The latter part of the inscription recounts the honors decreed to the deified Princess Berenice. Her statue is to be placed in the great temple at Canopus, near the statue of Osiris. In all temples of the first and second orders, a statue of her, made of gold and adorned with jewels, is to be kept in the adytum; a four days' festival in all the temples is to be kept in memory of her, beginning on Tybi 17th (March 7th), the day on which the mourning for her ceased and her apotheosis was decreed. On the festivals of the other divinities her image is to be carried in the procession. Hymns are to be sung in her honor, and regular rations given to the maiden daughters of the priests who do service to her.

Lastly, the presiding high priest in each temple, and the temple scribes, are charged to set up in every temple of the first, second, and third order, and in the most conspicuous place, a copy of the decree, carved in Hieroglyphic, Egyptian and Greek characters, on a pillar of stone or brass.

Out of the many copies that must have existed, this is the only one hitherto discovered.

Correspondence.

The Ventilation of the United States Senate Chamber. To the Editor of the Scientific American:

Allow me a few words of comment on the article on ventilating the Senate Chamber in your issue of December 13, 1873:

Ventilation is a very simple thing; and to secure it, it requires only to be not prevented or obstructed. Nature will ventilate any apartment if it is only allowed to do so. As easily as a man draws his breath, so will an apartment, crowded or not, ventilate itself if it be allowed a throat to do it with. To devise fans, steam engines, exhausts, or injectors to ventilate the senate or other house, is only foolishly trying to help Nature to do work which she can better do without help. It would be no more absurd to invent a whirligig to put into a man's mouth to help him to draw his breath than it is to devise an injector and an exhaust to force in pure and draw out impure air to and from a room. To help a river over a waterfall is not more preposterous than, by moving apparatus, to accelerate the entrance of fresh and the exit of foul air from a crowded hall. The same force which makes the water descend, gravity, forces cold air under hot air and makes it ascend. If the foul air of a crowded hall could be seen and handled, the nature of its movements would have been long ago as well understood as those of water. Supposing foul air were the color of dense smoke, it would be seen to accumulate at the ceiling. If it could be seen that it always tended upwards, a hole in the roof would be the natural result of the desire to get quit of it. The amount of haziness regarding this simple matter in the minds of scientific men is unaccountable. The thousands of pounds and the amount of abortive invention spent on the ventilation of our Parliament Houses might make the angels weep, and all for what? To force atmospheric air to obey a law of its nature, which it cannot of itself disobey. As the sparks fly upwards so will heated air, if it is not restrained; and herein consists the whole secret of ventilation. It needs no device to float a cork; neither does it need any machine, fan, steam engine, exhaust, or injector to purify the air of the Senate House. All that is strictly required is an entrance for fresh air below, and an exit for foul air above. These provided, ventilation will work in spite of all the wrong headed theories of the savans and without the well meant but useless inventions usually erected to assist Nature. If these holes are large enough, no hall need be either impure or oppressive. If the place be half filled, the supply of pure air will be enough. If crowded, it will be augmented to meet the larger demand. Every person who enters is a machine to make the current inwards and outwards work more vigorously; and every one who leaves deducts from the demand and the power to supply. The atmosphere is a nicer balance than ever man made, and vibrates to a counterpoise infinitesimal beyond his conception. It is a comfortable as well as an undeniable fact that the objects which require ventilation are the very means to create it. Fires, lights, and man himself, if they consume pure air, also heat it, causing it to ascend and give place to a new supply, which in turn is consumed, heated and pushed upwards. This process, which is never ending, is simple, admirable, exact, and complete. It requires no assistance, has worked from the beginning of time, and will work, though there be neither *savan* nor machinist in existence.

If our halls, like the ancient Greek, were without roofs, ventilation would cause us no thought. The foul air from our lungs and bodies would ascend right into the air, and a fresh supply would come down to us through the same opening. But our houses and halls are ceiled, and the currents are prevented taking their natural course. Even in a ceiled chamber, if an open space be left large enough, the ascending and descending currents through it would supply

all the ventilation required by a crowded assembly. But it is more convenient, as the modern fashion of buildings is and as our climates require, to admit our fresh air at the lower part of our houses instead of at the top. By this mode a smaller opening in the roof suffices. A very much smaller opening is needed than many would suppose. And here I beg to take exception to a statement in the article referred to. It is there said that the machinery injects 25 cubic feet of air per minute for every man of 1,200 assembled, or it is capable of doing so. This quantity is ridiculously overdone. A man does not consume even one foot of air per minute by breathing; 15 inhalations of 60 cubic inches each make only 900, and a cubic foot contains 1728. Take man by man in an assembly, half a foot per minute is all each will consume. One can inhale through a half inch tube more air than he requires. Even a quarter inch one will not oppress him much. I speak of a round tube, but, if you will, take a square one. Of this a square foot will represent 576 persons' breathing area, and will admit air sufficient to supply that number. It may be said the velocity of air into a crowded chamber is not so great as that of the air through the tube when one breathes by it. But it is to be remembered the air is passing into the lungs only half the time, while the inward rush to supply an assembly hall is constant. The fact is the current inwards and outwards in a chamber, ventilated in the natural way which I indicate, is quite as fast as the current in and out of a man's windpipe.

But in an assembly hall at night, the lights must be supplied with fresh air as well as the occupants. I need hardly mention fires, as it is not usual to have them in such places. If they be used, they also must have their supply of air, and they will take an amount of inlet for themselves, equal to the united areas of their chimneys. I suppose there are no fireplaces in the Senate Chamber; but a crowded hall gets heated, and an extra supply of air is demanded on that account. If such is the case, it calls in its own supply. The velocity both inwards and outwards increases and the temperature falls. If the air of a hall be pure, heat is not so oppressive. It is impure air that exhausts and makes people pant. Taking your estimate, 1,200, as the usual number in the Senate Chamber, a hole in the roof equal to two square feet, with an under inlet the same, are ample to supply all the breathing air required. The lights may be allowed as much, and the heat an equal space. As a large hole is about as cheaply made as a small one, and as plenty of outlet does not affect the people below, the openings may be made double or even treble the size mentioned without fear of inconvenience. These openings must be free to the atmosphere, but may be made with louvres to keep out the rain. A hinged skylight is as good as anything else. As a cistern of water will be emptied if any sort of hole be driven through the bottom, so will a crowded hall be refreshed if any sort of hole is driven through the roof.

I am sorry I did not get admission to the Senate House when I visited Washington, else I might be more precise in my suggestions. But I believe that there is a ceiling between the outer roof and the audience, and that this ceiling is pierced with ornamental fretwork, and that the piercing is equal in area to what I have indicated as necessary for outlet.

The inlet of fresh air is the next thing to be considered; and while it is equally simple in principle as the outlet, it is not exactly so in practice. The outlet may be anywhere in the roof. It may be far larger than really required. It may be one large opening, or it may be many small ones. The inlet must be a great many small openings, or a disagreeable current will blow in one place and inconvenience those near it. But even this is a simple matter. An opening in the masonry under the joists of the floor, communicating with the outer air, will allow a fresh current to rise through small gratings in the passages between seats. Or if the corridors have proper air holes, a supply to the main chamber may be got from them by slits above the doors. Or air may be let in along the channel where lie the heating pipes and allowed to find its way to the chamber through small grate work along the base of the wainscoting. The modes for small inlets are endless. And let me say the united areas of the divided inlets need not be so great as those of the outlets, because they are supplemented by chinks of windows, thresholds of doors, etc. I would impress on all objectors that no inconvenience from the currents will be felt, if an inlet area of 8 or 10 feet be properly scattered over a room of the size of the Senate Chamber.

Allow me a few words on the long pipe proposed, to suck the air from the park 220 feet off. I do not know what purer air people would wish than that at the Capitol. It blew on me as fresh as mountain breezes. It is all people have to breathe who are walking outside; and if those inside get the same, what else do they want? One undeviating law of air currents is that they always take the shortest available cut and depend upon it, the ventilating air of the Senate house will never run through a long pipe if it can get in at an open door nearer its work. The whole thing is of a piece with the London delusion, and indeed is a counterpart of it from beginning to end.

Palsley, Scotland.

WM. MACKEAN.

To the Editor of the Scientific American:

I have read an article in your issue of December 13th, 1873, on the above subject, and I understood the difficulty (remedied by the charges described) to be the want of sufficient area, and the proper arrangement of the air passages from the old fan to the Senate Chamber. Unless there is some mistake in your explanation, there was, in my opinion, no necessity for the new fans, engine, and the two air shafts,

which in all probability occasioned a large expenditure. I venture my opinion on these grounds: You say that the capacity of the old fan was 80 revolutions per minute, discharging 500 cubic feet of air at each revolution, making in all 40,000 cubic feet of air per minute; and that in consequence of the defect, it was producing but one fourth of the ventilation that it had the capacity to furnish. As you state the capacity of the new fans to be 30,000 cubic feet per minute, it appears there was at least no want of capacity in the old fan, and that in comparison with forced ventilation, there is no advantage in ventilating by exhaustion. In my opinion, Mr. Hayden selected a very indirect, as well as an extravagant method of remedying a very simple matter.

CHICAGO.

Mental Arithmetic.

To the Editor of the Scientific American:

The young mechanic who hopes to excel in his chosen trade should endeavor to become skillful in mental arithmetic; and at the last analysis, all computation is strictly mental, the figures employed being only tallies to record results. I will give a table illustrating the theorem that the product of any two numbers is equal to the square of half their sum less the square of half their difference, that long practice proves to be a useful method of multiplication:

$$\begin{aligned} 6 \times 6 &= 36 = 6^2 \\ 7 \times 5 &= 35 = 6^2 - 1^2 \\ 8 \times 4 &= 32 = 6^2 - 2^2 \\ 9 \times 3 &= 27 = 6^2 - 3^2 \\ 10 \times 2 &= 20 = 6^2 - 4^2 \\ 11 \times 1 &= 11 = 6^2 - 5^2 \end{aligned}$$

This theorem may be expressed algebraically, thus: $(a-x)(a+x) = a^2 - x^2$, and numerically as in the table.

Suppose it is required to multiply 53 by 47. Half their sum is 50, the square of 50 is 2,500, and the answer sought is that sum less $3^2 = 9 = 2,491$. In practice, such an example can be solved almost instantaneously. If 47 times 54 were required, proceed as in the example and add 47 to the product.

To use this method, considerable knowledge of square numbers and of some of their remarkable properties is required; and the careful study of difference series will be beneficial. This study has proved an excellent means of initiating pupils into the mysteries of square and other roots, enabling them to become proficient in a short time. There are many similar things in the curious and wonderful science of numbers that, like the magic squares given in your issue of December 20, 1873, are of far more value than is generally supposed. Let some one arrange them in a suitable form and put them into the hands of the Yankee boy.

New Britain, Conn.

F. H. R.

The Relative Attraction of the Earth and the Sun To the Editor of the Scientific American:

The semidiameter of the earth is, in round numbers, about 4,000 miles, and that of the sun 425,000 miles. An object situated on the surface of the earth will, therefore, when turned toward the sun, be 22,874 times farther from the center of solar attraction than it is from the center of terrestrial attraction; and when turned from the sun, it will be 22,876 times as far from the sun's center as from the earth's center. Now as the strength of attraction varies inversely as the squares of the distances, the pull of the earth's mass will be $22,874^2$ times as great (on a body on the surface of the earth turned toward the sun) as the pull of an equal solar mass will be; and when the object is away from the sun, the pull of the earth will be $22,876^2$ times as great as the pull of an equal solar mass. But, as the sun's mass is estimated to be 215,000 times as great as the earth's mass, the total pull of the sun

on an object in the two supposed situations will be: $\frac{315,000}{22,874^2}$ times that of the earth.

315,000	315,000	315,000	315,000	1
$22,874^2 = 523,176,276$	and	$22,876^2 = 523,211,376$	or	1,660,877
and $\frac{1}{1,660,888}$.				

Now if the foregoing estimates be correct, there must be, in certain situations, a sensible difference between the weight of a given mass when on the surface of the earth in the direction of the sun, and the weight of the same mass when the earth has turned it away from the sun. This could be verified by experiment.

Let the place be at the equator, and the time of the experiment be one of the equinoxes. Suppose scales to be constructed of the capacity of several tons and of the utmost possible delicacy. Now let us try our experiment with a weight of 10 tons. Its weight at noon will be 10 T. + $\frac{1}{1,660,877}$ of 10 T. and its weight at midnight will be 10 T. + $\frac{1}{1,660,888}$ of 10 T. or: Noon weight = 20,000 lbs. - 12 lbs. 10 drams = 19,987 lbs. 15 cts. 6 drams. Midnight weight = 20,000 + 12 lbs. 8 drams = 20,012 lbs. 0 cts. 8 drams, making a difference between the noon weight and the midnight weight of 24 lbs. 1 oz. 2 drams.

If astronomers have miscalculated the relative masses of the sun and the earth, will not this experiment indicate the fact? And if we experiment in the same manner with the moon's attraction, may it not lead us to modify our statements of relative masses still further? And, moreover, may it not lead to a reconstruction of our tables of distances? If the principles set forth herein be correct, would not such an experiment be as worthy the interest of the great powers as are those expeditions of observation, so munificently aided, to

make the transit of Venus and the total eclipse of the sun contribute to our stock of astronomical knowledge?

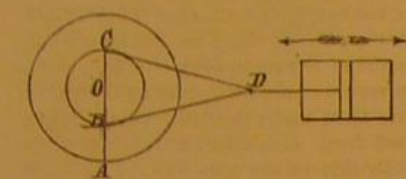
Brownville, Neb.

W. B. SLAUGHTER.

Adjusting Journal Boxes Horizontally.

To the Editor of the Scientific American:

Appropos of recent suggestions for taking up the wear of journal boxes, permit me to say that there is a common error among machinists to the effect that the wear upon the side of the main journal box nearest the cylinder is double that on the side opposite. Strange to say, the same idea is advanced as a theorem in a work on machine drawing, recently published by a noted writer on graphics. Some machinists, again, think that the wear is equal on each side of the center. The following is a demonstration of the true case:



The diagram being the skeleton figure of a locomotive or stationary engine, let A, the point of traction on belt or rail, be taken as the axis

of moments.

Let P = pressure on piston, let x = pressure on front of box at O, let y = pressure on back of box at O, let R = radius of wheel, and r = radius of crank. With crank pin at C, we have $x = \frac{P(R+r)}{R}$ by equaling moments. With crank pin at B, we have $y = \frac{P(R-r)}{R}$. Whence $x \div y =$

$\frac{P(R+r)}{R} \times \frac{R}{P(R-r)} = \frac{R+r}{R-r} = 1 + \frac{2r}{R-r}$, by performing division

But if $x = 2y$, then $x + y = 1 + \frac{2r}{R-r}$ must equal 2; whence $\frac{2r}{R-r} = 1$ and $2r = R - r$ or $R = 3r$. That is, the pressure on the front of box is double that on the back of box only when the radius of the wheel is three times that of the crank.

Or in a locomotive, let P , x and y be as before, and T = train resistance. Then going forward, with crank at C, $x = P + T$; or with crank at B, $y = P - T$, whence $x \div y = \frac{P+T}{P-T} = 1 + \frac{2T}{P-T}$ which, as before, is equal to 2 only when $P = 3T$.

The wear on both sides of the box will be equal only when $T = 0$. The wear on the front box will always therefore be practically the greater, but not necessarily twice as great.

Since the wear is proportional to the pressure, the formulae $x \div y = \frac{R+r}{R-r}$ and $x \div y = \frac{P+T}{P-T}$, may be used to determine the relative thickness of the two sides of the box.

Notwithstanding the weight of the engine throws the point of greatest wear towards the top or bottom of the box, the fact of unequal wear, proved above, shows the necessity of making the boxes adjustable horizontally, as suggested by your correspondent.

W. L. C.

Lehigh University, Bethlehem, Pa.

Animal Electricity and Magnetism.

To the Editor of the Scientific American:

Among the components that make up the whole of man's vital parts, animal electricity and magnetism are of prominent importance. Their existence has long been known, but almost all else in regard to them seems mystery.

Air when taken into the lungs gives up a portion of its oxygen, which passes into the blood, and, when expired, is converted into carbonic acid gas. The latter gas amounts to about three and a half per cent of the whole expiration. In the process a combustion takes place, wherein a portion of the oxygen combines with the blood, and another portion with carbon, to be exhaled as carbonic acid gas. I presume that this combustion or transformation is the cause of animal heat. But this is foreign to the present subject. Faraday discovered that oxygen was the most magnetic of all gases, holding the same place among gases that iron does among metals. When reduced to proportions and figures, if 17.5 represents the magnetism of oxygen, air would rate 3.4, while carbonic acid gas is diamagnetic and would be represented by 0.0. The amount of carbonic acid gas taken into the lungs with air is quite small, but from each healthy person sixteen cubic inches are exhaled per minute, or twenty-three thousand cubic inches per day. As this gas is composed of carbon one part and oxygen two parts, it follows that about fifteen thousand three hundred and thirty-two cubic inches of oxygen, charged with magnetism in the proportion above stated, has the total amount of magnetism daily eliminated from it by the vital organs of each individual. What becomes of this magnetism thus extracted from the oxygen of the air? It enters the lungs; it does not go out again. The sequence is beyond question: it is taken up by the organism and remains there to be used in the vital forces. Thus in the life-giving gas, not only is to be found the property of supporting life, by purifying the blood and furnishing heat for the body, but, also, the magnetism that performs an important, but a far more subtle part. An atmosphere of pure oxygen, if supplied to the lungs, increases the heat, magnetism, and electricity of the body, by the conversion of a much larger proportion of oxygen into carbonic acid gas, and quickens life to such an extent as to cause death from exuberance. When an absence of oxygen from the blood has almost caused a cessation of magnetic and electric currents in the body, an injection into the circulation of blood charged with oxygen will cause their instant return; and just in proportion as carbonic acid gas is exhaled from the lungs, do we find a supply of these fluids remaining.

I have referred to animal electricity and magnetism as

identical. In vital economy I believe them to be so in source of supply; and while manifestations of one may be had without the apparent presence of the other, yet there is so much to join them together, and so little to separate them, that the day of doubting their identity, in this respect, has about passed. Oxygen and ozone are the same, and yet how different! Are not both different conditions of the same thing?

JOHN HILL.

Columbus, Ga.

THE SILVER MINES OF PERU.

BY PROFESSOR JAMES OXTON.

Peru was conquered and explored by the early Spaniards under the belief that it was *El Dorado*; but there are no famous mines of gold in the Republic save those of Carabaya. It better deserves the name of *La Plata*, for its Andes are threaded with silver. The annual yield of Peruvian silver, however, is decreasing, owing to mismanagement. A thorough scientific survey of the country is needed, and then a judicious system of mining. We are confident this will reveal

"Rocks rich in gems and mountains big with mines,
That on the high equator ridgy rise."

The most famous silver mines in South America, after those of Potosi, are the mines of Cerro de Pasco, sixty leagues northeast of Lima. They are situated on the Atlantic slope of the Andes, over 13,000 feet above the sea, where the prevailing rock is conglomerate. The silver, discovered by an Indian in 1630, occurs in the native state; also as sulphuret mixed with pyrites, with *cobriso* (a carbonate of copper and lead, with sulphuret of copper), and with oxides, forming what are known in Peru and Mexico as *pacos* and *colorados*. The ore is treated to salt and mercury, but so rudely that generally one pound of mercury is lost to every half pound of silver extracted. Fortunately, Cerro de Pasco is only 200 miles from the celebrated quicksilver mines of Huancavelica. According to Herndon, the ore yields only six marks to the cajon. (A mark is eight ounces, and a cajon is three tons). A representative specimen in our possession contains 0.004 of silver. During the last two centuries and a half, the mines have produced about \$500,000,000. The annual amount of ore mined has been 50,000 cajons, yielding an average of four and a half marks, the amalgam containing 22 per cent of silver. Just now, work has nearly ceased, owing to the inadequate means of drainage. But at Cerro de Pasco, as at other places, it has been found profitable to re-work, by the improved modern method, the tailings left by the old Spanish miners.

Hualgayoc, fourteen leagues north of Cajamarca, has long been celebrated for its rich mines; but it is also afflicted with a plethora of water. There are many good mines in the vicinity of Lampa and Puno on the borders of Lake Titicaca; those of Manto, Salcedo, Chupica, and Cancharani were famous in Spanish history. The ores of Huantajaya near Iquique yield from 2,000 to 5,000 marks to the cajon. Masses of pure silver have been found on the surface of the plain, one weighing 800 lbs. Rich deposits occur also in the province of Cailloma, north of Arequipa; and at Yauli, San Mateo, and other localities near the Oroya Railroad. Extensive veins have been recently discovered at Chiletta, the terminus of the Pacasmayo railroad, the ore assaying from \$60 to \$200 a ton.

But the most numerous and promising silver mines of Peru are, without doubt, located in the department of Ancache, just north of Lima; not because it is a richer region than the eastern cordillera, but because it is the only district which has been scientifically explored. This has been done by the accomplished naturalist, Professor Raymond, under the patronage of Mr. Henry Meiggs. The report just published at Lima contains assays of specimens from the most valuable mines in which the silver occurs. It appears: (1) That silver is not very common in the native state. (2) That the minerals richest in silver are pyrrargyrite ("rosicler" or ruby silver) and stephanite (brittle silver glance). (3) That the greater part of the silver, however, is extracted from tetrahedrite, galena, and many mineral oxides (*pacos* or *colorados*). The *pacos* richest in silver ore are those which result from the oxidation of stephanite and pyrrargyrite; the poorest are found in great part of oxide of iron, in which the silver is minutely disseminated in the native state. (4) It is worthy of notice that the silver ores are constantly associated with antimony. Even the galenas having a cubical structure always contain a small percentage of antimony.

New Houses.

The coincidence of a man's moving into a new house and dying soon after has frequently been a subject of remark, and there is an avoidable cause—the house is moved into before the walls and plaster and the wood are sufficiently dried. Sometimes the cause of death is the poisonous character of the water conveyed through new lead pipes. No water for drinking or cooking purposes should be used in a building supplied with new lead pipes, in whole or in part, for at least one month after the water has been used daily; this gives time for a protecting coating to form on the inner surface of the pipes, when their chemical change from contact with water generally ceases.

But the damp materials of the house have the most decided effect, especially on persons over fifty years old or of frail constitutions; whereas if the person were in the full vigor of life and health, not even an inconvenience would be experienced.

In building a new house, or on going to live in another locality where the water supply is not far from the house, it should be ascertained with the utmost certainty that the

spring or well is higher than the privies or barnyards. Insidious and fatal forms of decline and typhoid very often result from persons drinking water which is drained from the localities named.

The safest plan, and the only safe plan for furnishing dwellings with the most healthful and unobjectionable water, is to have a watertight cistern, and let the water from the roof of the house or barn, or other outhouses, be conveyed into it through a box of sand several yards long, this box to rest on a board, or cemented bottom and sides, so that no outside water could not get into it.—*Hall's Journal of Health*.

Solvent Powers of Water.

Water is a physical rather than a chemical agent in bleaching and dyeing; it is the vehicle which carries the chemical substance to the cloth to be operated upon, or which removes the matters necessary to be removed from it. When a substance is mixed with water, it may either be dissolved by it, and disappear, as salt does; or it may remain in suspension, as chalk does. Nothing is considered to be actually dissolved in water if it can settle out again, or if it will not pass with the water through a filter made of paper or calico; thus to talk of dissolving ground chalk in water is incorrect, for if allowed to stand it would settle out; or, if the mixture were filtered, the water would pass clear, while the chalk would remain upon the calico; but blue vitriol (sulphate of copper), for example, does really dissolve in water, and the liquor all filters through together; to deprive the water of the blue vitriol would require chemical means different in kind from filtration. Water, therefore, dissolves some substances and not others. Water does not dissolve the same quantity of all soluble substances; of some it can dissolve its own weight, and more; of others a small portion; and of some extremely little. As a rule, hot water dissolves more than cold, and more quickly than cold; but, upon cooling, the excess mostly falls out as crystals. This point deserves notice, for a liquor, which is of right strength when a little warm, may be too weak when it becomes cold; left in a carboy, for example, in a cold place, because the salt crystallizes out; this is the case only with those salts that are but sparingly soluble, as chlorate of potash, cream of tartar, sulphate of potash, etc. The crystallizing is sometimes troublesome in steam colors which, right enough when freshly made, become filled with small crystals, and rough on the machine; it is felt in the case of an ageing liquor, which contains chlorate of potash as an active agent, which, crystallizing out, leaves the liquor weak and not able to do its work. As a usual thing, the drug room upon a printing or dyeing works should be cool, but there are some liquors better in a moderately warm place; brown vitriol, for example, in winter time is apt to go solid in the carboys, if kept in an exposed place.—*Am. Tex. Manuf.*

Sir Richard A. Glass.

Sir Richard Atwood Glass died recently at Southampton, aged 53. It was at his factory that 1,250 miles of the first Atlantic cable of 1866 was wholly constructed, under the direction of Mr. Glass, who, on the successful completion of the undertaking, after ten years of unremitting labor, received the honor of knighthood. He retired from the company in 1867, and afterwards became chairman of the Anglo-American Telegraph Company. He was for a short time a member of the House of Commons.

The Detection of Death.

The late Marquis d'Ourche, one of whose friends was buried alive, left a sum of 20,000 francs (\$4,000) to the French Academy of Medicine, to be given to the inventor of a simple process of ascertaining when death has really occurred, and a further sum of 5,000 francs to be awarded to the discoverer of a scientific method of verifying death. Altogether 102 essays were sent in for adjudication. Most of the papers contained such absurd suggestions that the list was practically limited to 33 competitors. The large prize was not awarded, but the 5,000 francs were divided between four competitors. No new facts, likely to enlarge the domain of forensic medicine, have been elucidated by these investigations.

MESSRS. MACNAUGHT, ROBINSON, & Co., of Southwark, London, England, have sent us diagrams of a most complete system of wrought iron girders for building purposes, made by them and kept constantly in stock. Their sections are chiefly of the double T form, and range from 2 to 6 inches in width, and from 3 to 14 inches in height. The list also includes flitch plates, bolts, nuts, washers, etc., an arrangement very convenient for builders, who by consulting the chart can ascertain the approximate cost.

WE have received from Messrs. Goodnow and Wightman, of 23 Cornhill, Boston, Mass., an illustrated catalogue of tools, lathe attachments, and machinists' supplies, which provides for nearly all the possible wants of model makers and experimenters in mechanics. The line of small gearings is extensive and complete, and the book describes several new gages and combination tools, of value and interest to all inventors and amateur mechanics.

A NEW APPLICATION OF GYPSUM.—Gypsum mixed with 4 per cent of powdered marshmallow root will harden in about one hour, and can then be sawn or turned, and made into dominoes, dice, etc. With 8 per cent of marshmallow, the hardness of the mass is increased, and it can be rolled out into thin plates, and painted or polished.

IMPROVED PATENT CANDY CUTTER.

This machine is intended for cutting "beefsteak" and other candies in which nuts, etc., are intermingled, and which are cut from a loaf-like mass into slices while warm. The apparatus consists of a knife reciprocating to cut the candy, and provided with means of constant lubrication to prevent the adhesion of the warm candy, and to cause it to cut more freely.

The frame supports a table and a beam, on which the operating parts are mounted. The candy is made into a long loaf-like mass, with nuts, etc., and placed on a long movable board, A, and against a block on its back end. This board is fed up under the knife as slice after slice is cut off. The box, B, incloses the candy on the sides to hold it in place and in shape, and remains stationary, while the candy and its supporting board is moved up. The wheel, C, is turned by a hand crank, and rotates a smaller wheel having a fly wheel on its shaft. This fly wheel has a connecting part, D, from a bearing on its rim to one on the knife frame, E, to drive the knife back and forth to cut the candy. The knife frame has guide bars at its ends playing back and forth in bearings, F, on posts attached to the beam, as shown. The bearings move up and down on the posts, and the latter are hollow, with one side open. The bearings connect with vertical screws within the posts, so that they may be raised or lowered by turning the screws, to feed the knife as it cuts. These screws have bevel pinions on their top ends, gearing with bevel pinions on the shaft, G, which extends over both posts. The shaft is turned by a hand crank, to raise or feed the knife on the candy, regularly at both ends. The edge of the knife moves through boxes on each side of the candy, which contain sponges saturated with oil, for lubricating as above noted. These boxes are borne by arms from bearings, so that they will move up and down with the knife and keep the lubricator to its edge. The board, A, is moved up by pinion and rack underneath, not shown, with suitable arrangement for gaging its feed, to regulate the thickness of the slices uniformly.

This machine has been in use in the shop of J. Easig, candy manufacturer, Keokuk, Iowa, for the past six months, and, we are informed, has given perfect satisfaction.

For further information and purchase of patents and rights, address the patentee, Francis Quinn, Keokuk, Iowa. Patented October 1, 1872, and October 14, 1873.

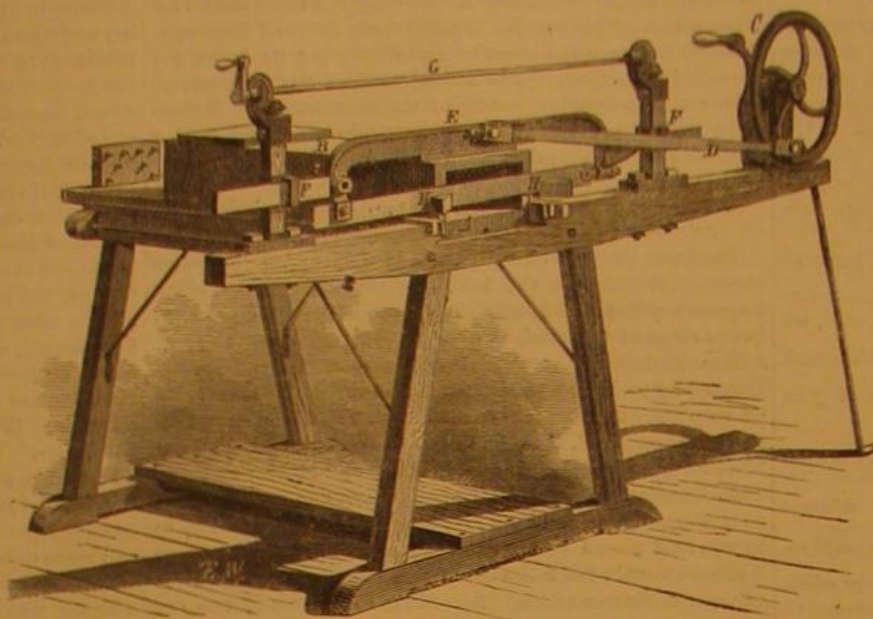
IMPROVED FURNACE BRIDGE WALL.

The invention which we illustrate herewith is a bridge wall, constructed so as to produce the same action on the flame as the flat wick does in the lamp, namely, forming it into a thin sheet or, rather, breaking the flame into thin sheets, thus preparing the flame before charging it with currents of air, so that the latter can penetrate every portion. The result is claimed to be nearly perfect combustion.

Fig. 1 is a side elevation of a boiler set in brick work, of which a portion is removed, showing an end view of the bridge wall in position. Fig. 2 is a vertical section taken through the bridge wall, back of the fire box. A is a conduit or pipe, having its outer end on the outside of the brick work, and extending across the back of the fire box, entering into the conduits, B B, at the opening, shown at G, Fig. 2. This pipe, A, is for the purpose of conveying the air and also heating it before entering the conduits, B. It is protected from the direct action of the fire by the brick work shown at E, Fig. 1. B B represents two air conduits arranged in a vertical plane passing longitudinally under the boiler. The portions which are exposed to the gases or flame present waved surfaces, and are so arranged in relation to each other as to form a zig-zag or serpentine flue, through which the flame or products of combustion are compelled to pass on their way out of the fire box. It will be noticed that the top and bottom of the zig-zag flue terminate nearly in a point. In this perforations or a continuous slit for the admission of air, striking the flame crosswise, in fact in every direction (as shown by arrows in Fig. 2), on its way through the zig-zag flue. It will also be noticed in the form of this flue that a direct line is avoided. The object of this is to cause the flame, when it strikes the flue, to be completely broken up into thin sheets, and thus prepared so that the air can penetrate every portion. At the same instant, therefore, that the flame is broken up, it is thoroughly charged with cross currents of heated air in every possible direction, producing combustion of the gases before entering the stack. C is an opening into the side of the gas burner, where the connection is made with the pipe, A. D shows a wall closing the connection between the after part

of the boiler and fire box, compelling the products of combustion to pass through the zig-zag flue. The inventor states that this bridge wall has been thoroughly tested, and that the advantages gained by its use are, first, a saving of 25 per cent of fuel; second, the benefit of the coke or solid part of the coal, which, under the present construction of furnaces, it is claimed is wasted; third, all the sooty matter is consumed before reaching the stack, and also all the gases, so that but a very small portion of the heat escapes.

The improvement is further claimed to be efficient and durable, not liable to get out of order, and to require no attention after being set in its place. It can be applied to both locomotive and marine boilers. For further particulars ad-

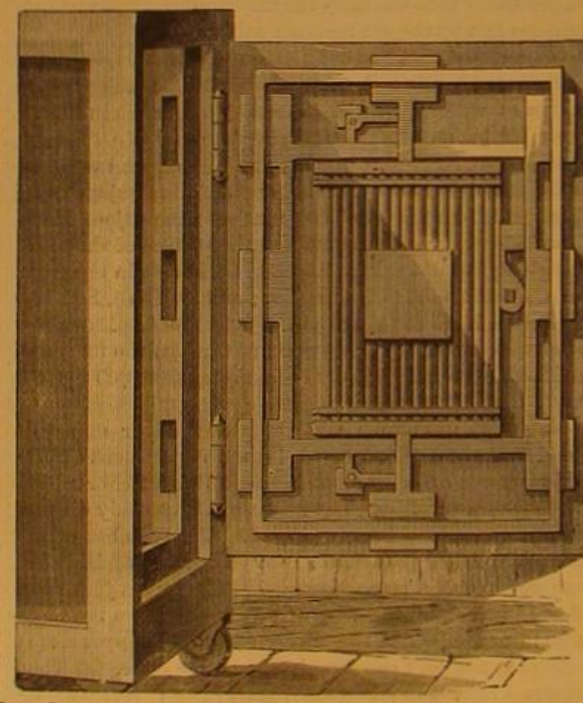


QUINN'S PATENT CANDY CUTTER.

dress the inventor, Mr. W. F. Beecher, 83 Seneca street, Cleveland, Ohio.

THE BAFFLE DRILL-PROOF SAFE.

An ingenious contrivance has recently been patented by Mr. Henry Geering, of Birmingham, England. Experience



has shown that a skilled thief, as a rule, by boring a number of holes through the chilled plate to which the lock of a safe is attached, invariably succeeds in removing the lock bodily, and the safe, with its contents, may then be dealt with at leisure.

The present invention is designed to prevent this, and it

consists in the arrangement, at the back of the door and in front of the lock, or at any other required part of the safe, of a series of cylindrical steel rods, free to turn in a frame or bearing pieces. These rods are arranged side by side, and as near together as is compatible with their perfect freedom of motion, excepting immediately in front of the key hole in the door, at which part a space is left for the passage of the key to the lock. One or two series of rods may be used. Where two are employed, the axis of one of the series may cross the axis of the other series, or be placed perfectly parallel with it at pleasure. The patentee provides flat or angular rotating bars, which may be employed instead of cylindrical steel bars. The practical effect of the use of these

steel rods is simply this: When the door of a safe or strong room is provided with the invention, the burglar's drill, after it has drilled through the plate of the door, comes against one or more of the rotating steel rods, which, under pressure of the drill, turn on their axes and move from under the drill, which is thus prevented from obtaining a bearing upon them. By this means access to the lock, for the purpose of picking or destroying it, is prevented. Where still greater security is desired, a plate of hardened steel or chilled iron is fixed in front of the steel rods. This plate is pierced with angular perforations, or armed with ribs or projections on the face turned towards the outside of the safe; and in use these perforations or ribs intercept the drill of the burglar, which is either broken or so much injured in contact as to be almost inoperative before it can reach the steel rods. At a public trial, says *Hardware, Metals, and Machinery*, a number of hard steel drills were put through the iron and steel plates with a pressure of from 12 to 15 cwt. behind the drills; but when the latter touched the revolving steel rods, they failed to bite, and were in nearly every case broken. Beyond this, the

clicking of the revolving rods, when touched by the drills, was quite loud enough to raise an alarm sufficient, in ordinary cases, to frustrate any burglarious enterprise.

On Some Metallic Spectra.

M. LECOQ DE BOISBAUDRAN.

(1). Lead. When the induction spark from an electric coil passes between two electrodes of lead, the spectrum consists merely of narrow lines; when the electrodes get covered with oxide of lead, there are the numerous characteristic bands, and some of the lines then disappear, while others retain their brightness. The action of the condenser is almost exactly opposite to that of oxidation; it intensifies the lines, and, where they are extinguished through oxidation, the condenser restores them. (2). Chloride of gold. In a gas flame, this gives magnificent bands crossed by slightly nebulous lines, extending from yellow to blue green. With the spark in a solution of AuCl_3 , the spectrum consists of green bands, and a certain number of narrow lines, distributed between red and violet. The relative brightness of the lines varies according to the mode of operation. The author points out changes undergone by the lines δ 506.3 and δ 523 when one modifies the degree of dilution, the length of the spark, or the direction of induced current. (3). Thallium. The salts of thallium in a gas flame give, besides the bright green line δ 534.9, another, faint and nebulous, having for wave length 568.0. It seems to belong to thallium, for its relative intensity is maintained with various salts of thallium carefully purified. (4). Lithium. From theoretical considerations, the author was led to expect the probable existence of a new line in the spectrum, having 413.0 for wave length. He obtains merely a trace of this line on passing the induction spark in a solution of LiCl , but it can be easily had with the spark in Li_2CO_3 at red heat. Two series of measurements gave 412.9 and 413 for the wave length.—*Comptes Rendus—Chemical News*.

Practical Science as a Trainer.

Professor Williams, in an interesting article in *Nature*, relating to remarkable practical achievements of Count Rumford, says: The main interest of the career of this wonderful man appears to me to lie in this, that it affords a magnificent demonstration of the practical value of scientific training, and the methodical application of scientific processes to the business of life. I have long maintained that every father who is able and willing to qualify his son to attain a high degree of success, either as a man of business, a soldier, a sailor, a lawyer, a statesman, or in any responsible department of life, should primarily place him in a laboratory, where he will not merely learn the elements of science, but be well trained in carrying out original physical research, such training being the best of all known means of affording that discipline of the intellectual powers upon which all practical success depends.

Fig. 1

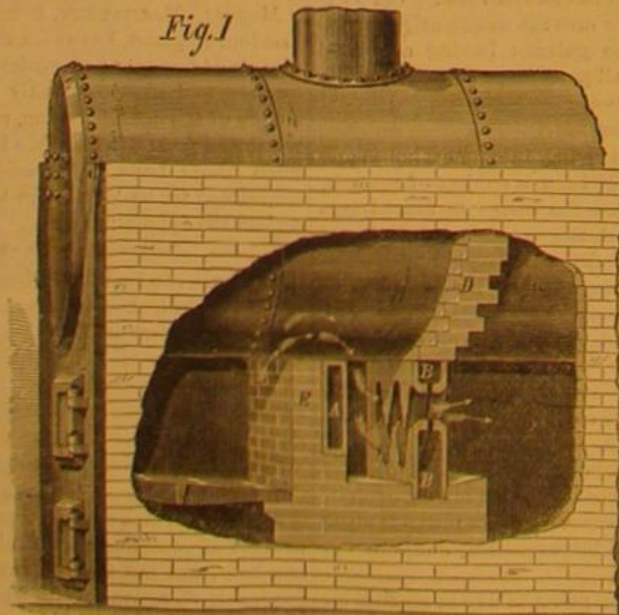
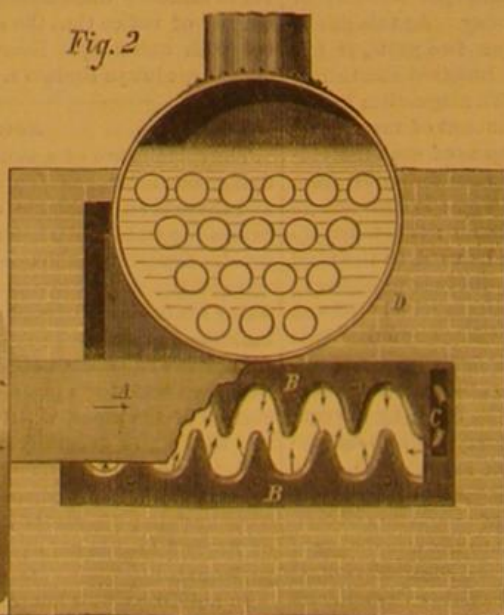


Fig. 2



BEECHER'S FURNACE BRIDGE WALL.

OVERHEAD STEAM CRANES FOR DOCK PURPOSES.

The Middlesbrough docks, Yorkshire, England, which have recently been made by the North Eastern Railway Company to accommodate their greatly increased shipping traffic, possess many points of interest and novelty, prominent among which is the system of steam cranes employed, a system which we illustrate herewith.

It was found that no fixed crane could be kept constantly employed at Middlesbrough on account of the great variation in the length of the ships, steamers, etc., while, furthermore, as the total area of quay room would be, in the first instance, somewhat limited, the space occupied by a fixed crane would be attended with serious inconvenience. The same objection existed to the adoption of the ordinary construction of portable cranes, involving a separate line of rails for them to travel on. There was also the further condition that the cranes must be capable of loading and discharging vessels, the sides of which were 15 feet to 20 feet above the level of the quay, as rapidly as lighters, which would frequently be 20 feet below the quay level, and that in both cases the driver should have a clear view of his work. Under these circumstances it was decided to state the leading conditions to various manufacturers of cranes, and invite them to give tenders and prices for what appeared to them best adapted to fulfil these conditions. The design adopted, says *Engineering*, to which we are indebted for the engraving, was that sent in by Messrs. Appleby Brothers, of London; this design, as will be seen from the engraving, consisting of a traveling staging or gantry, on which is mounted a steam crane of the same construction as that sent by the firm to the Vienna Exhibition (see page 95 of our volume XXIX.), and which is in successful use at so many of the docks and harbors in England and on the Continent.

The traveling staging of each crane has a span of 23 feet, center to center of rails, one of the latter being laid close to the edge of the quay, and the other in the 6 feet between rails. The clear height is 17 feet 6 inches, which allows the uninterrupted circulation of locomotives and all kinds of rolling stock on each of the two lines of rails which are spanned by the gantry. The traveling wheels are 12 feet, center to center. The framing is composed of a pair of timber uprights, braced and strengthened by cast iron brackets, and two wrought iron plate girders, which are connected to the timber uprights by four wrought iron plate brackets, strengthened with angle irons. A strong carriage, with the necessary roller path and brackets for the gear required to transmit the traveling motion, which will shortly be referred to, is firmly bolted at the extreme end of the girders nearest to the dock, while the girders are planked over so as to form a store for coal and water. The crane, and the whole of the substructure, is designed for a working load of 8 tons at the maximum radius of 21 feet from center of crane post to the plumb line of the lifting chain, while the crane itself is, as has already been stated, of precisely the same construction as those which have given satisfactory working results elsewhere, with apparatus for altering the radius by steam

from a maximum of 24 feet to a minimum of 14 feet.

The traveling motion is transmitted from the crane engines by suitable gear and shafts to the traveling wheels, and warping drums or capstans are fitted on a countershaft on the inner side of each frame, so that these warping drums can be driven independently of the traveling wheels. This simple addition is found to effect a very large saving in manual labor and time.

Another great advantage which has been demonstrated by practice is that the cranes can be so readily concentrated at any point where they may be required; and indeed, as is shown in the engraving, three of these cranes are brought to load a long screw steamer having three hatchways; this is evidently a most important consideration with owners and shippers, especially under circumstances which so frequently arise where great dispatch is essential. Or two cranes can be brought together for any exceptional heavy lift. The cranes were tested with the maximum working load of 5 tons, and subsequently for speed, when each crane delivered 50 tons per hour from the trucks into the steamer's hatchway.

The arrangement we have described may be modified with advantage under some conditions by making the crane porta-

It might at first sight appear that the road to carry these cranes must be of unusual strength, but on further consideration it will be seen that this is not absolutely necessary, because the base obtained is so large that there is comparatively little strain on the road, in fact, probably no more than on a line of rails of the ordinary gage, carrying a portable crane of the usual type, working the same loads at the same radius. Several of these cranes have been in successful operation for some time past, and a number more are in course of construction for the Middlesbrough Docks.

The system, evidently, has great advantages under the conditions above named, as well as for working in crowded railway stations, or in stone quarries, timber yards, etc., and it appears singular that an arrangement at once so simple and efficient should, until now, not have been brought into more extensive use, especially for dock and railway traffic.

Sumac.

Sumac is largely used in tanning the finer kinds of leather, especially in the manufacture of the hard grained moroccos and similar goods. It is also employed as the base of many colors in calico and *de laine* printing. Probably the consumption of this article throughout the country for all purposes

aggregates more than 20,000 tons, of which about two thirds are imported from Sicily, not because just as good sumac cannot be grown in this country, but because, until a few years ago, our people did not know its value, or in what way to prepare it for the market. The sumacs of Virginia, Maryland, and Tennessee in particular are said to be the best in the world, and even their worst varieties have been officially pronounced by experts to be better than any imported from Sicily.

Almost every farmer has a clump of these bushes. They are called by some "shoemaker," by others "red shoemaker." Probably many farmers may have tried to kill them by cutting down. If they have, they know how difficult a task it is. It grows like asparagus, all the better for being cut; and when once started upon a lot and cut close once a year, it is as easy to cut as corn fodder.

The only trouble is in curing it properly. This must be done with all the care that is bestowed upon tobacco or hops. Exposure, after cutting, to a heavy dew injures it, and a rain storm detracts materially from its value. It is cut when in full leaf; and when properly dried is ground, leaves and sticks together. An acre

in full bearing will produce not less than three tons; and when fit for market, it is worth from eighty to one hundred dollars a ton. The "manufacturers," as the curers are called, pay one cent a pound for it in a green state.

A sumac mill costs about \$3,000. The Commissioner of Agriculture gave an outline of a mill in his report for 1869. If thirty farmers would unite in an effort to establish a sumac mill, each planting out a few acres, says the *Ohio Farmer*, we have no doubt the enterprise would prove far more remunerative than either corn or wheat, and be the means of inaugurating a new enterprise in their State. There is no danger of an overstock. The demand is daily increasing, for hemlock is growing scarce, and every day new tanneries and dye houses are going into operation.



OVERHEAD STEAM CRANES AT MIDDLESBROUGH DOCKS, ENGLAND.

ble on its gantry, so that it will travel from end to end, all the other motions being retained, and the traveling motion in that case being transmitted through a square shaft with tumbler bearings. This construction is especially valuable for use on a jetty where vessels lay on each side; to suit these conditions, the gantry is made to span the whole width of the jetty, and to travel over the ordinary lines of rails and roadway. Another modification of the system consists in having the crane fixed on an ordinary overhead traveler gantry, or it may be made to travel across the gantry; in such a case the fixed staging may be constructed of square timber, or of columns and girders; this class of traveling crane has been rather extensively used in the construction of public works and large buildings.

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The Commissioner of Agriculture advises to plant in rows in order to cultivate between, either by seed or cutting of the roots. We should advise cuttings by all means, as sumac is as tenacious of life as the blackberry or horse radish. It will never need but one planting, and the crop can be gathered any time from July to the time of frost. If it is cut later in the season, and annually, the leaves and the stocks can be ground together. If the cutting is delayed until the stock has formed into solid wood, the leaves must be stripped from the stock, and the stock is thus wasted. It is doubtful if anything is gained in the weight of leaves after the middle of July, at which time almost every tree has completed what is called "first growth" for the season. An auction sale of 1,406 bags of Sicily sumac, damaged on the voyage of importation, recently took place in Philadelphia, and will serve to indicate the value of the article: 102 bags sold at \$53 per ton; 37 bags sold at \$45; 178 bags at \$72; 200 bags at \$59; 231 at \$66; 631 at \$49, and 137 bags at \$30 per ton.

ARTIFICIAL ALIZARINE.—Messrs. Lucius and Brüning oxydize anthracene by a mixture of nitric acid and bichromate of potash; the anthraquinone thus formed is boiled with nitric acid, whereby nitroanthraquinone is formed; this is then treated with an alkali, and the alizarine formed precipitated by an acid. Purpurin is contained in the product thus formed, for which reason the dye thus produced is said to be superior to that made in other color factories.—*Reimann's Fürberzeitung.*

E. L. C. says that the experiment in the wear of gold coin, reported in our issue of January 17, was not conducted in a manner to produce a correct result, as the gold coins used were heavier than the silver ones, which of course would cause greater wear on the gold. The correct way to test them would be to take a gold coin and a silver one of the same weight, regardless of size; then weigh out 20 pounds of each, and proceed in the manner described.

KANGAROO AND ALLIGATOR SKINS.—The hides of kangaroos are imported in considerable quantities from Australia to San Francisco, where they are tanned. They give a leather quite thin, much more supple than calf skin, and yet less permeable to water. Alligator skin from the South has been used for some time in this city for the manufacture of heavy boots for winter wear.

THE use of Epsom salts is found to give brighter tints to certain aniline colors, especially primula and methyl violet. Sulphurous acid is also beneficial for these colors, the tints being brighter and less readily rubbed off.

SAFFRANIN.—If mixed with strong sulphuric acid, this dye-stuff develops a fine blue tint, becoming emerald green by addition of a little water. By suitable additions of water and acid, nearly all the prismatic colors can be produced.

AN some recent experiments on the droera, it was found that the leaves could reach round and catch a fly anywhere within half an inch of the plant. The flies have to be tied, as it takes the leaves about an hour to get round.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT GRASS AND GRASS HARVESTERS.—CYRILLUS WHEELER JR., vs. CYRILLUS H. MOOREHEAD.

[In Equity—Before Woodruff, Judge.]

A patentee may maintain a suit at law upon a patent in his own name, although he is under a contract to assign it to others, if it has not been executed.

But equity regards that as already done which the patentee has agreed to do, and requires that the proper assignees be made parties to a bill in chancery brought against infringers.

If the other parties to a contract release to the patentee all their interest in the patent, he may maintain a bill in his own name for all subsequent infringements, but not for those committed previous to the release.

Neither can he recover damages for any infringements committed after he has sold and assigned the patent.

The pendency of a suit upon a patent in one district is no bar to the prosecution of a suit upon it in another, whatever may be the effect of a recovery in such foreign suit.

A patent covers only the devices which are claimed, although others are described by way of explaining them or illustrating the way in which they operate.

When a patent is released in several divisions, no one of them is void, because they every one describe all the mechanism shown in the original, provided the claim in each is for a different device, which is clearly described, and there is no conflict between them.

An inventor may claim in one patent a combination of devices when they are so constructed as to operate in a certain way; and in another he may claim in combination with some of those devices another one especially by means of which the operation so described is produced.

An inventor may have distinct patents for several distinct devices, although he might have included them all in one, making a separate claim for each device.

Although a patent has expired and the device covered by it can be used only in connection with other devices embraced in a patent still in life, the latter device cannot be used without the consent of the patentee, though in connection with the first.

WOODRUFF, Circuit J.

On the 5th of December, 1864, the complainant, Cyrillus Wheeler, Jr., received from the United States a patent for an improvement in grass and grain harvesters, for which he had made application March 18, 1864. On the 10th of November, 1869, he surrendered his patent for the purpose of obtaining release thereof in divisions, and on the 3d of January, 1870, the patent was released in seven divisions, numbered 875, 876, 877, 878, 879, 880, and 881. Of these the release numbered 876 was surrendered on the 6th of April, 1871, and on the 14th of May thereafter was again released, numbered 1,410.

On the 6th of February, 1872, another patent was granted to the complainant for an improvement in grass and grain harvesters, which was also surrendered and released June 5, 1870, and again surrendered and released on the 28th of May, 1871, was again released, numbered 1,412.

For the alleged infringement of the released patents numbered 875, 877, 878, 879, 1,410, and 1,412, this suit is brought.

The answer sets up probably as many grounds of defense as the ingenuity of counsel could suggest. It denies that the complainant invented the devices originally patented, and denies that a machine constructed in accordance with his patents is a practicable machine, or has any useful or serious grounds; avers that the validity of the several releases on various patents, and that the complainant surrendered them, and obtained releases without their authority, consent, or concurrence; and alleges that the releases were obtained without any legal or justifiable grounds therefor, and that some of the releases were not of the complainant's invention; that some of the releases were for the same devices patented in others; that one of the releases has expired, without extension, which included all the distinctive peculiarities shown in the original patent, which objects that other persons are jointly interested with the complainant in the patents, and that the suit is defective for want of the presence of such persons as parties. It denies the validity of the extension of the patents beyond the term for which they were originally granted. It avers the complainant's patent in Illinois to be the complainant's, and that the complainant is still pending. It denies infringement by the defendant at any time since January 2, 1869, or that he has made or sold within the southern district of New York any infringing machine.

The defendant has moreover interposed a supplemental answer setting up, as a partial defense, that since this suit was commenced—to wit, on the third day of July, 1871—the complainant, Wheeler, sold, assigned, transferred, and set over to Cornelius Aultman all the right, title and interest, he, the said Wheeler, then had in the several letters patent and patent interests in the bill of complaint herein mentioned, and therein set forth, as the property of the said Wheeler. This assignment and transfer of the defendant relies upon as a partial defense—that is to say as a bar to any decree for an accounting to or with the complainant for any profits arising from infringements committed after the date of the said assignment, and as a bar to the granting of any injunction herein upon the prayer of this complainant.

Possibly the defendant's answer some other grounds of defense were suggested, but not all of the supposed defenses were insisted upon on the hearing.

1. The objection founded upon want of necessary parties rests upon two agreements, one of which goes, as is claimed, to the right of the complainant to maintain this suit without joining other parties. That agreement was entered into by the complainant, Wheeler, and others of the first part, and Cornelius Aultman and others of the second part, on the 27th of December, 1869, to continue in force for ten years. It is the same agreement that was urged as a defense against Aultman in the suit of Aultman vs. Holley et al. It is called in that suit and in this the "consolidation contract."

In deciding the case of Aultman vs. Holley, at this present term, I have considered the same objection which is now urged here, and held that that agreement did not disable Aultman to maintain a suit in his own name, upon his patents included within the scope of that agreement. The same reasons apply to the present complainant, and my opinion in that case on this point must be taken as my opinion in this, and may, if either party so desires, be inserted in this place, *mutatis mutandis*, as part of this opinion.

By a supplemental agreement was entered into by and between Wheeler, the complainant, and Henry Morgan, Allen, Mosher and others, on the 25th of October, 1869. It recites that he had theretofore entered into certain agreements with the others, relating to his patents for harvesters, and in it he agrees to obtain a release of his patents, and that upon obtaining such release he will execute to such several other parties assignments to convey to them the same or interests in said patents now held by him, and all releases and renewals and extensions of the same, to the said Morgan, one fourth; to other of the persons named, one fifth; to others eighteen one hundredths; and to another, seventeen one hundredths; so that the said several parties shall become joint owners thereof (certain specified States excepted); that the income derived from the excepted States shall be divided in like proportions. Among other numerous detailed provisions showing the considerations moving between the parties, is one that Wheeler and Morgan, when the releases have been obtained and the deeds of assignment are executed, are authorized to make sales of territorial rights, give licenses, to prosecute for infringements, compromise and settle claims for infringements, etc., they to render accounts, etc., to the others, and pay to the several others their proportionate share.

By a supplemental another firm was admitted to share, with one of the firms who were included in the agreement, certain of the advantages secured thereby.

The defendant, in his allegation of defect of parties, names a part only of the persons with whom his agreement was made, and on recurring to the consolidation contract it appears that he has only named those who were parties to that contract, and that he has omitted to name the others. The objection in the answer refers only to the consolidation contract, and has no reference to the agreement of October, 1869; nevertheless, I cannot say that an objection in the answer that Morgan and Mosher and some others specified are necessary parties does not warrant the production of this agreement of October, 1869, and any claim in respect to the specified persons which the agreement would sustain. It cannot be denied that that agreement made the equitable title to the patents in question, as well as the legal title, jointly with himself, until then Wheeler might have sued at law upon his legal title for the joint benefit. In equity, their title was in the absence of any proof of release, reassignment, or of a rescission of the agreement, as clear as law was to the extent that equity would regard that as done which ought to be done, and in equity their equitable title and immediate right to share the proceeds of a recovery made them necessary parties to a suit to recover for and to restrain infringements, if that objection is raised.

True, the complainant testifies that this agreement, "as far as the transfer of the legal title to the patents is concerned," was never acted upon." This is not sufficient to avoid the effect of the agreement; it does not show that any change was made in the relations of the parties to the released patents.

Their equitable titles in the shares, severally stipulated to each, became vested upon the procurement of the releases, subject only to an accounting with certain of the parties mentioned. To vest the legal title it was necessary that the agreement should be acted upon, but the parties, without action, could suffer Wheeler to retain the legal title and rest of their equitable rights. Proof that the agreement, in so far as it called for a transfer of the legal title, was not acted upon, does not show that it was in any manner defeated, or that it was rescinded, or that anything occurred to interfere with or interrupt its full force and effect in equity; while, on the other hand, the express admission by the complainant, in his testimony, that other writings were executed by him, and by showing what those writings were, leaves the defendant at liberty to insist upon the full force of his objection, and to presume that, had the complainant produced those writings, the equitable title of those absent parties would not be less clear.

It is, however, proved that on the 8th and 9th of July, 1868, releases were executed to the complainant by Morgan, Mosher, and certain other persons, who, by such releases, were excluded from the said agreement, and the owners of all the interest of the parties to the said agreement in question, excepting, of course, Wheeler himself. By these said releases the parties sell and relinquish to the complainant, his heirs and assigns, any and all the right, title, and interest, which the parties thereto can or may have, or claim either in law or in equity, in or to said patents, and any release or extension of the same by reason of any agreement, contract, or understanding previously had with them or those whom they represent; to the complainant, his heirs and assigns, and his legal representatives to the full end of the term for which said Letters Patent are or may be granted.

This operated to vest in Wheeler the equitable as well as the legal title. In respect to subsequent infringements, his right to sue in equity as well as at law was unimpaired.

This, however, leaves to the defendant a partial defence to this suit, which is that, on or about the 30th of June, 1870, as to infringements made and profits from infringements accrued prior to those last named releases, the objection remains, and on that ground the defendant now insists that if the defendant be decreed herein to account, such accounting shall not go back to an earlier date than July 8, 1868.

The complainant urges that this release of the equitable interest in the Letters Patent carries with it their interest in then existing claims for infringement, and that the defendant's attention is expressed; the words used have no such import nor implication.

These releases, in that respect, are not unlike the instrument which, pending this suit, the complainant has executed to Cornelius Aultman, and which the defendant has set up in his supplemental answer. The only difference is that the former transfer the equitable title, and the latter both the legal and equitable title. If the latter were construed to embrace all claims to infringement made and profits accrued prior to the date of the releases, to defeat the suit altogether, I must, therefore, hold the objection to want of parties, valid to this extent—viz., that the complainant, if entitled to a decree, notwithstanding other alleged defenses, cannot require the defendant to account in this suit for profits arising and accruing from infringements prior to July 8, 1868.

2. In the answer it is also attempted to go into all the details of the alleged facts, and to set up a very able and elaborate case, by the representation of counsel. In one form or another they have nearly all of them, on a like question, been under consideration in other cases heard and decided in this court between other parties. (See Wheeler vs. The Clipper Company, 10 Blatch. R., 181; Aultman vs. Holley et al., at this present term.)

The patentable nature of the invention described in and secured by the original patents granted to Wheeler, December 5, 1864, and February 5, 1865, and the practicability of the devices patented and their utility I deem unquestionable. The contrary, though set up in the defendant's answer, is not insisted upon by his counsel.

That the releases here in question are not invalid on the ground that they included devices not shown, described, or indicated in the original patents, their specifications, or claims, or that they included devices heretofore held, and I find no reason to change my opinion on that point.

Though alleged in the answer no ground is shown for holding the extension of the patents invalid or void.

The pendency of a suit in Illinois against the defendant and Leander J. McCormick, set up in the answer, is no bar to this suit, whatever operation, if any, a recovery thereon may have upon a final recovery there.

3. The invalidity of the releases in question is most strenuously urged by the counsel for the defendant on the ground that they are several patents for the same alleged invention, and not several patents for distinct and severable parts of the invention described and shown in the original patent.

This is most elaborately and ably argued. I do not understand that the counsel for the complainant contests the legal principles urged in support of this branch of the defendant's case. The contest whether there is any foundation of fact upon which it rests, whether, according to a just construction of the several releases, they are not in fact for severable parts of the aggregate invention included in the original patent.

I think the arguments of the defendant's counsel have not sufficiently kept in view this idea: where a patentee, having patented an aggregate of several devices, is permitted to surrender his patent and receive new letters patent for the several devices included in it, it does not follow that his new specifications may not be identical in their description of each of the devices included in the original aggregate patent. It is the patentee's selecting out of these devices some or one, being separable and capable of use as a distinct device or devices, and making that or those the subject of his specifications, that determines what is covered by each release. The description of an entire machine, or of a combination of devices, and sometimes necessary in order to show the adaptation of the separated device to a useful purpose, and illustrate, not its construction alone, but its application in one practicable mode, to the purpose for which it was designed. Such a description may be given, but that does not make the patent cover all that is included in the original patent.

In this case, then, it is competent for the patentee to amend his original specification, so as fully and minutely to describe all that was shown in the original or in his drawings or model, and receive patents for each separate device shown therein, or separate and severable combinations of devices, capable of distinct use, and, while such specification might be amended in *locum repit* to the original, it should, the construction of each separate patented device or combination of devices, so as to give the required information to the public, and illustrating the application of each device or combination to actual use in the construction of an aggregate machine.

This does not make one release include all that is described in the specification. All that is included in a specification is not necessarily included in the patent. What is claimed in and secured by the patent is secured only when used in the mode illustrated by the description of other devices with which it may be used in the specification, but it is secured against its use in connection with other devices of an entirely distinct character.

For example, in release numbered 1,410, the patentee claims in combination with a harvester frame that is free to vibrate about a gear center, a laterally projecting finger bar, so hinged to said frame as to follow the undulation of ground over which it is drawn. This claim, read in connection with the specification, refers to and is confined to a special class of harvesting and

moving machines—viz., those in which the rise and fall of the finger bar are effected by a vibration of the frame of the machine around the gear center, and the hinging of the finger bar to one end or corner of that frame, so that it may rise and fall with it. It is the use of a laterally projecting finger bar in connection with such a frame, and hinged thereto, and also hinged so as to permit the rise and fall of either end, which is the subject of this patent. In comparison with this, take either of the claims in the first in release, numbered 875.

In combination with the hinged bar H and the finger bar, the intermediate shoe M hinged to said bar H, substantially in the manner and for the purpose set forth.

Here is a limited claim to the shoe confined to its connection with the oscillating bar H and the finger bar, in the manner pointed out in the specification. It is clear that the claim in number 2,810 might be infringed without the employment of this specific combination, and it is equally clear that the claim last above recited would not be infringed by the use of the shoe M in any other manner or combination than with the oscillating bar H, mentioned therein.

It is true that the devices specified in each claim may be so used as to infringe one, but one may be used, and may infringe one of the claims and not infringe the other. As already suggested, the fact that the specification in each patent described the whole is not material. This is illustrated where there is but one patent, and of course but one specification; and yet the patentee, by his several claims, separates the devices, and, as may be lawfully done, claims the whole as an aggregate, and each separately.

A like comparison, instituted in reference to the other several claims in these releases, leads to the same conclusion. In some the several and separate character of the devices is more plainly apparent than in others; but I think they are none of them liable to the objection that the complainant has taken more than one patent for the same device or combination.

In a certain sense it may be said that a patent for a combination of several new devices includes them all; but this does not forbid the patentee from claiming the combination, and also claiming the several devices which enter into it, if he be the inventor of each, and they are useful by themselves or in other combinations.

It is not to my mind very clear that the complainant might not have secured all to which he was entitled by releasing his original patents, and claiming separately therein each device, or combination of devices, which he has claimed under several releases. But the law permits him to divide his patent, and find no sufficient ground for pronouncing the releases invalid.

A ground of defence, depending substantially upon the point last considered, arises out of the fact alleged in the answer, that release numbered 880, which was founded upon the original patent of December 5, 1864, was not then extended. The term of the original patent, and of course the term of this release, expired December 5, 1868; whereupon it is claimed that inasmuch as the invention patented by that release became, on the expiration of the term, public property, and the defendant therefore became entitled to use it, first, that the defendant is not liable for any infringement made at that time by the use of anything included in that patent; and, secondly, that that release does in fact embrace within its devices included in the other releases, and so the defendant is not liable at all, or if at all, he is not liable unless it be for infringements prior to that date. In the first place, the defendant is not sued for violating any rights secured to the complainant by the released patent 880. In the next place, the whole proposition falls if release numbered 880 embraces only a distinct and separate device not included in the other releases, so as to be free from the objections already considered. I will not enquire whether that device was valid, either as not embracing a patentable invention, or because the device which was the special subject of that patent was not new, or not the invention of the patentee. Nor will it be necessary to inquire whether the complainant is at liberty to allege the invalidity of that patent on any ground in order to avoid the conclusion sought to be drawn from the expiration of its term.

I am of opinion that nothing fell into the public domain, on the expiration of that patent, except the special device claimed in it, and that the patent did not include the device embraced in the other releases upon which this suit is brought.

Bearing in mind that a patent includes no more than the patentee claims therein, it will be seen that although, as in other releases, the specification gives a full description of the device, and of other devices which illustrate its application to use, the claim thereupon is:

The use of two hinges substantially as described, whereby the finger beam may be folded to the main frame, in the manner substantially as set forth.

Waiving, as before, the question of the validity of this patent, it is manifest that the devices claimed in the other releases do not necessarily perfect such folding of the finger beam. They, or some of them, provide for the rise and fall of the finger beam at either or both ends, and for its oscillation, so as to elevate or depress the points of the fingers, but neither of them describe a construction or use adapted to this folding of the finger bar sidewise against the frame. That is only described and provided for in the specification of this release 880, and it is doubtful, at least, whether the machine, as described and shown in the original patent, had such capacity. In that it is not described in the other releases, and is in the other releases, and is nowise essential to the operation of the device which are therein patented, is pointed out in the specification of release 880, and it is the special location of the hinge by which the shoe or socket piece is hinged to the oscillating bar. The device consists in so extending the place of that hinge sidewise towards the inner or grain side of the machine as that it may clear the frame when turned or folded. All the other motions of the oscillating bar, mentioned in other releases, are ineffective, and the finger bar might rise and fall at either or both ends in actual use for mowing, and so far as desired, in reaping, without this capacity of folding to the side of the main frame. This special location sidewise of the frame admitting of such folding, is the specific device covered, or sought to be covered, by this release, and whether such mere location involved any patentable quality or not it does not in itself so include the device that the termination of the exclusive right to use or employ the specific location involves also the right to use or employ other devices. Such location, if patentable, might be suggested by a third person, not the inventor of the other devices. If he had the right to use such other devices he might employ them in his new location. If not, his patent would be of no value, it being merely an added improvement to what was patented to another. In short, the devices included in the other releases do not necessarily include the device which is claimed in this release, and the special right to extend the location of the hinge inward, so as to clear the frame, and so permit or enable the finger bar to be thus folded, may, as an improvement, be vested in another inventor, who, nevertheless, cannot use it on a machine constructed within the other patented devices without infringing the patents therefor. Such a location of the hinges, whereby the hinged finger beam may be folded to the side of the frame, may be applied to machines involving the use of the other patented devices, and the right to use such a location may have become free to the public, and yet without involving the right to use such other devices.

For general illustration, suppose separate patents for several devices, all of which are useful in constructing an aggregate machine—the expiration of one of the patents makes the specific device therein patented public property. But while that will warrant the use of that device in connection with other devices, it will not warrant a use thereof in connection with the other patented devices, unless any use thereof necessarily involved the use of such devices; nor even then, except upon the ground that there is one patentee of both or all, who, in giving the use of one to the public, necessarily gives all that is essentially necessary to make that use available. Not only so, a device may be patented as a public property, either by the expiration of a patent or by abandonment to the public, which is useful and valuable, which, nevertheless, cannot be used except in connection or combination with other patented devices. In such cases, it cannot be used save by permission of the patentee of such other devices, whether he be the former patentee of such first named device or a third person. This exhibits the condition of the device patented in the release 880, even if it were considered that it could not be considered as in connection or combination with devices included in the other releases, while, if it is acceptable of use in connection with other modes of hinging the cutter bar, which would not include the devices claimed in such releases, the result more conclusively follows that the expiration of that patent forms no justification for infringing the other released and extended patents.

5. The question of the novelty of the invention claimed by the complainant, and whether he was the first inventor, was very elaborately discussed in this court by the counsel defending the case of Wheeler vs. The Clipper Company (10 Blatch. R., 181), upon the same proofs which are represented in this bearing on these questions. The influence of the same prior patents, applications for patents, inventions, attempted inventions, experiments, and failures, upon the inventions of others, was discussed in that case, and also in the case of Aultman vs. Holley, decided at this present term, and in some extent also in Kirby & Osborn vs. The Dodge and Stevens Companies, in the northern district of New York. Those questions have again been most elaborately reviewed on some alleged new aspects of the questions considered, and I have endeavored to give to the views of counsel not only a patient but careful attention, and I am constrained to the same conclusion in this case as is stated in the former cases; and what is stated on the subject, without a discussion of each patent, invention, and experiment in detail, in Wheeler vs. The Clipper Company, and Aultman vs. Holley, must be taken as my opinion in this case.

6. As to infringement by the defendant, the resistance of the charge depends very largely upon an impeachment of the complainant's title as inventor of the several devices employed by the defendant. So far as the denial of any infringement of the complainant's exclusive rights depends upon that impeachment, what has already been said is sufficiently overrules it. In relation to the specific claims infringed, much that was said in the Clipper case is applicable to the defendant's machine. The infringement seems to me very clear. It includes and, in substance, uses the devices embraced in the third and fourth claims of release 875, and probably at least one other, but only the infringement of the third and fourth was urged by the counsel for the complainant. As to what is embraced in the claim in release 877, the claims in releases 876 and 879, and 2,810, the first, fourth, fifth, sixth, and eighth claims in release patent numbered 2,812. The testimony of the expert, Mr. Renwick, is full and explicit, that the defendant's machine contains all these devices or combinations. My conclusion upon all the proofs is conformity with his testimony to that effect. The witness also testifies that the defendant's machine contains also substantially the same combination described in release 2,812, and referred to in the third claim thereof; but as the counsel for the complainant, in his printed argument submitted, expressly states that the claims in this patent alleged to be infringed are the first, fourth, fifth, sixth, and eighth, I confine the decision to those claims.

Without further detailed discussion of the numerous points and arguments most ably presented by the counsel in this case, I must content myself with saying that, after a laborious examination of the case, I am of opinion that the complainant is entitled to a decree in conformity with the foregoing opinion, declaring the infringement and directing an account of profits; but for reasons above stated that account must begin with the date of the releases from Morgan and others, July 8, 1868, and inasmuch as the complainant has, since the filing of this bill in this court, on the 3d of July, 1872, assigned and transferred all his right, title, and interest in the patents to Cornelius Aultman, as alleged in the defendant's supplemental answer, the account must terminate with the last named date, after which the complainant has no interest in the profits of the defendant's infringement, and no interest to be protected by injunction. The usual reference will be made to take such account, and the amount reported must be decreed to the complainant with costs.

George Harding, for complainant.

Henry Baldwin Jr., and Charles F. Blake, for defendant.

Recent American and Foreign Patents.

Improved Type Writing Machine.

John Galloway, New York city.—There is a roller, of sufficient size to receive a sheet of the paper to be used, and covered with cloth. This is mounted on a horizontal shaft which revolves in bearings attached to the frame. The paper, in connection with the colored paper or cloth from which the color is obtained for the impression, is rolled around the roller, and its edges are secured by a clamp. To the inner end of the roller is attached a spiral thread, which works between the pins of a shaft, so that the roller may be moved longitudinally upon its shaft at the same time that it is carried around thereby. By suitable means, the teeth of the shaft may be turned down out of gear with the thread, so that the roller may be pushed back at once, when required. By suitable construction the roller is rotated by the upward movement of the forward parts of the frames, the downward movement of said parts raising a push pawl one tooth. A pawl, which is pivoted to the frame, has its engaging end resting against the teeth of the wheel, to prevent said wheel from being turned back by the friction of the pawl as it is raised. A long block or hand piece is perforated longitudinally to receive a slide upon the forward bar of the movable frame. Upon the inner side of the forward end of the sliding block is formed an arm which projects through a slot in a plate, the ends of which are secured to the side bars of the frame. In the plate, at the upper and lower edges of said slot, are formed notches, and the free end of the arm is so formed that it may fit into the upper or lower notches, according as it is inclined upward or downward. Upon the top of the slotted part of the plate are formed the letters of the alphabet, the nine digits, a comma and a period, which characters are arranged in two rows, one row corresponding with the upper and the other with the lower row of notches. Upon the lower side of the sliding block are formed two rows of raised type corresponding with the characters, and which project at such an inclination that, when the arm is in the notch of either the upper or lower row of notches, the corresponding row of types will be in proper position for making the impression. In using the machine, the paper is placed upon the roller and the block is grasped with the hand, and is moved to bring the arm successively into the notches corresponding to the letters of the word to be formed upon the paper. As the arm is brought into each notch, the block is forced down, and the letter is printed upon the paper. At the end of each word the roller is caused to rotate twice the usual distance, and thus forms a space between the words.

Improved Safety Attachment for Car Trucks.

George C. Offen, Portland, Me.—The rollers are about three times as wide as the truck wheels, and are provided with short side flanges, and turn in bracket-shaped bearings, which are pivoted in suitable manner to the cross piece, to keep square on the track in case the truck is thrown off the track. They are hung at such height above the track that they just clear the same, the flanges keeping them on the track when thrown into use. The rollers may be connected suitably to the engine, to notify the engineer when the wheels are off the track. On the damaging or detaching of any wheel, they carry immediately the truck, taking the place of the wheels, may prevent damage and accidents.

Improved Lock.

Herrmann Stein, New York city, assignor to himself and Herman Dale, Brooklyn, N. Y.—This invention consists in a revolving tumbler which acts directly on a recessed bolt, and is retained in opened or closed position by a disk-shaped spring plate with projecting teeth. The small slots or recesses for the key prevent the introduction of wires of sufficient strength to overcome the strong pressure of a plate on the tumbler, so that the lock cannot easily be tampered with, while the direct action of the tumbler on the bolt prevents the forcing back of the same by a chisel or other implement.

Improved Burglar Alarm.

Henry L. Brown, Middletown, Conn.—The object of this invention is to provide simple and convenient means for detecting burglars when entering buildings; and consists of an alarm movement and bell, in combination with a wire or cord and gas burners, so arranged that, in the act of opening the door or window with which the alarm is connected, gas is turned on, a flame is produced, and the alarm given. A wire or cord is attached to an arm in the wall and to a second arm, which is attached to and projects from the escapement shaft of the alarm movement. The alarm movement is wound up by means of a key on the main shaft, and is held and prevented from giving the alarm by the wire. This wire is attached to the vibrating escapement shaft by a crank, so that the movement is held stationary by it. When this wire is broken or parted, the alarm is given. A gas pipe is connected with the service pipe, and the burner on the end thereof is supplied with a small jet of gas, which is ignited when the alarm is set for use. When the door is opened a bar is drawn back, a gas cock is turned, which admits of a flow of gas through a pipe to a second burner. The two burners are so formed and placed so near each other that the gas which escapes from the second burner is ignited by the flame from the first burner. The former gives a full flame, which envelopes the wire and, in a few seconds, burns it off, and allows the alarm movement to vibrate the hammer and give the alarm.

Improved Machine for Printing Oil Cloth.

William E. Worth, San Francisco, Cal.—This invention consists of a vertically moving press for carrying the printing block and pressing it on the cloth. The block is mounted on a frame carrying a platform for the operators, and shifting laterally on another frame, which shifts forward and back over the printing floor, whereon the cloth to be printed is laid. The principal frame is provided with mechanism for shifting it, and both frames are capable of having their movements arrested by stops, so that the prints will match properly.

Improved Bench Plane.

George W. Huber and Aaron E. Flickinger, Norwalk, O.—The object of this invention is to construct a plane, which is light, handy, and easily adjustable to any thickness of shaving without the use of a hammer. It consists in the firm mounting of the plane iron between a cap piece with connecting clamping bolt and set screw, and a supporting shoe, which is pivoted to the sides of the base piece, and adjusted, together with the plane iron by a conical eccentric pivoted to the base.

Improved Saw Gumming Machine.

Henry Baughman, Dorn's Gold Mine, S. C.—In this invention an emery or vulcanite gumming wheel is used. The tool overhangs an oscillating frame at one end, so as to be presented to a circular saw by means of two handles. An eccentric dog regulates the depth of the cuts in the saw by the tool by coming against the side of the frame. It can be set for cutting deep or shallow notches by turning it on its pivot. The tool is driven by a belt operated by any suitable driving mechanism. The contrivance for holding small circular saws consists of a clamp and center pin fitted on a slotted bar which is detachably connected to the frame. The clamps slide along the slotted bar through which the center pin passes, and are secured at any point for saws of any size by nuts on the center pin screwing all fast. There is a bar with a gage screw for controlling the edge of the saw by being screwed fast during the operation of the gumming tool. It is released to shift the saw. A stop button is employed to engage with the frame and hold the securing frame when gumming straight saws, which are moved up to it instead of moving the tool down to the saw, as when gumming round saws. The saw frame is weighted, so that the end on which the tool is mounted is borne upward.

Improved Gauntlet Glove.

Frederick Farrant, Gloversville, N. Y.—This invention consists of a novel construction of the wristband of a gauntlet glove, of two or more pieces, contrived to arrange one or more pinked or otherwise ornamented edges of the material of which the glove is formed, around the band at the middle, to make a more stylish finish than is afforded by the plain surface of a band composed of only one piece.

Improved Culinary Tong.

Alfred Greenleaf, Brooklyn, N. Y.—This is a pair of wire tongs of which the middle part of the lower prong is bent upward above the other and has a coil formed on it to give it elasticity so that the points are held closely together. A thumb piece is affixed to the bend, by pressing down which the prongs are forced apart.

Improved Device for Converting Motion.

Joseph P. Taylor, Hudson City, N. J.—This is an improved apparatus for applying motive power for propelling machinery, and for other purposes, by a pendulum lever connected with a rotating wheel, a continuous rotary motion being produced by means of a ratchet wheel and two ratchet pawls. The wheel and the ratchet are revolved on a central shaft, and the pawls are carried one to the right and the other to the left, by the oscillation of the pendulum lever, and alternately drop into gear with the ratchet by their own gravity and rotate the wheel. They are thrown out of gear with the ratchet wheel at the completion of each stroke by means of weights. An impulse is given the pendulum lever by means of a cord attached at the bottom.

Improved Automatic Railroad Signals.

Jane D. Evans, West Chester, Pa. executrix of Henry S. Evans, deceased.—This invention is an improved device, by the use of which railroad trains will be enabled to set the signals automatically as the train approaches and leaves a station, a crossing, a curve, or other place requiring care. Posts are set upon each side of the dangerous place, and in such positions that the signals attached to said posts may be readily seen from such a distance as will enable the engineer to readily stop his train before reaching said point. The signals are pivoted to the posts and are connected by chains which are attached to the rotating part of said signals, so that each signal may be operated by and from the other. As a train passes in the opposite direction, a projecting wheel placed upon a journal extending from the side of the engine strikes and presses down inclined bars arranged upon the other side of the track, which bear down upon the ends of levers, which are pivoted to the ties, and the inner ends of which are joined to the inner ends of other levers, which communicate with the chains which work the signals. The inclines when relieved from the downward pressure of the car wheels are again raised to their former position by coiled springs placed beneath them in recesses in the ties.

Improved Ventilating Car Window.

Charles B. Knevals, New York city.—This invention consists in a horse-shoe-shaped plate, provided with stop flanges upon the ends of its arms and perforated. It is secured to the lower part of the casing around the lower pivot of the sash, and with its circular part inward and its ends outward. The flanges serve as stops to limit the movement of the window upon its pivots. With this construction, the forward side of the sash, whichever end of the car moves forward, is swung inward, so as to form front and rear openings between the side bars of the said sash and the frame. The inclination of the window not only ventilates the car by causing a movement in the air, but the window serves also as a shield to prevent cinders and dust from entering the car, which cinders and dust strike against the inclined surface of the window and are projected outward. Small bolts are secured to the bottom bar of the sash upon the opposite sides of its pivot, and in such positions that their lower ends may enter holes in the side bars of the plate and thus lock the sash in place when adjusted.

Improved Washing Machine.

Moses L. Hawks, Kinderhook, Mich.—This invention has for its object to improve the construction of the washing machine for which letters patent No. 149,525 were issued to same inventor, July 8, 1873. The journals of a large roller are held down by the half bearings which slide up and down in the slots of the standards. The half bearings are rounded off to receive the rubber bands. The journals of two inner small rollers revolve in bearings in the standards, and the journals of two outer small rollers, all four being below the large roller, pass through short carved slots in the standards and revolve in bearings in the ends of the cross bars, which are placed upon the outer sides of the standards. The upper parts of the rubber bands are whole, but their lower parts are split. The improved construction allows the outer lower rollers to yield more readily as the clothes are entering and leaving the machine, and prevents the tendency to press the rollers out of position. The cross bars are connected and held in place against the outer sides of the standards by the wires, the ends of which are attached to the ends of the said cross bars. The wires pass across the edges of the standards, and, at the inner side of said standards, are bent twice at right angles, so as to pass beneath the outer small rollers, and thus be out of the way of the clothes.

Improved Car Coupling.

William Charles Brooks, Stoneham, Pa.—The upper part of the drawhead comprises the top and two sides, between which is a hollow longitudinal space, in the lower part of which is the other part of the drawhead, which is pivoted to the sides at its middle part. At the inner end this lower portion has a spiral spring arranged with it, so as to force the front end up and press a coupling link, which has a hook on the upper side, up into a notch behind a corresponding hook on the lower surface of the top side of the drawhead. The two parts of the drawhead are beveled at the front end to form a bell mouth to guide the end of the coupling link into the space at the front end when the cars come together. The link forces the front end of the lower part down sufficiently for its hook to pass hooks on the underside of the top of the drawhead, and the spring instantly forces it up again, and holds it so as to keep the hook of the link in connection with the hook of the drawhead. To disconnect the hooks a push pin and a lever are arranged with the drawhead and link and provided with a spring to hold it up. The push pin is arranged above the link, so that, by being pressed down by the lever, it will press the link and the lower part down so as to disconnect the hooks. The lever will extend to the side of the car, where it can be reached to uncouple the cars without going between them.

Improved Umbrella.

James H. Dugan and George Moncrief, Stoneham, Mass.—This invention consists of an arrangement of an umbrella top, so as to revolve upon the handle to relieve it when strong gusts of wind blow against it quartering, or when the top strikes against other umbrellas or other objects in crowded places. The said arrangement consists of a notched revolving ring for the ribs, between two collars on the handle, and a revolving notched ring on the runner, also between two collars.

Improved Portable Fire Extinguisher.

Isaac C. Andrews, New York city.—There is an inner bucket for containing the acid, in the opposite sides of the lower part of which are formed V shaped notches to receive pins formed upon the inner sides of the arms of the bow or U shaped bar. The ends of the arms of the bow pass up through stuffing boxes in the cover, and their ends are secured to the ends of the yoke. Upon the lower or inner side of the cover is formed a stopper, which fits into the mouth of the acid bucket. The bottom of the acid bucket is recessed to receive a loop, which is connected with the bow by a short chain. To the upper or outer side of the cover is rigidly attached the end of a rack bar, which passes up through a longitudinal slot in the yoke, in which slot is pivoted a lever, upon the lower end of which is formed a segmental gear wheel, the teeth of which mesh into the teeth of the rack bar, so that by operating the lever ratchet the bow may be lowered or raised. Upon the inner sides of the arms of the bow are formed toes which, as the said bow is lowered, strike against the upper edge or mouth of the acid bucket and push it off the stopper. This allows the bucket to slip over, and as it approaches a horizontal position the peculiar form of the sockets allows it to escape from the bow, and it drops, bottom upward, into and hangs suspended in the alkali solution in the middle of the lower part of the outer or alkali vessel. The rapidity of descent of the bucket causes it to carry the greater part of the acid with it, which acid is thus discharged in the midst of the alkali solution, with which it thus becomes thoroughly and evenly mixed, the swinging motion of the suspended bucket greatly assisting the mixing.

Improved Button Holder.

Minor J. Cooper, New York city.—The holder consists of two plates of metal which are forked at one end, the space between the prongs being V shaped. One of these plates has grooves on the inner edges of the prongs, which grooves receive the buttons. This V shape of the openings adapts the holder for buttons of different diameters. The cloth passes in between the two plates, and is pressed upon the buttons by the prongs of back plate as the two plates are pressed together or toward each other when the holder is in use by the fingers of the operator. The button is then sewn on with a needle and thread, in the usual manner. The advantages claimed are that the fingers are not exposed to the needle, and the sewing is performed with much greater ease.

Improved Machine for Shaping Brush Woods.

John Ames, Jr., Lansingburg, N. Y.—Through a hole in the bench or table of the machine passes a vertical shaft, upon which is formed a spiral cutting edge. To the upper side of the forward edge of the base plate is attached a flange of such a height as to afford space for the bristles of the brush, so that the said bristles may serve as a guide in placing the brush. The brush is held securely, while being operated upon, by the plate, which rests upon the back of the brush, and its forward edge is made of the exact form to be given to the edge of the brush, so as to firmly support the said brush while being operated upon. A cam is made to press against the base plate, so that the brush may be securely clamped in place. The part of the plate opposite the cutter is further supported against the upward pressure of said cutter by a ring guard through which the cutter passes, and which is supported in place adjustably. By this construction the brush is shaped with an upward cut toward the back of the brush, which leaves the edge around the bristles perfectly true and smooth, the trifling sliver'ling that may be made being around the back of the brush, where it can be readily worked out.

Improved Cotton Seed Planter.

Zimri Carter, Line Creek, S. C.—This invention is an improvement in the class of planters having a furrow opening plow and covering devices arranged, respectively, in front and rear of a hopper, from which the seed is centrally discharged as the machine advances. The improvement relates to the arrangement of plows or shovels in rear of a centrally discharging hopper, whereby one distributes or disperses the seed after being deposited in the furrow, and the others cover it.

Improved Machine for Removing Snow from Roadways.

George Hart, Tarrytown, N. Y.—This invention consists of a small locomotive engine, which is surrounded at the sides by a casing, with inclined endless belts with buckets, which take up the snow from rotating brushes or wings and convey it over connecting chutes to a separate tank, where the snow is melted by steam connecting pipes and the direct application of heat. The different parts which come in contact with the snow are heated by steam from the boiler, to prevent the clogging of the machine and insure a rapid delivery of the snow to the tank.

Improved Skate.

James A. Whippley, Dartmouth, N. S.—The runner has standards formed together with it, and projecting upward from the upper edge, for the support of the heel plate, sole plate, heel clamp, heel dog, and toe clamp. The toe clamp and heel dog are mortised to fit on their standards so as to slide freely back and forth, and they extend down to the upper edge of the runner, and have a thumb nut screwed on the lower extremity, so as to clamp and bind them fast at any point by screwing the nuts down on the runner. The sole plate and heel plate are also notched a little to receive projections and lock together with them when said plates are connected to the runner. Said plates have a strong semicircular brace attached to the under side, and these braces are engaged with the standards by entering longitudinal notches, when the plates are placed on, sprung down, and moved endwise. At the same time the notches of the plates and the projections lock together. The standards also have a projection passing entirely through the plates, to secure them against lateral movement. There is also a vibrating heel piece, clamped by means of a pendant shank and a cam lever. The latter has a slot and a projecting point, in combination with the shank of the heel piece, provided with an incline, to operate the same. It will be seen that all the several parts of the skate can be cut or formed in the shapes required by the dies by which they are punched out of the plates of which they are formed, and that the only fitting necessary besides the smoothing and polishing is a little bending of the clamps and dog, the fitting of the nuts, and the fastening of the braces to the plates.

Improved Water Closet.

John F. Nelson, New York city.—A round valve in a water chamber is opened by a lift handle, when all the water and other matter are discharged from the basin and elbow pipe through the valve seat. A float then sinks in a second chamber, carrying with it a valve which opens the supply pipe and admits water through to the basin, thence through the elbow to the chamber first mentioned. On releasing the handle the round valve resumes its former position, having sufficient weight to carry it to its seat. Water now gradually enters and raises the float and closes the supply pipe. To avoid overflow, a third chamber and an intervening piston that works between the valve and float are used. This greatly lessens the chances of sticking, but will not always prevent it. To provide an outlet to meet this contingency, a piston on the same rod that carries the round valve is employed. This piston not only serves as a guide to cause the valve to pass perpendicularly to its seat; but as soon as the water reaches it, it will be lifted and carry with it the valve, thus opening an outlet for the surplus water, and preventing an overflow.

Improved Spinning Mule.

Thomas Houlding, Ipswich, Mass.—This invention consists of a shaft extending the whole length of the carriage of a spinning mule or jack, and gearing at each end, by a toothed flanged pinion, with a kind of toothed chain, stretched from end to end of the carriage track, and prevent one end from over running the other. The chains are adjustable in their supports at the ends, as may be needed from time to time, to adjust the carriage.

Improved Corn Sheller.

John Marshall, Cordova, Ill.—The corn to be shelled is placed in the hopper, from which it is fed to an endless apron or elevator, which consists of a wide belt provided with cross slats, and passing around rollers pivoted to the frame work of the machine. From the upper end of an elevator the corn falls into the space between a cylinder and concave, where it is shelled. The cylinder is cast hollow, and with its shell is about half an inch thick, and revolves in bearings upon the frame work of the machine. In the shell of the cylinder are formed a number of pairs of holes to receive the shanks of ribs. These holes are arranged in rows, longitudinal with the cylinder, and in such a way that the ribs of one row may be opposite the spaces between the ribs of the adjacent rows. The ribs are made of steel or wrought iron, are half round in form, and are provided at their ends with shanks projecting at right angles from their flat sides. The concave is made of cast iron, in sections, with semi-cylindrical ribs upon their inner or concave sides. The sections are arranged about a quarter or three eighths of an inch apart, and their edges have oblong or oval notches formed in them, which are so arranged that the notches of the adjacent edges may alternate with each other. It will be seen that while the said notches supplement the function of the parallel spaces between the sections in aiding the ready discharge or escape of the shelled corn downward, their form and size are also such as to prevent the cobs taking the same course.

Improved Fish Grappling Spear.

Jonah W. Knapp, Cross River, N. Y.—The spear hooks are jointed together and provided with springs, which are bent when the hooks are opened, and held by the toggle joint until the latter is sprung, and then close them with sufficient force to secure the fish. The springs are jointed to the stock instead of being permanently attached as they have always been arranged, so that the hooks can be released from the power of the springs, to facilitate the opening and setting of them. One of the hooks is connected with sliding sleeves on the stock by a rod and wires passing up and down on the rod and over a pulley, and communicating with slides; so that by the sliding of one sleeve toward the spear hooks, and the other sleeve toward the top of the handle, the rock lever will be turned around to open and reset the hooks; and by moving the sleeves in the opposite directions, the lever will be turned back again to free the connecting rod so that said rod will allow the jaws to close when tripped, also to subject the springs to the required tension for actuating the hooks, which is effected by the action of a cam on one of said springs. The springs are arranged in a clip to which a rock lever and cam are pivoted; and the form of the rock lever and the connection of the rod with said lever are such that, during the first part of the movement of said lever in the direction for opening the hooks, the tension of the springs is so lessened that when the opening of the hooks begins the springs have but little power to resist it, thus making it so easy that it can be readily effected. This clip has a set screw which acts in conjunction with the cam for producing and varying the tension of the springs; and the clip is made adjustable forward and backward on the stock along the springs, also to vary the tension.

Improved Corn Dropper.

Robert M. Bowman and William H. Bowman, London, Ohio.—This invention consists of a hopper bottom having a hole for dropping the grain into it, with a supplementary slide for closing the hole arranged on its under side. The bottom is constructed to slide forward and back to bring the hole under the grain in the hopper, and then move it beyond the cut-off to the space of delivery. At the same time, the hole is opened by carrying the supplementary slide against a stop, which holds it against moving with the hopper bottom as soon as the hole has passed beyond the cut-off. The bottom continues its motion as far as the width of the hole, and then goes back for another charge, the supplementary slide being closed during the back movement by a spring. The arrangement is designed to prevent the choking and clogging common to most droppers in use.

Carbonic Acid Gas Generator and Soda Water Fountain.

Friederick W. Wiesbrock, New York City.—The first invention is an improved apparatus for generating carbonic acid gas for charging soda fountains, and for other uses, which shall be so constructed that the operator can discharge any desired amount of acid into the generator, as may be required, and know exactly how much remains in the acid chamber, and which can be operated without an agitator. To facilitate and insure the thorough intermingling of the acid and marble dust, cross bars are extended across the middle part of the generator, and have their ends secured to the shell of the said generator. The dome or gas chest is connected with the generator by one or more pipes, and in the top or cover of the dome are formed two openings. One opening is closed with a screw cap, and the other is connected with a pipe which leads down at one side of the dome and passes through or is connected with the hollow gudgeon of the receiver, so as to conduct the gas to the washer without being disturbed by the oscillation of the generator. The acid chamber has gudgeons formed upon its sides, which work in bearings in the sides of the dome. One of the gudgeons projects and carries an index finger which moves along an index plate on the side of the dome, and thus indicates the exact amount of acid that is poured out of said chamber. In the upper side of the acid chamber is a hole which, when the generator stands at rest in a horizontal position, is directly beneath one of the dome openings, so that the acid poured in through the said opening may flow into the acid chamber. By this construction, the contents of the generator will be thoroughly intermingled, by simply oscillating the said generator, which movement does not affect the acid chamber, which swings upon its pivots and is kept right side up by gravity. This construction also enables the generator to be turned into a vertical position, so that the refuse can be readily discharged without its being necessary to retain sufficient gas in the generator to blow out the said refuse, as is the case with the ordinary apparatus, thus effecting a great saving of gas. The same inventor has also devised an improvement in fountains for soda water, etc., in which the cylinder has a removable bottom, with a downward flange. There are hoops around the cylinder, and a lining; and an overlapping cover, a discharge pipe, and a discharge cock are also provided. The lining is made to loosely fit the cylinder, and is held to the cover and to the discharge tube by flanged nuts. The bottom is attached to the lower end of the cylinder by means of a peculiar base piece, hoop, and screws, so that it may be readily detached. When the bottom pipe and nut are removed, the lining and nut may be taken out. By making the fountain in this manner, it is claimed, the expense of the cylinder is greatly lessened, and all needed repairs to the lining easily and cheaply made.

Improved Railway Car Brake.

Luther Adams, Mattoon, Ill.—A friction disk or wheel having a notch is the chief medium for bringing the brake mechanism into action. This disk is mounted on journals in the bifurcated end of a plate which is hinged to a cross bar or timber. A spring is attached to said plate, and has a hole in its free end to receive a rod which forms the short arm of a bent lever. This last extends above the platform, and is pivoted thereto so as to be easily accessible. A spring also holds the disk out of contact with the axle. When it is desired to apply the brakes, the lever is operated to depress the spring plate, and thus bring the disk to come in frictional contact with the axle, which causes it to revolve one half a revolution, or until the axle enters the groove or notch, when the disk will remain locked until the pressure on the spring is relieved. This movement of the disk upon its axis applies the brakes, since it winds up the chain, which is secured in a circumferential groove of said disk, and extends back and connects with one end of a bar that is pivoted to the brake beam. By suitable mechanism, the action of the friction wheel is made automatic.

Improvement in Heating Air and Supplying Boilers therewith.

George E. Hubbard, Fond du Lac, Wis.—There is an air holder on the top of the boiler, near the smoke stack, into which air is forced by one or more air pumps, worked by the engine and connected with it by pipes. A pipe, with a check valve, connects this holder with a heating coil in the space, at the front, from which the hot air and exhaust steam escape. This coil is continued from the bottom of the space to the top of the boiler, where it connects with a pipe inside the boiler, which extends back into the steam dome, and discharges the air into the throttle pipe. The cold air is condensed to the extent of the boiler pressure, when it passes the check valve by the pumps, and what is gained afterward by the expansion is utilized as working force in the engine. In case air brakes are used on the cars, it is proposed to take the air for working them from this holder by a pipe, and thus utilize the same air pumps for supplying them. By the use of expanded air in connection with the steam, it is claimed that a large measure of heat which is otherwise wasted is utilized, thus economizing about twenty per cent of fuel.

Improved Dust Pan.

Orlando C. Forsyth, Jr., Newburgh, N. Y.—This invention is a dust pan provided with a handle made of wire bent at the middle to form an oblong end loop, next twisted together, then bent laterally and downwardly to support the rear of pan, so as to form legs of such a length as to support the pan in proper position for the dirt to be swept into it, and which will at the same time prevent the dust pan from being pushed back by the broom when sweeping the dust into it.

Improved Meat Holder.

Sarah Beisel, Shamokin, Pa.—This invention serves to hold meat while the same is being cut. It consists of a board clamped by set screws to the table and carrying two upright adjustable rollers between which the meat is placed. Vertical screw bolts also support a concave cross bar, which, on being forced down upon the meat, holds the same firmly in place.

Improved Car Mat.

John O'Neill, Brooklyn, N. Y.—The floors of street cars are usually covered with a wooden grating, made in sections, called car mats. As these mats are now made, the slats or bars are made to run all in one direction, either longitudinally or transversely with the car. The present invention consists in forming each separate section with groups of slats, arranged at right angles with each other, thereby, it is claimed, greatly strengthening the mat and rendering it durable.

Improved Till Alarm.

John F. Baldwin, Nashua, N. H., assignor to himself and Miles Alarm Till Manufacturing Company, Providence, R. I.—The receptacle in which the bolts and levers are placed and work consists of a box, the front and sides of which are cast in one piece, and the rear side of which is closed by a guide plate. Bolts are arranged so that their bodies fit into an upper chamber of the box, and their tops project in front and rear to rest upon the upper edges of the box and guide plate. The lower ends of the bolts are inclined and rest upon the upper ends of the one armed levers which have their fulcrum in the guide plate. By suitable construction, when the lower parts of the one armed levers are held back by springs, their upper ends are inclined to correspond with the inclined lower ends of the bolts. When the bolts are so arranged that the inclination of their lower ends may correspond with the inclination of the tops of the levers, the forward movement of the lower ends of said levers will raise the said bolts; but when the bolts are reversed, the forward movement of the lower ends of the said levers will lower them. By other construction, when all the bolts are down, lugs, when the drawer or till is drawn outward, will pass out beneath other lugs; but should the till or drawer be drawn upon without all the bolts being down, the first lugs will strike against and cannot pass the others. There is other apparatus so arranged that, when the drawer or till is drawn upon without all the bolts being down, a lug releases a lever from a ratchet and sounds the alarm.

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AND HOW TO OBTAIN THEM.

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W. P. D. will find a recipe for a transparent cement for glass on p. 27, vol. 30.—W. H. P. will find the description of a paste that will not sour on p. 290, vol. 28.—M. M. F. will find the explanation of the gravity clock on p. 58, vol. 30.—E. R. D. should see our advertising columns for book publishers' names.—J. Mc. can repair his waterproof suit, if it be made of rubber cloth, by following the directions on p. 155, vol. 35.—S. H. Jr. should see p. 349, vol. 26, and p. 33, vol. 27, for directions for utilizing old rubber belts.—C. P. should read the directions on p. 408, vol. 24, for destroying moths.—P. H. R. should consult a qualified medical man, and beware of nostrums.—A. S. will find directions for destroying red ants on p. 122, vol. 27.—P. can mount his chromos by the process described on p. 154, vol. 27.—S. H. S. will find a recipe for a waterproof and fireproof cement on p. 241, vol. 27.—G. W. H. will find an answer to his query about American and foreign inventors in our editorial columns of this issue.—A. F. will find information about gas engines on p. 33, current volume.

B. F. P. asks: 1. Is it an easy thing for burglars to turn the key, if left in the lock of a chamber door, from the outside? 2. If so, can they pick a lever lock, if the key is taken out when the door is locked for the night? Which is safest? A. 1. Yes. 2. Yes. Perhaps the latter may be somewhat the safest, though neither of them would be likely to give much trouble to an expert burglar.

D. R. H. asks: In the case of two steam fire engines, one on a level and one at the foot of a hill, with the hose (2 lengths, or 100 feet) in the first case being level and in the second being laid up the hill, and the water gauges on the engines showing each 150 lbs. to the square inch, is there any more pressure on the inch in the hose laid up the hill than that laid on the level ground? A. We suppose not.

C. W. Jr. asks: Is there any special cause producing storms at the time of the autumnal equinox? A. We think not.

F. M. H. asks: Which of the three methods would be best for keeping the ceiling over the smoke stack of a 15 horse power boiler from heating? The pipe is about 15 inches from the ceiling, and runs horizontally with it for 9 feet. 1. Nail a piece of tin tight to it. 2. Have it hung on wires about two inches from it. 3. Have a pan made and have it hung on wires about 6 inches from the ceiling and keep it full of water. 2. What is a good treatise on steam heating? A. 1. Probably the last method is the best. 2. Box on "Heat." See our advertising columns for booksellers' addresses.

W. A. B. asks: 1. Will silver coin answer for anodes in electroplating, that is, without taking out the alloy? 2. Has the United States nickel coinage any alloy in it? 3. I had some old gold, and tried to separate the alloy from it by the moist method. I dissolved it in strong nitric acid, and then tested for silver, but there was not any. I then poured off the supernatant liquor, which contained copper, and found a brown precipitate remaining. Then I added aqua regia, but it would not dissolve the precipitate. Why is this? How can I make chloride of gold of it? 4. I wished to make a plating solution for rubbing on with a sponge, according to a formula in an electroplating manual: I first took some pieces of pure silver (worn anodes) and dissolved in nitric acid and water. When dissolved, I evaporated. I dissolved the resulting crystals of nitrate of silver in rain water. Then (as per manual) I threw in a few crystals of hyposulphite of soda. A brown precipitate was formed, which eventually turned black. I threw in an excess of the hyposulphite to dissolve precipitate, but it would not dissolve. Why left so? How can I make it into solution? 5. Having a quantity of copper wires coated with silver (sliding wires) I dissolved them in nitric acid, then diluted it with rain water, and precipitated with pieces of copper. I poured off the supernatant liquor. A white mass remained. How shall I make solution of silver out of this, in order to make silver solution? 6. Could you tell me how to test the strength of my batteries by some simple contrivance that I could make myself? A. 1. Yes. 2. The nickel is alloyed with a certain proportion of copper. 3. The material you dissolved in nitric acid was not gold. The only acid solvent for gold is a mixture of nitric and hydrochloric acids, and the solvent in this case is the nascent chlorine which is liberated, forming chloride of gold. 4. Ammonia will dissolve the precipitate. 5. The white mass which remained was metallic silver, thrown down by the copper from the silver solution. This will dissolve in dilute nitric acid, forming nitrate of silver. 6. Consult some good work on electricity.

F. H. asks: What is the proper rule for reducing logs to cord measure? A. A rule frequently used is as follows: Multiply the square of one fifth the girth of the small end of the log, in feet, by twice the length in feet, and divide the product by 125.

F. E. C. says: I wish to be a machinist. 1. What branches should I study in addition to arithmetic and algebra? 2. I am now 16. When will I be old enough to enter a shop? 3. Will I have to serve as an apprentice? If so, how long and on what terms? A. 1. You should know something about drawing. 2. We think you are old enough now. 3. Arrangements are different in the various shops, and we advise you to make some inquiries from their proprietors.

W. McC. asks: Can you suggest a substance to be used in the manufacture of corundum wheels that is better than shellac, as adhesive as that material, but harder, and such as will render the wheels capable of being used both wet and dry? A. Such wheels are made, to be used both with oil and water. We believe the process of manufacture is patented.

J. C. S. says: I have an engine 6 inches bore by 10 inches stroke, now running 100 revolutions per minute, and doing about 3 horse power of work. At what speed should it be run to do that amount of work with least steam, at 20 pounds pressure, the driving pulley being changed to suit the speed of the engine? Probably the faster you can run it, without injury, the better.

W. & B. ask: Will three fans blowing into a common receiver, to supply blast for puddling furnaces, be as effective as the same three fans blowing through separate pipes? A. We suppose so, if application of blast is similar in both cases.

S. says: 1. I have a blank in which I wish to cut teeth for a gear. The diameter is $\frac{1}{4}$ inch. I want the teeth to be small. The gear is to work in a rack not yet made. Can you give me some simple method of obtaining the number of teeth, etc? I should like an even number of teeth to the inch. 2. How do you calculate how many threads to the inch to cut a worm to run in a gear? A. We advise you to study some standard work on gearing. "The Engineer's and Machinist's Assistant," will give you full information on the subject.

W. E. C. asks: Why is it that when a piece of steel with a hole in it has been hardened and annealed, it is necessary to bore the hole out, as it has contracted in the process? A. We suppose that the steel, when hardened, contracts more than it afterwards expands, when annealed. As the nature of hardening is not understood, it might be difficult to give a precise reason for this.

H. C. asks: 1. What will be the difference in the work of a pump, the perpendicular height being 18 feet, if I work it through a slanting tube 44 feet long, to the same level? 2. Has there been a patent taken out for a roof tile? 1. The difference would be that due to the friction of the water in the pipe, caused by its increase of length. See article on "Friction of Water in Pipes," p. 48, vol. 29. 2. We think there have been a number of patents for roof tiles.

C. H. S. says: I find the following memorandum: "Grade, 3744 feet in $1\frac{1}{4}$ mile; 2 cuts, one 96 feet, one 140 feet." This refers to the inclined plane of the railway at this place, which is built nearly as straight as a line can be drawn; and at the above gradient, the cuts referred to are through solid carboniferous limestone, which is a great curiosity to many. I saw in the SCIENTIFIC AMERICAN, a few weeks since, an account of the railway over the Alps, in which you state that they use a third rail, which is notched, and into which a toothed wheel, on the engine, works to aid the ascent. That plan was used here until about four years ago, and was invented (or claimed to be) by a resident of this city, a master mechanic in one of the machine shops here. I am not sure, but am under the impression, that he had a patent; if so, its date was about 20 years ago, as that is about the time it came into use here. A. We think this idea is quite an old one, and we aid nothing to give a contrary impression.

P. C. asks: 1. What is meant by mean pressure on the piston of an engine, and how is it calculated? 2. How many inches in cylinder are allowed to a horse power in manufacturing an engine? 1. The average pressure during the stroke. It must be determined by experiment. 2. It depends on intended pressure and piston speed.

J. W. K. says: I want to run kerosene through a gas pipe. What cement shall I use on the joints? Red or white lead, or our ordinary cement, will not stand it. A. You will probably have to make face joints, without cement, or you might use solder at each joint.

J. F. M. says: I wish to build an engine with a two inch cylinder, with stroke of 18 inches. 1. Can I get a piston speed of 300 feet per minute, with suitable connections? 2. Can I use a direct acting valve, moved by the piston, using no crank or shaft, only the reciprocating motion of the piston rod? 1. Yes. 2. Probably not with safety.

S. K. S. asks: How is the storm glass (referred to on page 234, vol 29) made? 2. How do you find the horse power of a double cylinder engine? The cylinders are set so as to act on the crank shaft at right angles. 3. Is the number of revolutions the number which the engine makes while doing its usual amount of work? A. 1. The best form of storm glass is that of a thin glass tube about 12 inches long and $\frac{1}{4}$ inch diameter, filled $\frac{1}{2}$ full of the following liquid: Camphor 2 drams, after 14 drams, sal ammoniac 1 dram, proof spirit 24 fluid ounces; dissolve. The top should be covered with a brass cap with a very small hole through it, or tied over with bladder. 2. Find the power of one cylinder by the process frequently given in these columns and multiply by 2. 3. Yes.

G. M. asks: 1. What is the best process of photographing on wood for engraving? 2. How is wood best prepared for pencil drawing? 3. Which is considered the best, a photograph on wood or a pencil drawing, to engrave from? 4. When types or stereotypes are cast, is compression used to get a perfect cast. A. 1. Consult some good work on photography. 2. The surface is whitened with chalk. 3. A pencil drawing is considered the best to engrave from. 4. We believe not.

M. M. asks: 1. Do bones lose any considerable portion of their value as manure, by being reduced with caustic alkali? I notice that the steam escaping from them while boiling appears to have the smell of ammonia. 2. When bones are reduced with sulphuric acid, a pungent vapor is discharged. What is that vapor, and is it injurious to inhale? 3. If 100 lbs. of bones are reduced with caustic alkali, and 100 lbs. with sulphuric acid, which (not taking into account the manure value of the alkali) will possess the greater value as manure? 4. Are the hoofs of animals as rich in fertilizing properties as the bones, and how can they be reduced to a condition suitable for use as manure? A. 1. The action of the alkali will be such as to dissolve or decompose the organic matter of the bones. 2. This is carbonic acid gas, from the decomposition of the carbonate of lime in the bones by the sulphuric acid. 3. The valuable constituent of bones is phosphate of lime. A portion of lime is removed from this by the action of sulphuric acid, converting it into a superphosphate which is soluble in water. 4. No. They can be chopped up fine and mixed with compost.

J. L. E. asks: How can I remove white paint from a black alpacas garment? A. Rub on the spot a mixture of fuller's earth and soft soap, made into a paste with spirits of turpentine.

C. W. C. asks: 1. Was not H. B. M. ship Captain, which foundered in the Bay of Biscay 3 or 4 years ago, the first turret ship on the Coles system? 2. Was she not a new ship? 3. About how many men were drowned? A. 1. We think so. 2. Yes. 3. Somewhat over 400, we believe.

E. S. asks: 1. Is there any possibility of polished silver corroding so as to become a non-conductor of electricity, by being buried in the ground, exposed to weather, or by any other treatment? 2. Can hard rubber be turned into nuts having threads cut, etc., and will they be strong enough to turn with a wrench? 3. How are platinum points fastened to sonometers? 4. Can platinum be worked into strips and riveted or soldered to wires, and will it become corroded so as to impair its conducting powers under any circumstances? A. 1. We think not. 2. Probably it can. 3. By the use of solder. 4. It can be, and we do not think it will lose its conducting power.

R. asks: Will it be safe to use, for dyeing, the steam generated in a boiler that contains a compound for removing scale? A. We think it quite likely, but could not answer positively without knowing more particulars.

C. B. R. says: 1. The rain water taken from our brick tank is quite hard. The tank is lined with Portland cement. What is the probable cause, and what will help it? 2. I am now using an engine, the cylinder of which is 16 x 8, making 60 revolutions. I want about double the power. What would be the best dimensions for a new cylinder? I want the shafting to run faster to do away with so much countershafting and to use smaller pulleys. Which would be the best for a 32 inch boiler, 3 inch tubes or two large flues? A. 1. We cannot answer this question without knowing more details. 2. You could readily get double the power from the present engine by running it twice as fast. Both styles of boilers that you mention are good. If you have plenty of room, the flue boiler may be desirable on some accounts, especially if you use hard water.

E. F. J. asks: If a cannon on the stern of a ship be fired at a target fixed on the bow, the ship moving forward as fast as the ball travels, can the target be hit, as it is moving as fast as the ball? A. We think so. There are several interesting questions involved in the solution of this problem, and we should be glad to hear from our readers.

A. J. D. asks: What is your opinion of the following plan for a dry house for drying timber? My factory is 100 feet long, and 2 stories high, the boiler being in the west end, and the chimney going up through one corner of building. My idea is to put a drying room in the second story, 12 feet wide x 8 feet high x 100 feet long, and connect with the chimney, just on the second floor, a brick flue and build it horizontally to the east end of building, then turn it into dry room at the bottom, the heat from the furnace to pass through this flue into the drying room, and into a flue leading back into the chimney again. The main difficulty is to prevent sparks from passing through into the dry house and setting fire to the lumber or staves. Do you know of any plan by which that can be prevented? A. Your idea does not strike us very favorably. It would be difficult to secure perfect immunity from sparks, and probably you would seriously injure the draft in your boiler.

H. & C. Co. ask: How can we best ascertain the horse power of an engine? A. Multiply mean effective pressure in lbs. during stroke, by piston speed in feet per minute, and divide the product by 33,000.

J. B. E. asks: 1. Who will, on application, examine me and, should I pass examination, give me such papers as would certify that I am a competent engineer? 2. Are $\frac{1}{4}$ inch common iron braces in a cylinder boiler strong enough to stand a pressure of 120 lbs., provided that each brace has a surface of over 32 square inches to brace. A. 1. The supervising inspectors appointed by the Government grant licenses to those who pass satisfactory examinations. 2. We think such bracing is insufficient.

E. J. H. asks: If water be applied to a wheel made upon the principle of some of the rotary steam engines, could a better percentage of power be obtained than from the present improved turbines? A. It seems probable that the turbine wheel will give better results, judging from experience.

J. W. F. asks: Please give me a correct rule for estimating the horse power of a high pressure engine, and also for estimating the amount of horse power in a boiler. I have tried four different rules, but I get different answers, that vary very much. The engine has a diameter of cylinder 12 inches, length of stroke 30 inches, average pressure of steam 80 lbs., revolutions 80. The boiler is 16 feet long and 4 feet diameter, with 52 two and three quarter inch tubes. Will increasing the number of revolutions of the engine increase the horse power? I tried your rule as given to M. C. in No. 8, vol. 30, but was not sure I was right. A. Area of piston $12 \times 12 \times 0.7854 = 113.1$ square inches. $80 \times 5 = 400$ feet piston speed per minute. Horse power = $113.1 \times 400 \div 33,000 = 139.37$. This solution supposes that the mean effective pressure in the cylinder is 80 lbs. per square inch, which is probably untrue. An increase of speed, other things being equal, increases the horse power. In regard to the horse power of a boiler, it has many different meanings. In some cases a boiler of one horse power designates a boiler that furnishes steam enough to produce one horse power, when used in an engine; others employ the term to distinguish a boiler that evaporates one cubic foot of water an hour; others a boiler that evaporates half a cubic foot; and there are many other significations of the term. A committee of the Franklin Institute, appointed to investigate the meaning of the "horse power of a boiler" failed to make any recommendation that was approved by the Institute, after deliberations extending over a period of more than a year and a half.

H. M. P. says: If I have a cylinder full of water with a flexible tube running lengthwise through it, also full of water, and I put 30 pounds pressure on the inch on cylinder with a force pump with a piston of the same diameter as the flexible tube one end of the tube being closed; What resistance would be required to prevent water escaping at the open end? A. As we understand the question, 30 lbs. per square inch.

E. C. asks: 1. Does the induction coil, if of sufficient size, produce an induced current more powerful than the inducing or battery current? If so, what lengths of wire must be employed to produce an induced current equal to the inducing one? 2. How is the bichromate battery constructed? A. 1. The induction coil produces a current of greater intensity than the battery current, that is, one capable of giving shocks, decomposing water, etc. 2. The carbon cell is filled with a mixture of a solution of bichromate of potash and dilute oil of vitriol, and the zinc cell with dilute sulphuric acid.

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C. H. S. asks: How can a piece of iron, 1 inch thick, be cleaned on one side. A. Probably it can be done with pumice, or of tooth.

M. R. B. asks: How can common cast iron be plated with tin? A. Clean the iron, cover it with muriatic acid, and dip into melted tin.

T. S. says: My house burnt down, and some 250 gold pieces were tarnished by soot. They were carrying them in an iron pot, and cooling by pouring cold water on them. Has the said gold been injured, and should the banks require a discount on such gold? How can I remove the brown color to give them the same appearance as before? A. Your gold has not been injured. You can remove the tarnished appearance by rubbing with jeweller's rouge, until there is a slight polish.

P. T. S. asks: The cast iron water back in my range, which has been in use about six months, continues to rust the water badly. The manufacturers of the range state that they never knew such a case. Can you suggest any remedy? The water used is soft water, rain water from a lead cistern. Would it be practicable to galvanize or nickel plate a new water back? Would not such treatment effectually prevent rust? A. If the water back is in constant use, it seems likely that the trouble arises from some outside connection. It would not cost much to galvanize the water back. Probably any good plumber could have it done for you.

C. F. M. asks: What is the best solvent for India rubber, and what (if any) for tanned leather? A. There are various solvents for rubber. One of the best and cheapest is bisulphide of carbon. We are not aware that tanned leather has ever been reduced to solution by any chemical solvent.

N. R. asks: How much water would a wooden pipe discharge per minute, under a head of 30 or 40 feet, the pipe being from 4 to 10 miles long? A. See our article on "Friction of Water in Pipes" on p. 48, vol. 29, for formula applicable to all cases.

A. H. asks: Where do fleas breed? A. Chiefly in dust, the fine of textile fabrics, old rags, etc. Cleanliness in the household and fresh air will hinder their multiplication. Oil of pennyroyal will drive them from any particular locality.

R. F. asks: What is infusorial earth? A. It is earth which contains the remains of minute animals.

J. W. asks: What power can I obtain by using an undershot water wheel, 10 feet wide, with 3½ inches fall? What are the most economical proportions for such a wheel, namely: diameter, number of buckets, and depth of shrouding? A. You should consult a water wheel manufacturer.

M. M. asks: Will the applying of brakes to driving wheels of engines have greater tendency to check the speed of a single engine than if applied to the trucks of the tender? If the power now applied to the trucks of the tender be applied to the driving wheels, will the speed of the engines be checked any quicker? A. We think it would be better to apply the brake to the trucks of the tender.

W. H. asks: 1. Of what is non-explosive gunpowder composed? 2. Can you tell me of a good renovating mixture for cloth clothing? 3. What is meant by a saturated tincture? 4. What does this mean: "Add water three ozs., and ammonia till slightly in excess?" A. 1. A process of rendering gunpowder temporarily incombustible has been tried in England. It consisted in mixing fine glass dust with the powder. What you refer to may be something similar. 2. A little curd soap dissolved in water and mixed with a little clarified egg yolk is a good cleaning mixture for clothes. 3. A tincture in which the alcohol will dissolve no more of the solid or liquid in solution. 4. In chemistry, generally, a body is said to be in excess when more has been added than is necessary for a given reaction, solution, or decomposition.

COMMUNICATIONS RECEIVED.

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

On Nail Biting and Finger Sucking. By C. M.

On Steam on the Canals. By A., and by W. M.

On Creeping Rails. By H. H. P.

On Magic Squares. By E. W.

On Machinists in the Navy. By J. Q. A.

On Devil Fish. By J. T. N.

Also enquiries from the following:

J. C. V.—A. N. P.—C. L. Z.—W. T.—J. R. D. W.—T. J. McC.—G. G. P.—J. W.—W. S. S.—R. M. P.—R. U. S.—N. W. Y.—J. N. P.

Correspondents in different parts of the country ask: Who makes machines for molding candles? Who makes roadometers? Who makes machines for cutting tobacco? Who is the best coal heating apparatus? Who makes billiard table cushions, that can be attached to a common table? Who makes shoe peg making machines? Who makes a wheel for grinding bayonet grooves? Who sells a family flour sifter? 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.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

December 30, 1873,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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Car window screen, J. E. Earle.....	146,053
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Carriage iron, H. K. Porter.....	146,093
Carriage top prop, W. P. Elam.....	146,035
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Cooler, milk, R. P. Main.....	146,084
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Fence machine, J. H. Evans.....	146,096
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Fire bar, etc., tubular, R. J. Ellis.....	146,095
Flour packer, S. Taggart.....	146,107
Furnace, hot air, D. B. Morris.....	146,083
Furnace, portable, H. J. Lingenfelter.....	146,054
Gage, joiner's, Jennings & Arnold.....	146,075
Garden implement, J. M. Lunguest.....	146,088
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Hinge for safe doors, etc., W. F. Stevens.....	146,073
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Lamp, C. A. Kleeman (r).....	5,708
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Leather, preserving, J. Lamplugh.....	146,080
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Loom for piled fabrics, H. Skinner.....	146,101
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Piano pedal stool, T. Springer.....	146,103
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Picture frames, wooden mat for, H. S. Hale.....	146,067
Pipe tongs, J. R. Brown.....	146,029
Piping, steam and water, J. H. Mills.....	146,062
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Plane, combination, A. Johnson.....	146,004
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Plow, J. J. Mitchell.....	146,058
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Press, wagon hay, B. Brocksmit.....	146,096
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Refrigerator, H. A. Roberts.....	146,068
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Sawing machine, scroll, T. W. Dowling.....	146,090
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Sewing machine gatherer, etc., A. Johnston.....	146,053
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Sharpening machine, H. H. Burke.....	146,090
Shutter fastener, P. Keffer.....	146,051
Shutter fastener, H. A. Skinner.....	146,028
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Stove, E. Smith (r).....	5,712
Stove damper, E. F. Cook.....	146,069
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Tramway plate, S. D. Thiman.....	146,093
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Valve, J. A. Nichols.....	146,064
Valve for steam pipes, J. W. Hodges.....	146,073
Vault cover illuminating, J. K. Ingalls.....	146,074
Vehicle, Farmer & Bradley.....	146,085
Vehicle holdback, Burdick & Flanders.....	146,042
Washing machine, P. Hibbs.....	146,071
Washing machine, L. Holderman.....	146,046
Washing machine, S. N. Page.....	146,091
Watch barrel, F. A. Giles.....	146,099
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Water wheel, J. B. Hamilton.....	146,068
Whipsocket clamp, C. B. Morehouse (r).....	5,713
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Windmill, E. Sanderson.....	146,070
Wines, medicated, V. Brosseau.....	146,028
Winnower, rotary, J. H. Adamson.....	146,080
Wire stretcher, Congdon & House.....	146,046
Work holding device, F. E. Hahn.....	146,064
Wrench, J. Lee.....	146,053
Zinc, etc., condensing white, C. W. Trotter.....	146,076

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:

27,678.—FASTENING ARTIFICIAL TEETH.—A. M. & J. L. Assay. March 18.
27,736.—HAT VENTILATOR.—J. Pollock. March 18.
27,809.—WASHING MACHINE.—J. Johnson. March 25.
28,027.—CUTTING SHEET METAL.—J. Waugh. April 18.

EXTENSIONS GRANTED.

26,874.—CLOTHES DRYER.—P. B. Hawes.
26,679.—DOUBLE SEAMING MACHINE.—L. T. Hubert.
26,689.—PIVOT BEARINGS.—F. C. Lowthorp.

TRADE MARKS REGISTERED.

1,588.—CIGARS.—Gilmer & Gibson, Baltimore, Md.
1,589.—SADDLE TREES.—S. E. Tompkins, Sing Sing, N. Y.
1,590.—COFFEE.—Hawley & Co., San Francisco, Cal.

DESIGNS PATENTED.

7,077.—RUFFLING.—S. E. Barney, New Haven, Conn.
7,078.—CUTLERY HANDLE.—J. D. Frary, New Britain, Ct.
7,079.—FIGURES.—J. D. Smith, Washington, D. C.
7,080.—PRINTING TYPES.—J. M. Conner, Greenville, N. Y.
7,081.—PINCUSHIONS.—A. Merriam et al., West Meriden, Ct.
7,082.—LABEL.—A. M. Thomson et al., Chicago, Ill.

SCHEDULE OF PATENT FEES.

On each Caveat.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Release.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3½ years).....	\$10
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 5 TO JANUARY 9, 1873.

2,967.—F. H. Whitman, Harrison, Cumberland county, Me., U. S., assignee of E. H. Woodsum, South Boston, Mass., U. S. Improved gain cutting machine, called "Woodsum's Gain Cutting Machine." Jan. 5, 1874.
2,968.—J. McLarty, Strathroy, Middlesex, Ontario. Improvements in ladders, called "The Improved Flexible Ladder." Jan. 5, 1874.
2,969.—F. R. Butcher, St. John, New Brunswick. Improvement in spring bed bottoms, called "Butcher's Improved Hinged Slat Spring Bed Bottom." Jan. 5, 1874.
2,970.—W. T. Hand, Fitch Bay, Stanstead county, P. Q., and T. B. Rider, Magog, Stanstead county, P. Q. Improvements on saw arbors, called "Rand's Improved Saw Arbor." Jan. 5, 1874.
2,971.—J. T. Poole, J. S. Allen, C. M. N. Allen, J. Williamson, G. N. Clark, D. B. Jones and E. Moore, all of Canterbury, York county, New Brunswick. Improvements on life preserving dresses and air buoys combined, called "Poole's Life Dress and Buoys." Jan. 5, 1874.
2,982.—C. H. Billings, Cleveland, Cuyahoga county, O., U. S., and J. T. Rapier, Montreal, P. Q. Improvements on self-acting car couplers for railway cars, called "Billings' Automatic Car Coupler." Jan. 5, 1874.
2,973.—H. L. Lowman, Birmingham, New Haven county, Conn., U. S., and R. M. Bassett, of same place. Improvements on manufacture of shovels, spades, hoes, grocers' scoops and other like articles, called "Lowman's Swaged Shanks." Jan. 5, 1874.

2,974.—W. O. Grover, Boston, Suffolk county, Mass., U. S. Improvement on bird cages, called "Grover's Improved Bird Cage." Jan. 5, 1874.
2,975.—G. Calcott, Thorold, Welland county, Ontario. Improvement on stores for heating apartments, called "Calcott's Improved Base Burner Store." Jan. 5, 1874.
2,976.—S. P. Slade, Rockford, Winnebago county, Ill., U. S. Improvement on anti-freezing writing fluid, called "Slade's Non Corrosive Anti-Freezing Writing Fluid." Jan. 5, 1874.
2,977.—V. C. Meyerhoffer, Rutland, Rutland county, Vt., U. S. Improvements in mail bags, called "Meyerhoffer's Improved Mail Bag." Jan. 5, 1874.
2,978.—I. A. Welch, Hamilton, Ontario. Improvement on flat brushes, called "I. A. Welch's Improved Flat Brush." Jan. 5, 1874.
2,979.—W. H. Porter, Bradford, Simcoe county, Ontario. Improvements on dental plates, called "Porter's Dental Plate." Jan. 5, 1874.
2,980.—W. Ferris, Pleasant Plain, Warren county, O., U. S. Improvements on knife and pitman connection for reapers and mowers, called "Ferris' Improvement in Pitman Connection for Harvesters." Jan. 5, 1874.
2,981.—I. O. Jones, Boston, Mass., U. S. Improvements on rakes, called "Jones' Reversible Rake." Jan. 5, 1874.
2,982.—J. B. Gully, Montreal, P. Q. Art or method of preparing steel belts for alleviating and curing rheumatism, called "Gully's Anti-Rheumatism Belt." Jan. 5, 1874.
2,983.—W. Dunlop, Toronto, Ontario. Improvements on stretch traps, for sewer and waste water drains, called "Dunlop's Improved Drain Trap." Jan. 5, 1874.
2,984.—J. Richards, G. W. Waitt, E. C. Shapley and C. F. Jones, all of Philadelphia, Pa., U. S. Improvements in locomotive chimneys, called "Richards' and Meehl's Locomotive Chimney." Jan. 5, 1874.
2,985.—A. B. McDonell, Osgoode, Carleton county, Ontario. Improvements in cultivators, called "McDonell's Cylinder Cultivator." Jan. 5, 1874.
2,986.—B. T. Nichols, Baselle, Union county, N. J., U. S. Improvements on nails and spikes, called "Nichols' Improved Nail and Spike." Jan. 5, 1874.
2,987.—R. S. Jarvis, Toronto, Ontario. Improvements on quilting frame, called "Jarvis' Adjustable Quilting Frame." Jan. 5, 1874.
2,988.—P. Cope, Perryopolis, Fayette county, Pa., U. S. Improvements on brackets for fence bars, called "Cope's Fence Bar Bracket." Jan. 5, 1874.
2,989.—W. T. Doremus, New York, U. S. Improvements on springs for furniture and other purposes, called "Doremus' Springs for Furniture and Other Purposes." Jan. 5, 1874.
2,990.—F. E. Dixon, Toronto, Ontario. New window fastener and support, called "Dixon's Improved Sash Fastener." Jan. 5, 1874.
2,991.—I. I. Lahaye, Reading, Berks county, Pa., U. S. Improvements on car coupling, called "Lahaye's Improved Car Coupling." Jan. 5, 1874.
2,992.—E. F. Austin, Rochester, Monroe county, N.

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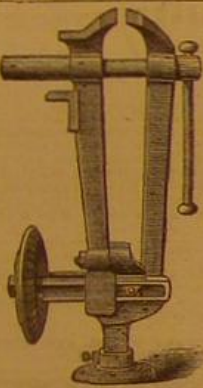
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50 CASH GIFTS, 500 each	25,000
100 CASH GIFTS, 250 each	25,000
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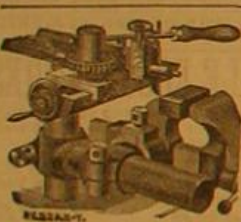
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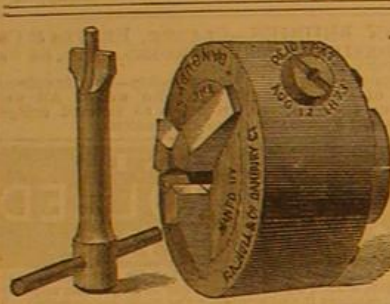
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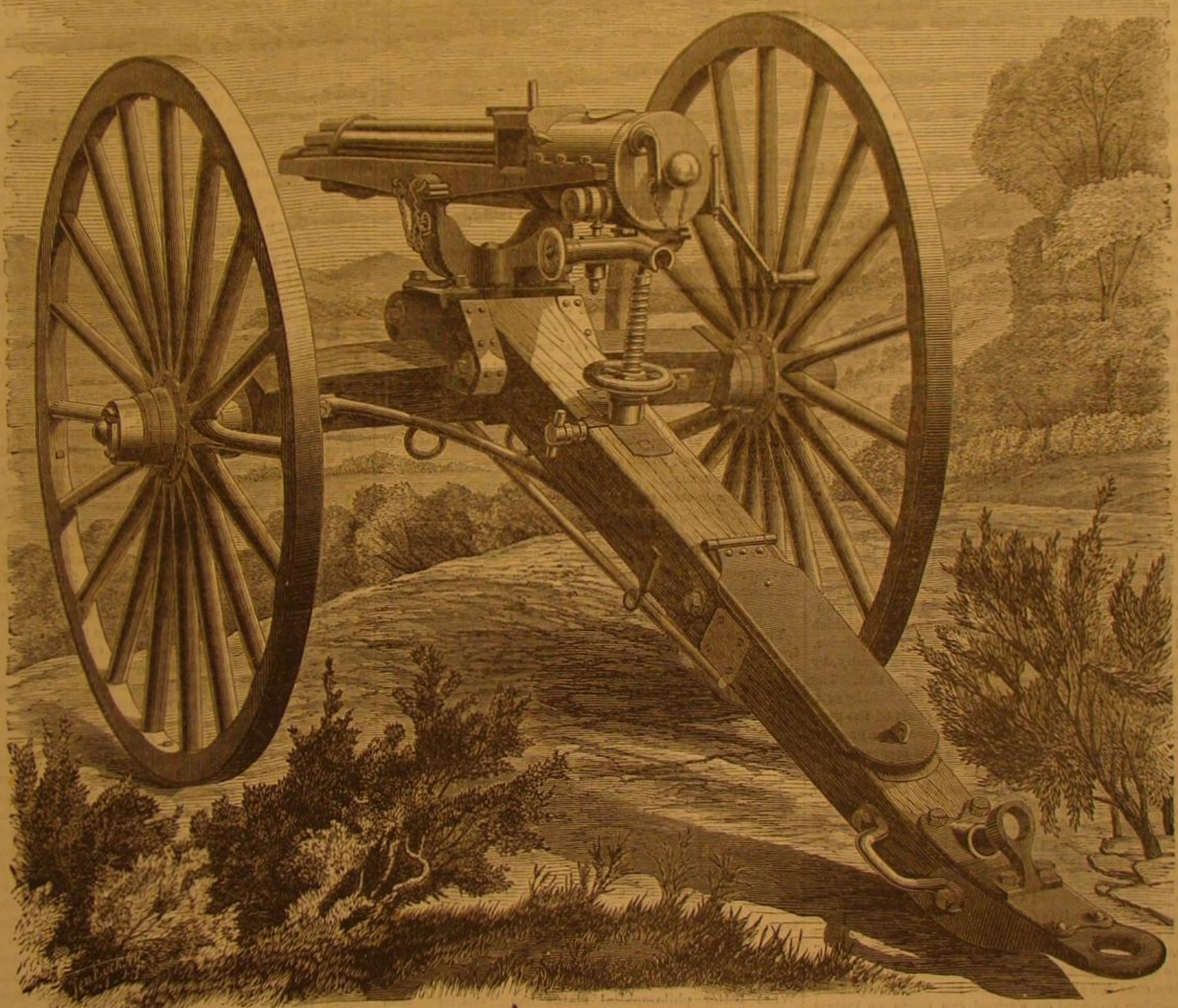
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Vol. XXX.—No. 6.
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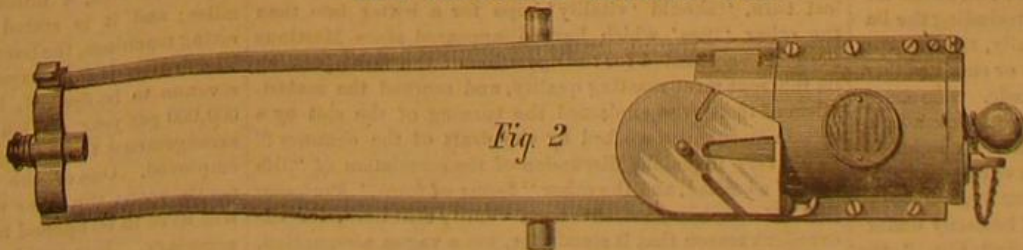


Fig. 2

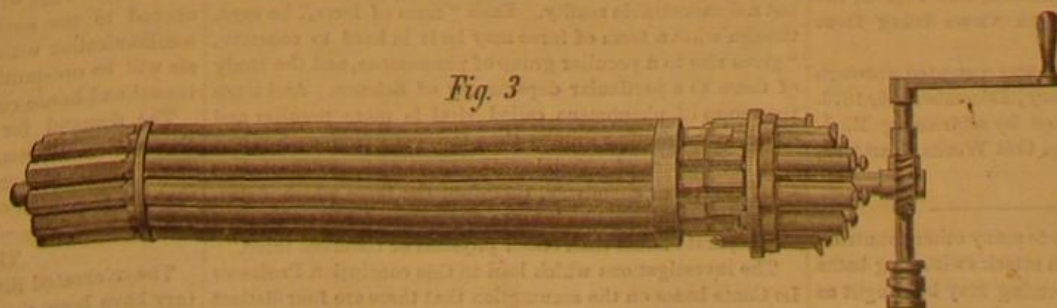


Fig. 3

proved 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.

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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IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

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 numerous 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 transference 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 tons 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 tons 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 com-

binations 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, untrammelled 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 etheral 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 height 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 of 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.

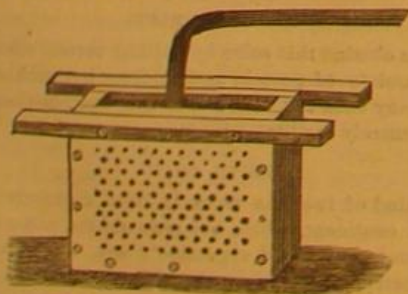
The researches of Professor Coffin also strikingly exhibit the fact of the influence of the seasons in modifying the direction of the wind, or in producing the results denominated monsoons. Thus, along the eastern coast of North America, as is shown on the maps, the tendency during the summer months, 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.*

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 hold-



ing the copper scraps. It is simply a prismatic box about 14 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.

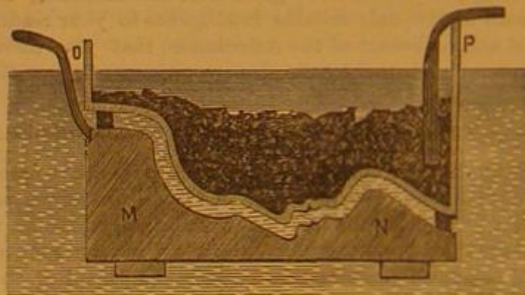
The following practical hints will be of use in selecting scraps to fill the receptacle: Choose pieces free from solder or rivets of brass or iron. Flatten out with a hammer such bits as are curled up, and divide with shears those of irregular form, so that all may fit closely upon each other. With these, 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



JAMES H. COFFIN.

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.—*Roswell'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 height 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 30° 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 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 grain, if very smutty so as to necessitate hand winnowing, is delivered directly to the sacks, but ordinarily it passes into a barley sower and chaff cleaner, which consists of a con-

ical 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 di-

brued 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 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

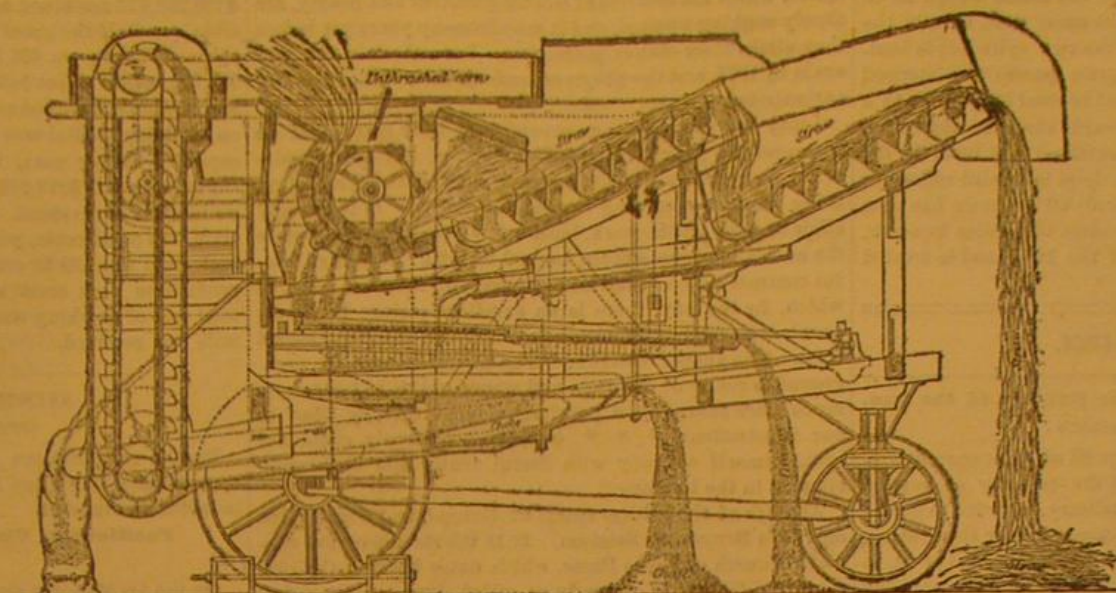


Fig. 1.—THRASHING MACHINES AT THE VIENNA EXPOSITION.

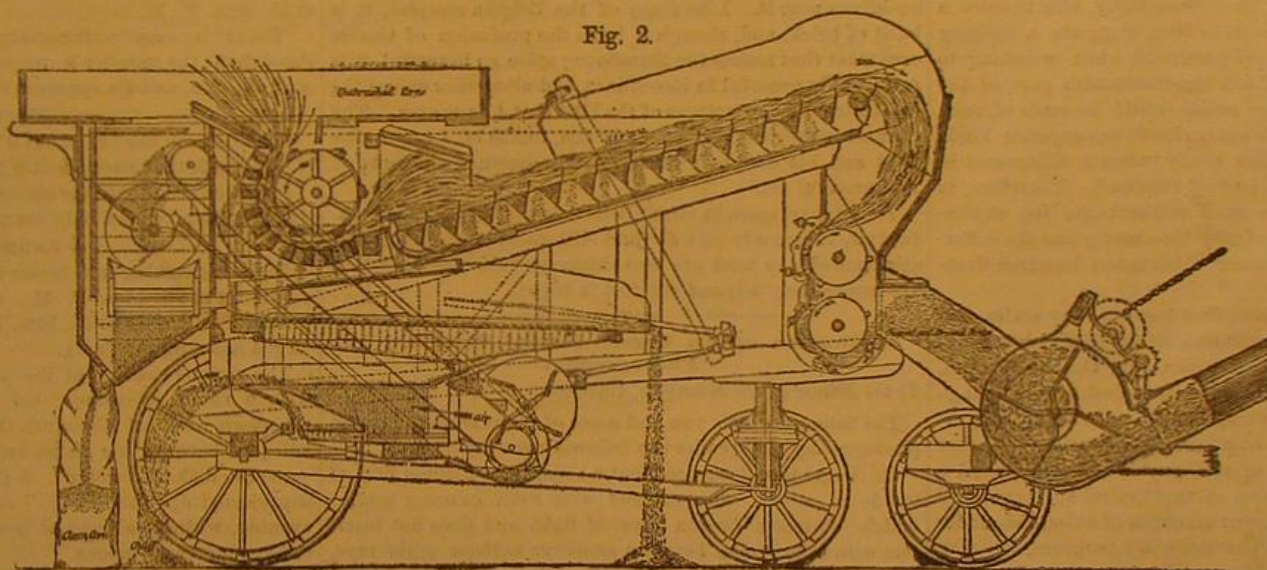


Fig. 3.

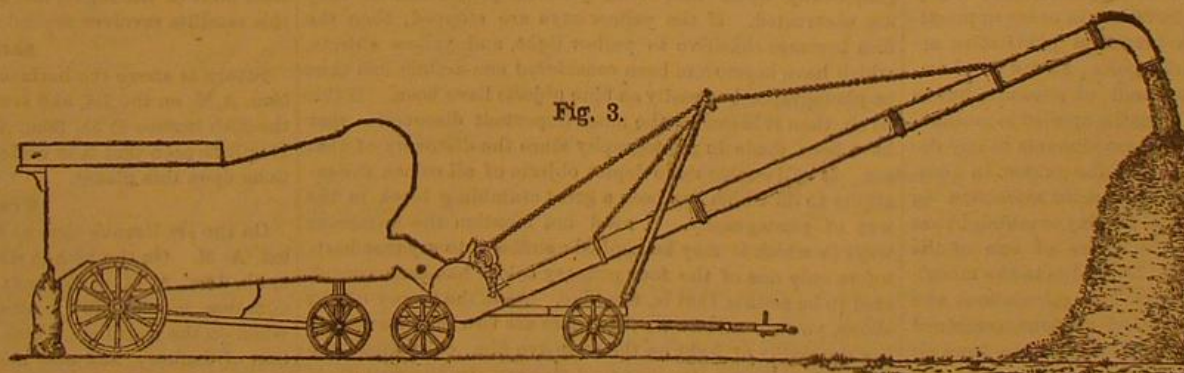
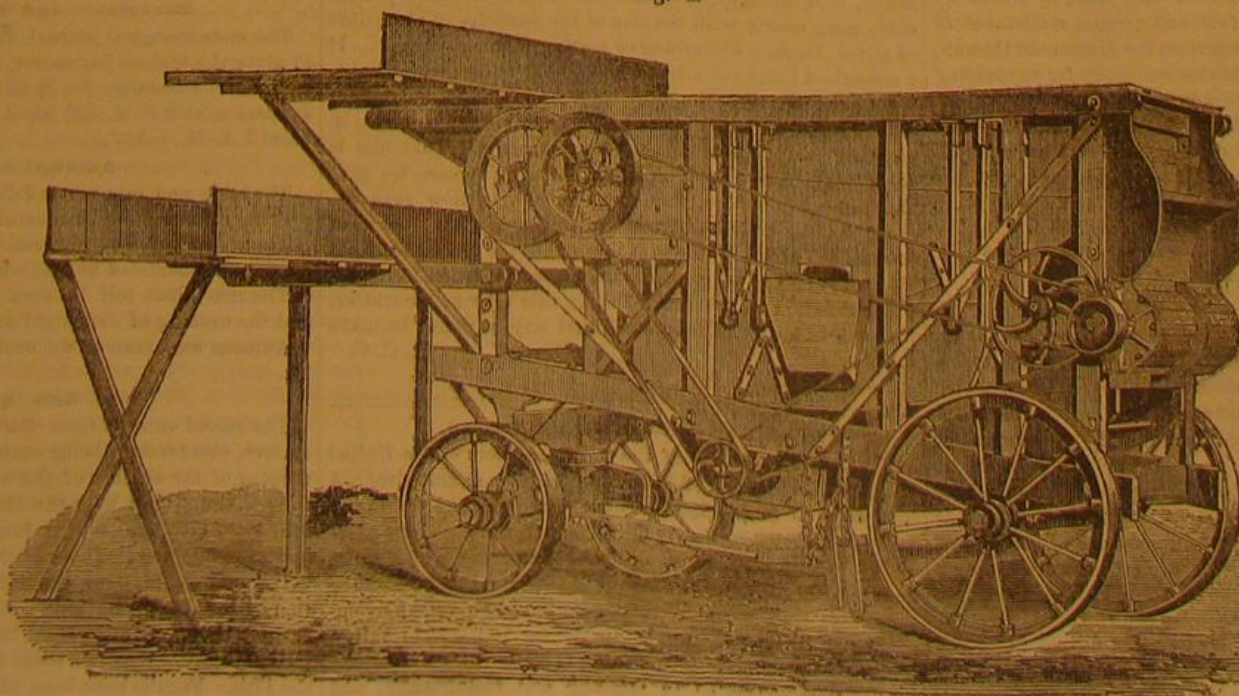


Fig. 4.



(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 tons 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 tons 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 tons, 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 attraction 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 height 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 height 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 height 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 height of the central spire of Rouen cathedral is a little greater than that of Strasbourg, being 483 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 height 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 height. 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 $\frac{1}{2}$ 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 422,874,823 passenger journeys, besides 272,342 season ticket holders; and 179,302,121 tons 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., 53°; 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. Faculae 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.

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 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 sphygmograph, 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

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. Friewell 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 artificial 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.

Cambridge, May 7 1873

My Dear Sir,

A few words in answer to your interesting letter.

The office of science is not to record possibilities; but to ascertain what nature does, and your own statements show that these monstrosities or sports are not sustained. As far as Darwinism deals with mere arguments of possibilities or even probabilities without a basis of fact it departs from the true scientific method & injures science, as much of the devotees of this newism have already done. Respectfully yours,

J. H. Parsons Esq. J. Agassiz

FACSIMILE LETTER OF PROFESSOR AGASSIZ ON THE DARWINIAN THEORY

\$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.

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.

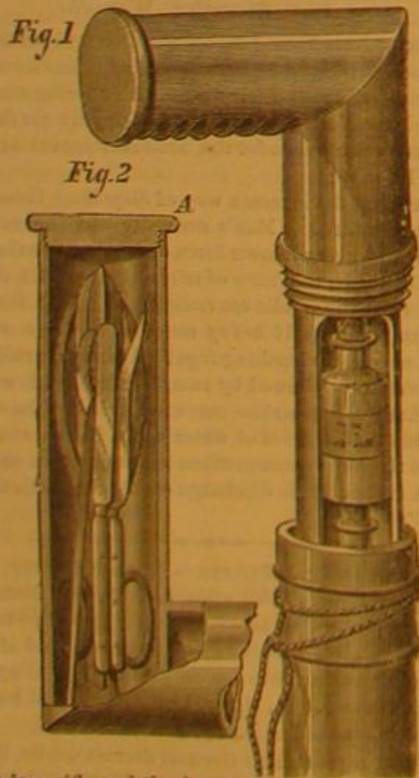
Figs. 1 and 2 are respectively perspective and sectional views. The lower or roof cap, made of galvanized iron, is in two parts, A and B. The funnel, A, is at least one inch larger in length and breadth than the size of the chimney. Its top is horizontal and extends three or more inches above the peak 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, 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.

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, needles, powder knife, a bistoury



FIRE AND WATERPROOF CHIMNEY GUARD.

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.

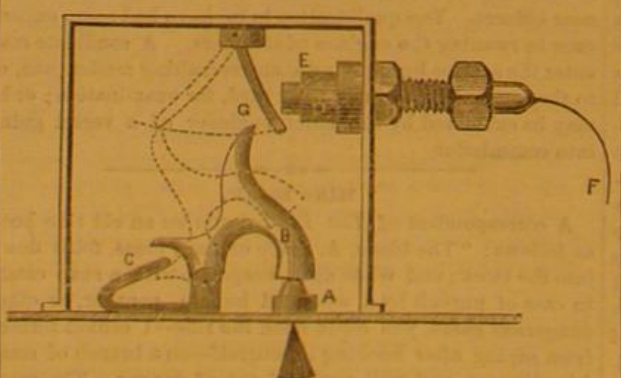
FIG. 1.



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 Hangtchen, 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 that the power of the nervous system is diminished, different parts of it becoming successively paralyzed. First, the vasomotor nerves become affected and the blood vessels 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 anemic, 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

Fig. 1



Fig. 2



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 Zoölogy.

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 1,800 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,

termining 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 spectroscopic 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, enclosing 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.

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.



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

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.

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 de-



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

Improved Drag Rope.—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 triplete 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 joint 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 concave 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 evenner, 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 be-

fore 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 height 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 road-bed, 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. Crow, 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 Week, 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 Isktyan, New York city.—This improvement in carpets and blankets consists of a long thick nap raised up from a web 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 web 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. Dinmore, 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 height 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 composed 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 pinch 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 Y-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. Elchholtz, 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 Paul, 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 be 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.

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ANSWERS TO CORRESPONDENTS

A. O. F. asks: Is it ever necessary for a locomotive slide valve to lift from its seat, either on sud, deny 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 release of the original patent, or can I secure the improvements by a separate patent? 3. 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 release.

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 almanac 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 12.8 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 $\frac{1}{2}$ pint, isinglass $\frac{1}{4}$ oz. Make a solution of these, add $\frac{1}{2}$ 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 tons 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 lining can I apply to cloth or woolen goods to smooth 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. 2. 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 $\frac{1}{4}$ oz., water 4 oz., let stand for 24 hours, and evaporate in a water bath to 2 oz.; add rectified spirit 2 oz., and strain through linen; mix while warm with a solution of 4 oz. best gum mastic in 2 oz. 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 Paine'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 home, found in Scotland. 5. Try gilding, as described on p. 230, 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 $63 \times 6 \times 70 \times 63 \times 2 \times 16 \div 33000 \times 12$. I think the last sign should be 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 $201.06 \times 30 \times 5 \times 100 \div 33,000 = 91.7$.

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 flattening. 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 tons 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 tons 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. R. 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 stove 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. Hemps commonly employed. 4. A mixture of white lead and tallow. 5. Wrought iron expands about $\frac{1}{16}$ 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, 1." 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. 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 5x16 feet, each containing 30 four inch flues. The flues 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 barged 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 (8); 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 fire is 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 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. 5. See p. 231, 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 non-conductors 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 discolour 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? B. 1. Ganot's "Physique" there are the following formulas, by Dr. Matthiessen: $V_t = 1 - 0.00000253(t-4) + 0.000000389(t-4)^2 + 0.000000007173(t-4)^3$ between 4° and 32° C, and $V_t = 0.999925 + 0.0000054724(t-4) + 0.0000001126(t-4)^2$ between 32° and 103° 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 0.0000253 times the given temperature, diminished by 4 , plus 0.000000389 times the square of the given temperature, less 4 , plus 0.000000007173 times the cube of the given temperature, less 4 . The translation of the other formula is similar. V_t 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.

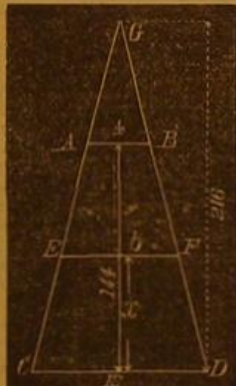
P. P. asks: What is the principal difficulty in running band saws in ordinary lumber mills, and why are they not used more extensively? Is not the power required to drive a band saw less in proportion to width of kerf, the rate of sawing being the same? A. The band saw is comparatively a recent invention, 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, is $(10+8-3-4+2+5-1-8+9+4) \div 10 = 2.2^\circ$ 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 12 feet. We then have a triangle, G C D, with a line, E F, parallel to the base, C D. Hence



Let $216 - x = 12$; b, and $b = 12 - \frac{x}{12}$. Having found the top and right 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 $(12 - \frac{x}{12}) \times x = 576$. Solving this equation for x, we find the height 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 lard 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 epoch, found in an almanac? 2. How is coal tar made? 3. How is apple whiskey 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 $1874 + 1 = 1875 \div 19 = 98$ and 13 remainder. The epoch is the moon's age at the end of the year; and if we take the epoch 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 ñ (ñ) in the Spanish language. The effect of the accent is the same as if g were before the ñ in French, as in Bologna (pronounced Bolonyá). 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, $\frac{1}{2}$ gallon; gum shellac, $\frac{1}{2}$ lb.; lampblack, $\frac{1}{2}$ 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?—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 hygroscopic (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.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

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.—O. B. Mickle. March 25.
27,822.—HARVESTER.—L. C. Reese. March 25.
27,823.—SWEEPING MACHINE.—H. A. Smith. March 25.
27,846.—BELTING.—H. Underwood. March 25.
27,852.—HARVESTING MACHINE.—R. F. Whit. March 25.
27,853.—NIGHT LIGHT REFLECTOR.—J. Wyberd. March 25.
27,855.—LOOK.—J. C. Cooke. March 25.
27,860.—COTTON BALE TIE.—J. McMurtry. March 25.
28,103.—FRUIT BASKET.—J. K. Park. April 15.
28,175.—SCARFARD FROG.—W. Hoffman. April 22.
28,488.—RATTAN MACHINE.—L. Hull. May 12.

EXTENSIONS GRANTED.

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

DESIGNS PATENTED.

- 7,081.—STAND AND BRACKET MATS.—L. Bushnell, New Bedford, Mass.
7,084.—CHILDREN'S CARRIAGES.—J. L. Brown, Boston, Mass.
7,085 to 7,092.—CARPETS.—R. R. Campbell, Lowell, Mass.
7,093.—KNOW AND ROSE.—W. Gorman, New Britain, Conn.
7,094 to 7,096.—CARPETS.—A. Heald, Philadelphia, Pa.
7,097.—TEA CANNISTER.—H. 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 to 7,103.—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
On each Trade Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3½ years).....	\$10
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, 1874.

- 2,967.—T. Piper, Hamilton, Ontario. Improvements on treadles for sewing machines, called "Piper's Improved Spring Clutch for Sewing Machines." Jan. 13, 1874.
2,993.—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. Colcott, 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 Threading." Jan. 13, 1874.
3,008.—T. F. Conklin, Fond du Lac, Fond du Lac county, Wis., U. S. Improvements on the construction of smokestacks of locomotive engines and other engines, called "Conklin's Fuel Economizer and Spark Arrestor." 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 bearings, 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, Wilder 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 floor, called "Barter's Floor 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.—H. 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, 1874.
3,028.—J. Hewitt, Grimsby, Lincoln county, Ontario. Improvements on sand 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. Walt, 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, Cuyahoga 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. Huernie, San Francisco, San Francisco county, Cal., U. S. Improvement on a Water Filter, called "Huernie'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 ferres pour pendre les portes de chars, called "Ferrures Ameliorées 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.

- 3,054.—E. A. Goodes, Philadelphia, Pa., U. S. Improvements on sewing machines, called "The Goodes' Fancy Stitch Sewing Machine." Jan. 21, 1874.
3,055.—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.

- 3,056.—E. P. Richardson, Lawrence, Essex county, Mass. Improvement in machine for sewing hose, called "Richardson's Improved Machine for Sewing Hose." Jan. 21, 1874.

- 3,057.—E. A. Goodes, Philadelphia, Pa., U. S. Improvements on sewing machines, called "The Goodes' Fancy Stitch Sewing Machine." Jan. 21, 1874.
3,058.—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.

- 3,059.—E. P. Richardson, Lawrence, Essex county, Mass. Improvement in machine for sewing hose, called "Richardson's Improved Machine for Sewing Hose." Jan. 21, 1874.

- 3,060.—E. A. Goodes, Philadelphia, Pa., U. S. Improvements on sewing machines, called "The Goodes' Fancy Stitch Sewing Machine." Jan. 21, 1874.
3,061.—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.

- 3,062.—E. P. Richardson, Lawrence, Essex county, Mass. Improvement in machine for sewing hose, called "Richardson's Improved Machine for Sewing Hose." Jan. 21, 1874.

lish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

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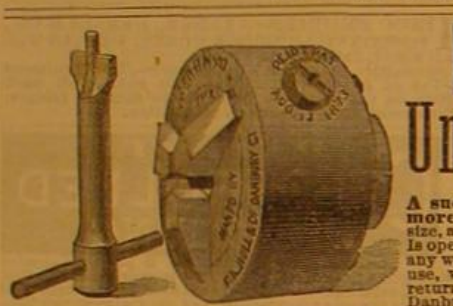
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Vol. XXX.—No. [7.]
(NEW SERIES.)

NEW YORK, FEBRUARY 14, 1874.

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JAMES YOUNG, FOUNDER OF THE PARAFFIN OIL INDUSTRY.

"It would certainly be esteemed one of the greatest discoveries of the age if any one could succeed in condensing coal gas into a white dry solid odorless substance, portable, and capable of being placed upon a candlestick or burned in a lamp," says Liebig in his "Familiar Letters on Chemistry," dated 1843. Seven years later James Young, the subject of the accompanying portrait, completed a long series of experiments with the successful extraction of paraffin from Boghead coal, and then, patenting his discovery, opened to the world a great and growing industry.

Mr. Young began life as a joiner, learning his trade in his father's shop. His spare time, however, was devoted to the study of chemistry and he eventually adopted that profession, becoming at first assistant to Professor Graham in the London University, and subsequently manager of Muspratt's and afterwards of Tennant's chemical works. In 1848 he resigned his position in order to embark in the manufacture of lubricating and burning oil from petroleum; but as his spring became exhausted, he began a series of investigations in order to find an artificial substitute for the natural oil.

From his own internal consciousness Mr. Young evolved the conclusion that petroleum, or its substitute, might be produced by the action of heat on the coal, the vapor going up into the sandstone to be condensed. The ultimate result of his researches was that, out of a cannel that came to be mixed with the soda ash for making the alkali, he got a quantity of liquid that contained paraffin.

Patenting his discovery, Mr. Young, with ten others, established works for the manufacture of paraffin at Bathgate, Scotland, in the center of the Torbane Hill coal field, a district peculiarly rich in cannel, and began the manufacture of which he is the founder.

Commencing with the raw material, which is principally a stone of slaty texture and a dusky brown color, we may explain that shale pits are generally worked in juxtaposition with the crude oil manufactories. The shale pits vary in depth from twenty to forty fathoms. The best quality is that which, when cut with a knife, does not splinter, but gives off a continuous shaving, such as would be got from a piece of soap or wax. On reaching the pit bank, the shale is tumbled into a crusher, in passing through which it is ground to pieces, sufficiently small to pass easily down the retorts. The more common retort is a flattened cylinder of cast iron, about twelve feet long, which contracts towards the ends, both of which are open, and its lower end dips two or three inches into a shallow pan filled with water. After the retort has been filled with broken shale, the furnace is brought into operation, so as to raise its middle zone to a low red heat. The process of distillation then goes on continuously. At a temperature of 300°, the hydrocarbons contained in the shale are given off in the shape of gas, which is, to a large extent, condensable. At most of the crude oil works, the incondensable vapor is collected in a gas holder, and used for lighting the workshops. The oil obtained from the decomposition of the coals, having assumed the form of vapor, is collected in a large main having connections with the retorts. Through this main the vapor is con-

veyed to the condensers, which, as a rule, are similar to those used in gas works. As it passes through the condensers, the vapor is reduced to a liquid form, in which state it is run off into reservoirs, some of which contain as many as 100,000 gallons.

On leaving an apparatus called a separator, in which the two components of oil and water are parted from each other, the process of purification commences by a second distillation. The dark green fluid called crude oil, which at this stage has an appearance not unlike natural rock oil or petroleum, is now pumped into large iron pans, where it is boiled to dryness. In this way the hydrocarbons are once more

ting machine. The air thus refrigerated is brought to be on a stream of brine, which it converts into a freezing mixture, thus enabling solid paraffin to be produced in the hottest summer weather. Remaining in solution at a temperature of 60°, paraffin coagulates into the solid form when the temperature is reduced to 32°. Crude solid paraffin is now worth from \$150 to \$175 per tun in England. Paraffin candles, from which a clear, lustrous, and perfectly odorless light is obtained, are made at most of the principal Scotch oil works.

In addition to the Bathgate works, Mr. Young also projected the Addiewell works, on a very extensive scale. The land leased for their requirements extended to some three or four thousand acres, all containing shale and other minerals; while some forty acres were set apart for the site of the works. The retort sheds are upwards of 200 yards in length, and each shed contains a double row of retorts. There are altogether close on 400 retorts at these works. This represents a capacity for distilling over 3,000 tons of shale per week, and producing 120,000 gallons of crude oil, yielding 50,000 to 60,000 gallons of burning oil, in addition to about 12 tons of refined paraffin, and a large quantity of lubricating oil. To accomplish these results, the appliances are necessarily on a large scale. The heavy vapors are collected in two underground tanks, each capable of containing 12,000 gallons. Any vapor which does not liquefy in the condensing main is passed through a four inch cast iron tubular condenser, which is made up of 1,300 nine feet lengths, or a course of nearly two and a quarter miles! For the purposes of distillation upwards of twenty 2,000 gallon stills, made of malleable iron, are erected. There is a similarly large number of refining stills, each capable of containing 4,000 gallons. A number of immense store tanks, each capable of containing 15,000 gallons, are fitted up contiguous to the refining kilns, being so situated that they can collect the oil as it passes from one stage of the refining operations to another. The building in which the various oils are subjected to chemical treatment is four hundred feet in length and eighty feet wide. It has two fireproof gables, cutting off in the center the engine house from which the machinery is actuated. Underneath the roof of the building there are altogether upwards of a hundred large cast iron vessels, with a capacity varying from

JAMES YOUNG, FOUNDER OF THE PARAFFIN OIL INDUSTRY.

3,000 to 500 gallons. Upwards of 1,000 hands are employed at Addiewell, and in the shale pits adjoining over 500 miners are at work. One and a quarter million cubic feet of gas are produced at the works daily. The Addiewell shale yields from thirty to forty gallons of crude oil per tun, of the specific gravity of 0.870.

Within the comparatively short space of twenty years, the mineral oil trade has attained such a magnitude that it gives employment to over 7,000 workmen, who earn weekly something like \$50,000 in wages. At the present time about 800,000 tons of shale oil are annually distilled, producing nearly 30,000,000 gallons of crude oil, while the quantity of refined burning oil obtained from the crude product is close upon 12,000,000 gallons per annum, in addition to solid paraffin, naphtha, and other chemical products.

Of Mr. Young's more personal history we have left ourselves little room to speak; but this is the less to be regret-



ted, as his has been essentially a scientific career. For a number of years past he has held the office of President of the Andersonian University, in Glasgow. Surrounded by the members of his own family and by those of his lamented friend Livingstone—for he has really been *in loco parentis* to the children of the African traveler—Mr. Young, for whose portrait we are indebted to the *Practical Magazine*, now spends the great bulk of his time at his beautiful estate of Kelly, near Greenock, Scotland, or at his no less fine and romantic estate of Durriss in Aberdeenshire. But he also mixes to some little extent in public life, contributing liberally to all movements of a patriotic or charitable character, and aiding by every means within his power the progress of scientific knowledge.

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VELOCITY OF NERVOUS IMPULSES.

In his suggestive lecture on the sun, our English visitor, Mr. R. A. Proctor, makes use of several striking illustrations to give an idea of the immense distance between us and our great luminary. One of these supposes an infant with an arm of the inconvenient length of ninety-one millions of miles, who should stretch forth his hand and touch the sun. Naturally the darling would have his finger burnt; but, so slow is the transmission of feeling, he would have to wait until he was a hundred and thirty-five years old before he could be conscious of the fact. In this estimate Mr. Proctor evidently adopts the rate of nerve motion obtained some twenty years ago by the observations of Dr. Hirsch—that is, about one hundred and eleven feet a second. The later and more elaborate researches of Dr. Schleske show a rapidity of conduction by the sensory nerves of about ninety-seven feet a second, which would require our sunburnt infant to wait some years longer before discovering his indiscretion. If he trusted his sight in the matter, he might become aware of the danger of his distant member in the short space of eight minutes, so much more rapid is the speed of light than the movement of feeling along the nerves. The passage of volition along the motor nerves appears to be still slower; so that upwards of a century and a half, perhaps, might elapse before the mental order to withdraw the finger could be carried out.

However slow the rate of nervous movement may be, as compared with the velocity of light or the still faster motion of electricity, it is nevertheless so rapid that until quite recently it was thought to be immeasurable, within the limited range in which our observation of it is possible. The most widely separated points in the course of any nerve allow but a few feet of difference at best for timing the periods of sensation or volition; and the nervous impulse travels so quickly that such small distances would seem to be wholly annihilated. To our consciousness a prick on the great toe is discovered as promptly as one on the cheek; and it is only by the intervention of the most delicate and ingenious of mechanical contrivances that the difference in time is made apparent.

The first step toward making the solution of this interesting problem possible was taken in the antiphysiological art of gunnery. In the development of that art, it became necessary to measure the speed of projectiles, both in the gun and during the several stages of their flight. For this purpose Pouillet's chronoscope was devised, by means of which an electric current was made to indicate the duration of the most rapidly transient processes. Thus the passage of a bullet along the barrel of a gun was found to occupy the hundred and fiftieth part of a second. It quickly occurred to Helmholtz that here, possibly, was a means of measuring the speed of nervous action. His application of the

method was too complex for description in this place; it was, however, so trustworthy as to leave no doubt of the practical accuracy of its results. His object was to measure the intervals of time, if there were any, between the excitation of a nerve at two different points and the corresponding contractions of the muscle. The difference between such intervals would, of course, be the time required for the passage of the nervous impulse over the space between the two points of excitation. Experimenting with the leg of a frog, two sets of observations were obtained, differing from each other by a small but constant quantity. For the more distant point of excitation, a measurable fraction of a second longer was uniformly required to make the muscle contract. The difference of distance being exactly measured, the rate of propagation of the nervous impulse was easily calculated. Instead of rivaling the velocity of electricity, as had hitherto been supposed, the rapidity of conduction in the motor nerves of the frog was found to be no more than eighty-five feet a second. All this was as early as 1851. To test the accuracy of the result thus obtained, Professor Helmholtz devised another and more simple apparatus, which he called a myographicon. In this the contracting muscle was made to directly register the beginning and successive stages of the contraction by means of a style working against a rotating cylinder. This confirmed the general correctness of the estimate obtained with Pouillet's apparatus, the rate demonstrated being a little over 89 feet a second.

Various improvements of the myographicon were soon suggested by Du Bois Raymond and others, whose observations, while differing slightly in result, were not conflicting with previous results, due allowance being made for temperature and other disturbing conditions. The maximum rate obtained by the last named observer was 30 meters a second, or 98½ feet. This was the estimate on which he based his widely quoted illustration of the harpooned whale. If one of these sea monsters, a hundred feet long, were struck in the tail, he said it would take a full second before the sense of pain could reach the victim's brain; and, omitting the time necessary for perception and volition, another second must pass before an order could be telegraphed to the tail to retaliate by upsetting the harpooner's boat.

In all the experiments on motor nerves thus far, the leg of a frog had been used. In 1867, Baxt and Helmholtz applied the test to man, using an improvement of the myographicon suggested by Du Bois Raymond. The result gave the rate of conduction for the motor nerves of man, corresponding to that already obtained by Hirsch for the sensory nerves. A very careful series of experiments by the same observers, in the summer of 1869, showed a mean rapidity for the motor nerves in man very much greater, or about 254 feet a second. But this by no means invalidated the result already obtained, since, as Helmholtz had shown, the rate varies greatly with temperature, being not more than one tenth as great at 32° as at 60° or 70°.

More recently it has been established by Dr. Munck that the velocity of nervous impulses is different in different nerves, and in different parts of the same nerves, the rapidity increasing as the termination of the nerve is approached, and by Marey's observation, that fatigue of the muscles has the effect of seriously reducing the rate of nervous conduction; while Wittich has found that the rate is in some degree dependent on the mode of excitation, being greater when electricity is used than when the stimulus is mechanical. The same observer also reports a considerable difference between the rates of motor and sensory nerves, the latter excelling by at least a third.

The measurement of the rate at which the nervous impulse travels brainward necessarily involves a process very different from any employed in the study of the motor nerves. The problem was first attacked by the Swiss astronomer Dr. Hirsch. Soon after Helmholtz took up the other branch of the investigation, and his solution of it was as ingenious as it was successful. It involved the measurement, with the delicate chronometric instruments employed by astronomers, of the difference in time between the appreciation of impressions made at a distance from the brain, say on the great toe, and others nearer, as on the cheek. Roughly described, the plan adopted was substantially this: The observer sat with his finger on a signal key, with which he announced the perception of an electric shock as soon as possible after feeling it, thus closing an electric circuit which had been broken by the shock. The minute interval between the breaking and closing of the circuit measured the time taken by the transmission of the shock to the brain, the time required for the perception of the sensation, time for willing the movement of the signal key, time for the transmission of this volition to the proper muscles, time for the contraction of the muscles, and finally the time lost in the physical process of signaling. Obviously all these parts, except the first, must be substantially the same in all experiments by the same person, using the same finger for making the signal. Any difference in the whole time must therefore be owing to the greater or smaller distance of the particular point of impression from the brain. This difference being measured with tolerable exactness, it is possible to calculate pretty closely the rate at which the nervous impulse is transmitted. The estimate first made by Dr. Hirsch was, as already noted, 111 feet a second. More recent determinations give averages ranging from 97 feet, by Dr. Schleske, to 136 feet, Wittich's estimate for a nervous impulse excited by electricity. With a mechanical stimulus, he found an average velocity of 124 feet. These figures, of course, are to be taken relatively. The rate varies in different individuals, and, doubtless, in the same individual, with varying

conditions of health, temperature, and so on, the general average being about that of a high wind, a race horse, or a locomotive. Light excels it about ten million times, and electricity more than fifteen million times.

But, it may be asked, what is the use of all these investigations? Of what account is a delay of the hundredth part of a second, more or less, in the perception of a sensation or the transmission of a volition, so long as we are not conscious of it? In astronomy, it has proved to be of material account; and it is more than probable that the knowledge of the normal rate of nervous impulses thus obtained may some day be of the greatest help in the diagnosis of nervous diseases.

With the nicest appliances for observing and timing phenomena, there still remain discrepancies between the reports of different observers, however skillful. Time is required for the act of perception, for willing the pre-determined signal, and yet more for executing the volition, all of which directly affect the accuracy of the observation; and since these intervals differ with different observers, the exact moment of an occurrence cannot be fixed without knowing and allowing for them.

THE AUTOPSY OF PROFESSOR AGASSIZ.

Dr. Morrill Wyman, of Cambridge, Mass., has published a report on the autopsy recently made upon the body of Professor Agassiz, from which it may be deduced that the disease to which the great naturalist succumbed was one of long standing. The arteries at the base of the brain showed evidence of extensive chronic disease of their lining membrane, and also several important changes which were fatal. In the left ventricle at the lower third, a firm, organized clot, of the size of a peach stone, attached to the wall at the anterior portion near the septum, was found, and around this clot a more recent one had formed, its center softened and granular. From this, probably some small portions had been carried by the blood to the arteries at the base of the brain, doing their part in obstructing them and causing the fatal alterations above noted. The lungs showed evidence of old inflammation. The entire weight of the brain was 53.4 ounces avoirdupois, and its greatest weight, between the ages of 35 and 40 years, was estimated at 56.5 ounces.

Without entering into the technical details of the investigation, the result shows that the trouble began with inflammation of the lining membrane of the lungs, and that the morbid processes, carried by the blood from heart to brain, there disorganized and checked the circulation. The malady was too deeply situated to have admitted of surgical aid, nor could any effort of human skill have averted death from its effects. The autopsy was made in the interests of science and in deference to the expressed wishes of Professor Agassiz, long since placed on record.

MICROSCOPIC CRYSTALS IN PLANTS.

Besides the familiar bundles of needle-shaped crystals, called raphides, dispersed throughout the cellular structure of certain plants, there are in the seed covers and leaves of several orders of plants, and in the pods of the bean family, multitudes of prismatic crystals of extreme minuteness, which have hitherto escaped detection. In the horned poppy, these crystals are as small as the 8,000th of an inch in diameter. In the gooseberry and elm, they are $\frac{1}{3000}$ of an inch; in the black currant, about half as large; in the black bryony, they are about $\frac{1}{1200}$ of an inch in diameter, thickly set at regular distances throughout the seed covers. In the gooseberry, they are so distinctly and regularly placed in the outer skin—each crystal in a separate cell—that they present the appearance of crystalline tissues. In plants of the bean family, the size is variable, the average being about $\frac{1}{3000}$ of an inch. In the garden pea, they are much larger. These crystals appear to consist chiefly of oxalate of lime, sometimes carbonate. Raphides are mainly phosphate of lime.

Plants most relished by animals are found to be especially rich in these microscopic crystals. In a piece of the midrib of a clover leaflet, $\frac{1}{8}$ of an inch in length, Mr. Gulliver, who has added more than any other to our knowledge of these minute but important products of vegetable action, has counted 10 chains of crystals with 25 in a chain, making 250 in all, or no less than 17,500 to the inch. In like manner 21,000 crystals were reckoned for one inch of the sutural margin of a single valve of a pea pod. The pod had four such margins, each three inches in length; so that in a single pod there must have been as many as 250,000 crystals. In view of the marvelous number of these crystals, as well as their regularity and constancy, Mr. Gulliver believes it no longer possible for physiologists to maintain that such structures are accidental freaks of nature, of no relation to or value in the life and use of the species.

THE FIRELESS LOCOMOTIVE.

Mr. Richard H. Buel, a well known consulting engineer in this city, has recently published in the *Railroad Gazette* an account of a trial trip with one of the engines of the Fireless Locomotive Company. This article is interesting as being the first in which the theory of the action has been fully set forth. We have, on several occasions, made mention in our columns of the fireless locomotive, and have pointed out the advantages it possesses in many cases, such as greater comparative safety, less need of skilled attendants, and the absence of smoke and other products of combustion. Mr. Buel, in the article referred to, demonstrates that the locomotive can be operated successfully, if properly designed and managed; and he points out such improvements as seem to be desirable. We give a brief summary of the principal statements, omitting all mathematical work:

The locomotive with which the experiment was made consists of a platform set upon a four wheeled truck, carrying a cylindrical reservoir 37 inches in diameter and 9 feet long, with a steam dome 1 foot in diameter and 2 feet high. The steam space of the reservoir is connected with a pair of vertical engines, each having a diameter of 5 inches and a stroke of 7 inches; a 2 inch pipe, perforated with small holes, runs the whole length of the reservoir, near the bottom. In charging the reservoir this pipe is connected with the steam space of a stationary boiler, and steam is admitted until the pressure in the boiler and the reservoir are the same. The locomotive is then ready to run, and will continue to move until the water in the reservoir has cooled down so much as to be incapable of furnishing steam of a working pressure.

In making the trial trip, the pressure in the reservoir at starting was 142 pounds per square inch; and at the end of 49 minutes, during 35.5 of which the engines were in motion, it had fallen to 23, giving a mean pressure during the run of 81.5 pounds per square inch. At the start, the reservoir was half full of water. Indicator diagrams were taken during the run, and such data were noted as were possible. From these, it appears that the whole distance run was about 4.5 miles; the average horse power developed by the engines was 3.61, and the number of pounds of water evaporated in the reservoir, calculated from the indicator diagrams, 147. The writer then shows that if the engines had been designed in accordance with the best modern practice, the distance run by the locomotive, with this same evaporation, would have been from 2 to 2½ times as great. A calculation is then given, showing that, with a reservoir of the same size and engines about one and a half times as powerful as in the actual case, starting with a pressure in the reservoir of 275 pounds per square inch and ending with a pressure of 20, the locomotive might be expected to continue in motion for nearly six hours before the reservoir required recharging.

THE ORIGIN OF THE DIAMOND.

If we can trust a paragraph just now going the rounds of the press, the "diamond in the sky" of the nursery verses must be taken not as a happy comparison but as a genuine prophecy of scientific discovery.

It—that is, the paragraph—gravely alleges, on the strength of some supposed philosopher's opinion, that diamonds are in all probability a cosmic product—chips of original creation, so to speak—which the earth has picked up in the course of her travels through space; in short, that they are of meteoric origin. To the popular mind there must be something plausible in the suggestion, else it would not have been so favorably received by so many intelligent editors, ever on the alert for bits of valuable scientific information wherewith to regale their intelligent readers. Indeed, what could be more plausible to those whose knowledge of the diamond is embraced by the one word, carbon, and whose acquaintance with it is limited to some little familiarity with the appearance of the cut gem? How pure, how hard, how brilliant! What fitter product could there be of the heavenly spaces? But facts are earthly and very stubborn, prone ever to take the shine out of splendid theories. It is true that the diamond is a puzzle even to chemists; that the mode of its formation is a mystery; that even its place in the order of Nature is a matter of doubt. Like amber, it is found among minerals. Amber is known to be a vegetable product; and the diamond is thought by some to show strong evidence of a similar origin.

Its antecedents are mysterious, it must be admitted, but not wholly dark. Enough is known to make it certain that the notion of its cosmic origin is not to be seriously entertained, unless one is prepared to accept at the same time the far-fetched, germ-bearing meteor which Sir William Thomson suggested as the importer of life to our previously lifeless planet. In no other way, barring the earthly production of the gem, can we account for the presence of plant germs in the bodies of diamond crystals. Where in extra terrestrial spaces could the diamond, now at Berlin, have picked up its enclosed organic forms, so closely resembling *protococcus pluvialis*? Or that other diamond its chain of green corpuscles, like *polinoglaea macrococcus*?

As surely as flies in amber prove the presence of animal life during some stage in the formation of that singular substance, the vegetable organisms found in diamonds are proof that these gems were formed amid surroundings not inconsistent with the presence of vegetation, perhaps in water: a supposition that finds support not only in the fact of their occasional inclusion of organic matter, but still more in the presence of dendrites, such as form on minerals of aquatic origin, in a diamond belonging to Professor Goppert. Crystals of gold, iron and other minerals have also been found inside of diamonds; still other diamonds are superficially impressed by sand and crystals, which leads some to believe them to have been originally soft; but it is quite as probable that these foreign substances may have interfered in some way with the perfect development of the diamond crystals, forcing them to grow around or partly around the obstructions.

Thus, even in its crystalline condition, the diamond is not always such a simple body as is popularly supposed. The writer of the paragraph in question speaks of it as "pure carbon crystallized," fit product of pure matter in pure space. So it is, sometimes, but it is also stained with impurities at times, and tinged with color, a thing of grades and degrees. And lower down in the scale are the imperfectly crystalline forms, known as boart and carbonado, harder than the true gem, but cruder and possibly more useful. It would be as correct to judge the common mineral quartz solely from its appearance in what is known as Brazilian pebble, as the diamond solely from the flashing brilliant. One exhibits no

greater range of grades and shades and qualities than the other.

Though supremely beautiful in its best estate, the diamond appears to be but an earthly product, after all, subject like everything else, even theories, to earthly imperfections. There may be a diamond factory up in the sky somewhere but the evidence of it is not strong. Arizona, even, promises a better field for exploration.

THE DEATH OF DR. LIVINGSTONE.

Information has recently reached England of the decease of Dr. Livingstone, the celebrated African explorer, during June last. It seems that, in journeying over a partially submerged country, he was obliged to wade some four days through quite deep water. The exposure brought on a severe attack of dysentery, of which he fell the victim.

David Livingstone was born near Glasgow, Scotland, in the year 1815, and at the age of twenty-five became one of the agents of the London Missionary Society in Southern Africa. During the sixteen years of his residence in that country, he traversed the region from the Cape of Good Hope to 10° south latitude, and then followed the Zambezi river to its mouth, thus completing a journey of over 11,000 miles. Returning to England, he organized a small expedition which set out in 1858, and returned in 1863, after further exploring the above mentioned country. In 1868 Dr. Livingstone again went back to Africa, and again entered a region totally unknown to civilization. Until found by the *Herald* reporter Stanley, some two years ago, little was heard from him, and numerous rumors of his death were extensively circulated. After Stanley's departure, he continued his exploration, but no news of him has been received until the present time, when the British officials at Zanzibar transmit the intelligence of his death.

It would be difficult to describe the labors of this most indefatigable of travelers in the space here at our disposal. In his death geographical science loses one of its most persevering students. It may be truly said that for a blank spot on the map of Africa—for a region unknown save through tradition—he has substituted a country rich, fertile and productive, which, before many years, will exercise no small effect upon the commerce of the world. His labors toward the suppression of the slave trade are well known, and have tended largely to limit the spread and decrease the barbarities of that infamous traffic. He resolutely refused to discontinue his work until he should believe it complete; and so, isolating himself from home and his own race for nearly a quarter of a century, he has existed among the savages, enduring privations without number. Though to many his toil may appear fruitless, and the years of patient search, barren in directly useful results, the world is nevertheless the gainer by the example of "one who loved his fellow men," who, single hearted in his devotion, died as he had lived, a martyr to science.

STEAM BOILER EXPLOSIONS.—THE WORK ACCOMPLISHED BY THE UNITED STATES COMMISSION.

We have received many inquiries of late as to what has been accomplished by the Commission appointed to investigate the causes of steam boiler explosions. The preliminary report of this Commission has just been transmitted to Congress. Below we give a summary of the principal points:

The following Commissioners were appointed to conduct the experiments: D. D. Smith, Supervising Inspector-General of Steam Vessels, President; Charles W. Copeland, of New York city; Benjamin Crawford, of Alleghany City, Pa.; Isaac V. Holmes, of Mount Vernon, O.; and Francis B. Stevens, of New Jersey. Mr. Stevens having declined to serve, J. R. Robinson, of Boston, Mass., was appointed in his place. The Commission above named held their first meeting on June 25, 1873, and in September issued circulars to scientific men and engineers, asking for expressions of their views. In these circulars they state the various theories of steam boiler explosions:

1. Gradual increase of steam pressure.
2. Low water and overheating of the plates of the boiler.
3. Deposit of sediment or incrustation on the inner surfaces exposed to the fire.
4. The generation of explosive gases within the boiler.
5. Electrical action.
6. Percussive action of the water, in case of rupture of boiler in the steam chamber.
7. The water being deprived of air.
8. Spheroidal condition of the water.
9. Repulsion of the water from the fire surfaces or plates.

The Commission also issued a circular, asking that safety valves be sent to them for test.

They received numerous replies to their first circular, which they state contained valuable suggestions. More than twenty safety valves were sent to them, both from the United States and abroad.

The Commissioners divided themselves into two committees, the eastern and western, the first to make arrangements for conducting experiments at Sandy Hook, and the second at Pittsburgh. There were five boilers, with the necessary connections, at Sandy Hook, which had been placed there by Mr. Stevens, and these were presented to the Commission by that gentleman. A bomb-proof was erected, the pipes were re-arranged and extended, a blower engine and blower were set up, an old steamboat boiler was connected, and four ordinary range boilers were set up. Gages were procured, and were compared with each other and otherwise tested for several days. On the 7th of November, 1873, the Commissioners commenced their experiments.

A boiler was tested by hydrostatic pressure to 182 pounds per square inch. A pyrometer was arranged so that the temperature of the crown sheet could be ascertained. Steam was raised to 50 pounds per square inch, and the water was blown off below the crown sheet. When the temperature of the latter had reached 750°, and the steam pressure was 54 pounds, one of the flues collapsed.

An old steamboat boiler that had been tested with cold water to a pressure of 44 pounds was next experimented with. A fire was made in the furnace, the boiler having an ample supply of water; and when the pressure was 70 pounds per square inch, two of the top sheets of the boiler gave way. The pressure gradually rose to 73 or 74 pounds, when the safety valve suddenly opened and the experiment was brought to a close. A subsequent examination showed that an old crack had existed at some points of the rupture.

On the 13th of November, the water in the pipes was frozen, and the Commissioners decided to suspend operations at Sandy Hook for the season.

Preparations had been completed for the experiments at Pittsburgh, five boilers being placed in position, bomb-proofs erected, and a shop and store room fitted up. The boilers were of the ordinary two flue variety in use on western rivers, two of them being of steel and three of iron.

Experiments were commenced on November 20, with one of the iron boilers. The fire was not sufficient to produce a greater pressure than 195 pounds per square inch. The experiment was repeated, and a pressure of 202 pounds per square inch was attained. On the 21st of November another boiler was tested, and the fire gave out when the pressure had reached 342 pounds per square inch, with no other effect than producing some slight leaks. The first boiler was also tried again, its furnace having been enlarged, but the highest pressure attained was 220 pounds per square inch. On the 22d of November, the same boiler was tried once more, and this time a pressure of 275 pounds per square inch was reached before the fire gave out. Steam was then raised on the second boiler, and both flues were collapsed from end to end. An instant before the collapse, two men entered the bomb-proof, which contained three recording gages. According to their statements the three gages showed, at this time, 400, 450, and 500 pounds per square inch, respectively; but the record given by the gages, when examined after the collapse, was 350 pounds. The Commissioners remark that one of the results of the experiments has been to develop the fact that the instruments employed were quite unreliable, under the extraordinary pressures and temperatures to which they were subjected. No other results or conclusions are given, it being remarked that they can be more effectively embodied in a final report. The Commissioners report that about \$50,000 (half of the appropriation) has already been expended.

The above is a careful synopsis of the report, given nearly in the words of the Commissioners. But we feel that we ought not to let the matter drop without some few comments. Our own position on the subject of boiler explosions has been often clearly defined, and our readers well know that we look for nothing more mysterious than too much steam, or too weak a boiler. At the same time, we are willing to concede that great good may result from experiments of this kind, properly carried out. One part of the work of the Commission we have looked forward to with the greatest interest. We refer to the test of safety valves. The only extended trial of the kind of which we have knowledge was made by the Life Saving Commission, a few years ago; and the result of that trial showed clearly that many of the safety valves in common use were wrongly named. It is difficult for us to see why the Commission, organizing early in the summer, delayed their experiments until the approach of cold weather. It is still more difficult to understand why the cessation of operations has been so complete. Surely, if every change of pressure and temperature of the steam affects the accuracy of a gage (which is quite a novel proposition to engineers) the Commissioners could continue their experiments, and reach a definite conclusion upon this point. The tests of safety valves, also, might well be continued through the winter. There is a strong suspicion in the minds of many that this Commission is not working purely in the interest of Science. It seems somewhat remarkable that the Supervising Inspector-General, who has so many other important duties, should be the chief man in the Commission. The fact that such an enormous sum of money has been expended, with such slight results, is calculated to awaken inquiry; and the refusal of Mr. Stevens, who inaugurated this style of experiments, to serve on the Commission, is a most significant fact. The public are vitally interested in all work of this character, and we but do our duty in calling attention to the shortcomings of the Commissioners, as evidenced by their own report.

Dangers of Gasoline.

At Bennington, Vt., last month, the knitting factory of H. E. Bradford was destroyed by fire. A leakage of the gasoline pipes permitted the flow of this heavy hydrocarbon gas along the floor until it reached the fire at the boiler, when a terrible explosion took place, demolishing the building. Nine women were instantly killed and several others were badly hurt. One of the especial dangers attending the use of gasoline is that, in case of leakage, it moves along the cellar bottom or lower floors of the building, and there is no means of detecting its presence until it reaches fire, when the entire mass explodes with terrible violence. Many sad accidents have occurred from its use. The ordinary street gas is less dangerous, because, being lighter, it commingles with the air, and its presence is soon detected by the olfactory.

ALLAN'S FLOATING BATTERIES AND SALOONS.

Mr. Alexander Allan, of Scarborough, well known to the world as the inventor of the straight link valve motion, has recently invented and patented certain modifications of the Bessemer steady cabin idea. Mr. Allan does not attempt to deal with the subject of sea sickness further than trying to show that the arrangements he suggests will reduce the movements which authorities state are the principal causes of it. These are given as (1st) pitching, (2d) rolling, (3d) angular pitching, (4th) angular rolling, (5th) vibration from waves striking the ship, (6th) tremor from engines, (7th) longitudinal advance of ship, (8th) upward and downward motion of translation, (9th) seeing swinging or moving objects, and smells of burnt grease, engine room, and bilge water.

The first four motions are overcome by Fig. 1. The float is guided as a large pendulum, on its center ball and pillar, ballasted in the bottom, and floats freely in the water surrounding in its dock. If the ship takes all the four movements given above, the dock would do the same; but the water in the dock would keep its atmospheric level, and the pendulous spherical float would keep pace with it and maintain its level also, whatever point of the compass the movement came from.

As regards vibrations from waves striking the ship: The dock in which the cabins float is of about the least vibratory shape; it is away from the ship's side or skin; the medium in which the cabins float is free to take the reduced vibrations to its surface and liberate them in smaller waves, and would not affect the convex surface of the floating cabin.

As respecting the tremor from engines, this would be reduced in the same way by the non-vibratory shape of the dock, the floating medium carrying vibratory waves to its surface, and the strong shape of the floating body. Then for the longitudinal advance of the ship: While the ship remains on an even keel, we do not see any cause of disturbance more than in the advance of a railway train or carriage of any kind.

As to the upward and downward motion of translation. This, Mr. Allan fears, cannot be entirely neutralized, and some speakers at the Society of Arts' discussion did not consider it the worst movement or a serious one. Should the ship plunge or lurch suddenly into the trough of a sea, the floating cabin would acquire momentum, which would be checked or buffeted, and the effect or shock would be reduced in the cabins by the float dipping lower (say by one eighth inch to one fourth inch), raising the water in the dock somewhat.

As to the subject of swinging or moving objects: In the lower cabin passengers would not see any article in motion. In the saloon, to prevent the passengers seeing the roof approaching and receding as the ship rolled, an awning could be arranged to cover a large area of the roof, supported on the float like a huge umbrella; and should the roof touch the wires of support, by an extreme roll they would regain position as the ship righted. These cabins will be without the usual smells of engine room and bilge water.

Fig. 2 shows a modification of the arrangement in which the ball socket is fixed on a spindle fitted to a spider frame, secured to armored shields erected on deck. This keeps the caisson steady.

Mr. Allan's specification includes a number of ingenious modifications of the main principle, for which we have not space. We have said enough to show that Mr. Bessemer is not alone in the field of invention as a producer of steady platforms, and we have no doubt that Mr. Allan's consummate knowledge as a mechanical engineer would enable him to command a great element of success in putting his invention in practice.—*The Engineer*.

Influence of the Winds on Vegetation.

A writer in the *American Exchange and Review* has recently called attention to the extent to which vegetation is dependent for its life and growth on the winds, by which alone vapor and rain are conveyed from the place of formation and distributed over the earth. While animal life is able, by its powers of locomotion, to seek the necessary moisture, the

vegetable world, were it not for the air currents, would perish from the earth. This destruction would obviously be very rapid as the quantity of the solid matter in a plant is small compared to that of the water. And therefore the moisture of the soil is more necessary to vegetable growth than are the mineral constituents; and the water not only provides the means of growth of the plant, but also accelerates the decay by which the solid constituents are returned to the earth, to rise anew in the plant life of another generation.

For the evaporation by which water is raised into vapors, for the subsequent distribution of that vapor and for its conden-

ture of the air when the dew point is reached, and the temperature to which it was subsequently lowered. The higher the one and the lower the other, the greater will be the precipitation.

The means by which the lowering of the temperature can be accomplished are varied. A warm vapor-laden air may blow into a cold region, and thus have its temperature lowered sufficiently below the dew point to give a considerable rainfall. A cold wind may mingle with a warm one, and thus produce a moderate shower; or powerful ascending currents may carry the moisture of the lower strata into the upper regions of the atmosphere, where the temperature is very low.

The deposition of the moisture of the air is, then, in all the cases we have considered, referable to atmospheric motion: for upon it will depend the presence or the absence of moisture in any region, and consequently the presence or absence of vegetable life. The ocean of aqueous vapor partakes perfectly of the movements of the atmosphere. It in fact derives its movements mainly from those of its bulkier neighbor. It is to the motion of the winds, then, that we must look for the explanation of the peculiarities that attend the distribution of moisture.

Car Coupling Slaughters.

During the eleven months ending December 1, 1873 four hundred persons were killed while coupling cars on the Pennsylvania railroad. "Is it the fault of the inventions, or is it the fault of the railway companies, that some of the improved devices be not more widely used, and the slaughter of employees stopped?" asks a correspondent of the *Commercial Advertiser*.

Several devices have been fully described and illustrated in our columns, and many have, when practically used, proved valuable inventions. We think there is little room for argument on the point that if a railroad company chooses to ignore modern improvements, and persists in retaining on its cars

the old fashioned connection, saving perhaps the few dollars otherwise invested in experimenting at the cost of the lives of hundreds of its employees, the blame falls fairly and squarely on their shoulders and the public should fully appreciate the fact.

The Stability and Reciprocal Metamorphoses of the Oxides of Nitrogen.

The above subject, already studied by many chemists, has recently been investigated by M. Berthelot, and many new facts have been adduced. Hyponitric acid, until the present considered to be most stable of the oxides of nitrogen, has been, by the above chemist, decomposed into oxygen and nitrogen. The gas, hermetically sealed up in a glass tube, was submitted to the action of series of electric sparks. In

an hour and a quarter the acid was decomposed; and after eighteen hours, but 14 per cent of the primitive volume remained. As this limit could not be passed, total decomposition was believed to have taken place.

M. Berthelot also notes a curious anomaly which is presented by the combination of nitrous acid with oxygen, in order to produce hyponitric acid. Contrary to the usual result, a dilatation takes place. Two volumes of nitrous acid unite with one of oxygen, and the result is four volumes of hyponitric acid.

Passing to protoxide of nitrogen, the author finds that it is at about 1060° Fah. that the gas is decomposed by heat. The electric spark decomposes it very rapidly; in one minute one third of the gas is decomposed; and at the end of three minutes, two thirds or three quarters. The deutoxide of nitrogen, under the action of the spark, resolves itself, one part into nitrogen and oxygen and the other into protoxide of nitrogen and oxygen. The protoxide at the limit forms two thirds of the decomposed portion. Under the influence of prolonged contact (cold) with the binoxide, many mineral and organic substances undergo slow and partial oxidation.

"A MASS. MAN" points out that Massachusetts stand next to Connecticut on the roll of inventive genius, as shown by the table on page 65 of our current volume.

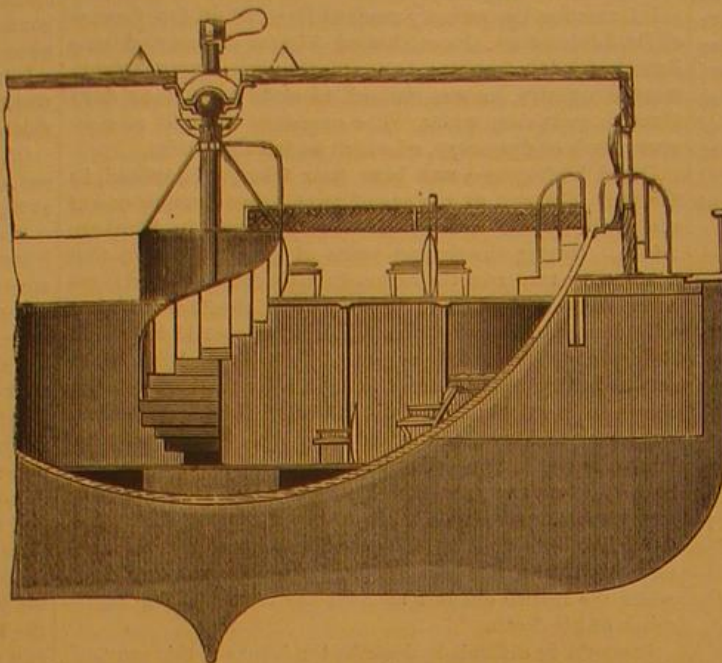


Fig. 1.—ALLAN'S FLOATING SALOON.

sation in the falling rain, Nature has provided the ceaseless, omnipresent aerial currents. The magnitude of this process of exhaustion and restitution may be estimated from the fact that the total daily discharge of all the rivers in the world into all the oceans is but the quantity of rain which has fallen in a single day. The sun's heat falling on a water surface converts a part of it into a vapor, which rises into and is diffused through the atmosphere, in obedience to the laws that govern the mingling of gases. Within a certain limit this vapor remains invisible, and cannot be distinguished from the main bulk of the air. At every temperature the air is capable of holding in an invisible condition a definite quantity of vapor. The warmer the air, the more it can hold. But for every temperature there is a point, beyond which it is impossible for more vapor to pass it. This point is called

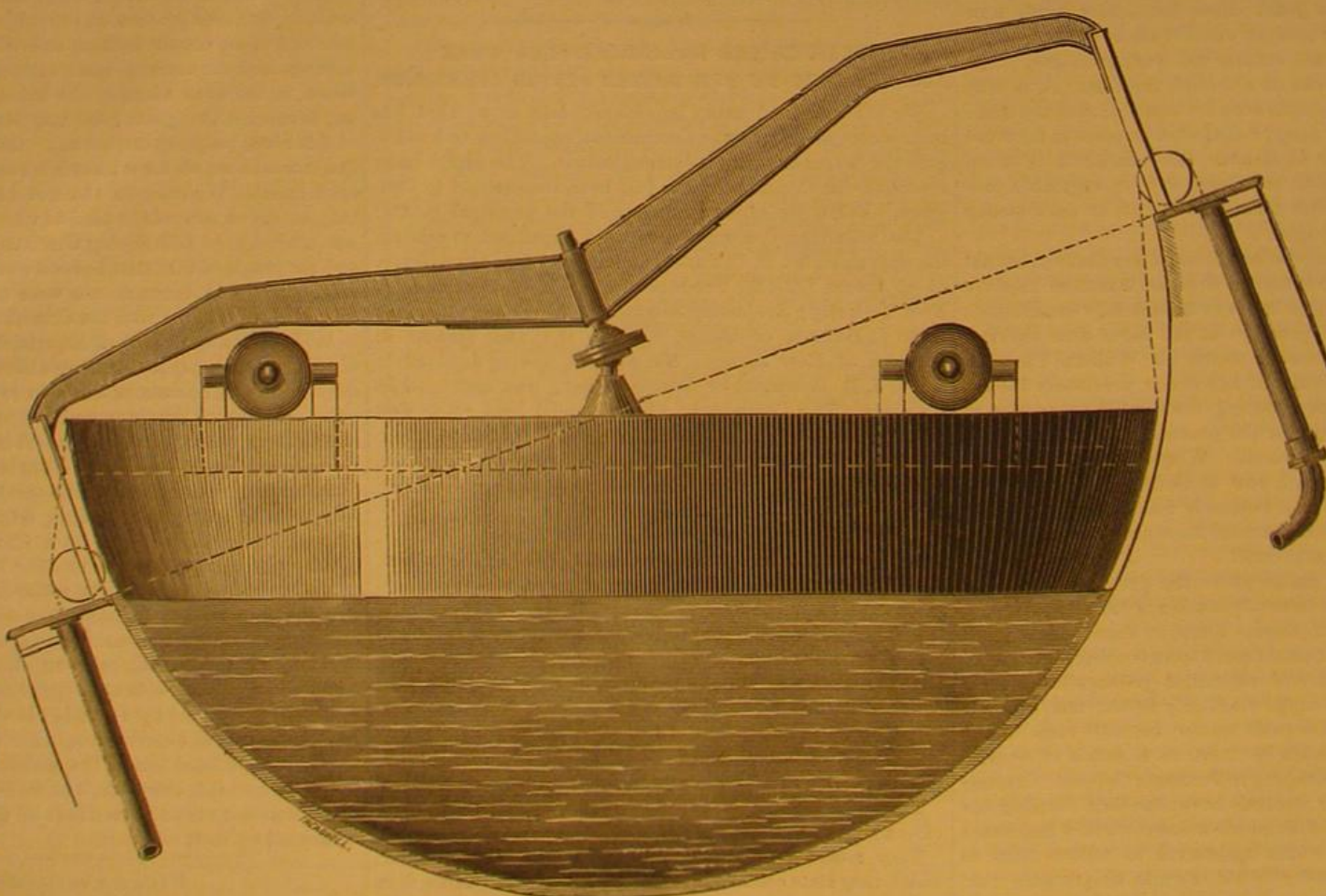
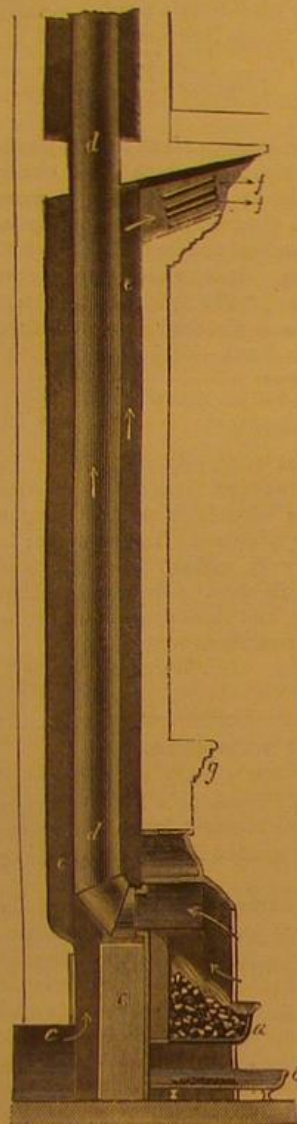


Fig. 2.—ALLAN'S FLOATING BATTERY.

the point of saturation, or the dew point. When the air has reached its dew point, and its temperature is increased, no visible effect is produced—its capacity for moisture is simply increased; but if its temperature be lowered, then it is no longer capable of holding all its moisture and the surplus becomes visible in some form or other of precipitation, namely, as fog, cloud, dew, rain, hail, or snow. In order to account, then, for any precipitation of moisture, it is necessary first that a sufficient quantity of vapor pass into the air to bring it to its dew point, and then that the temperature be lowered. The quantity of moisture thus precipitated will clearly depend upon two circumstances, namely, the tempera-

CAPTAIN GALTON'S VENTILATING FIREPLACE.

Mr. C. William Siemens, F.R.S., recently delivered a lecture before the operative classes at Bradford, England, on the important subject of fuel. The portion of the discourse under the subheading of domestic consumption was mainly devoted to advocating the use of Captain Galton's ventilating fireplace, a sectional engraving of which we herewith



present. Referring to the invention, Mr. Siemens termed it "the one grate that combines an increased amount of comfort with reasonable economy, and which, although accessible to all, is as yet very little used." It is not patented.

The device differs little in external appearance from an ordinary grate except that it has a high brick back which forms the exterior boundary of a chamber, *c*, into which air passes directly from without, becomes moderately heated (to 84° Fah.), and using, in a separate flue, *e*, is injected into the room at *f*, under the ceiling. A plenum of pressure is thus established within the room, whereby indrafts through doors and windows are avoided, and the air is continually renewed by passing away through the fireplace chimney as usual. The latter, *d*, it will be noticed, is encircled by the air flues, so that the heat of the ascending products of combustion is utilized throughout its whole length. *a* and *b* are respectively the grate and ash pit, which are curved outwards slightly in advance of the mantel.

Mr. Siemens remarks that the cheerfulness of an open fire, the comfort of a room filled with fresh but moderately warmed air, and great economy of fuel, are here happily combined with unquestionable efficiency and simplicity. Such high commendation emanating from so distinguished an authority will, we think, bespeak for the apparatus more than an ordinary share of attention. It seems to us that the principle underlying its construction may lead to some better arrangement of heating and ventilating devices in our public halls and school rooms, and thus prevent many of the difficulties pointed out in our recent editorial on this important subject.

HOW GREENBACKS ARE CANCELLED.

The money received by mail comes in all sorts of damaged conditions, and has all imaginable kinds of horrible or ludicrous histories. Sometimes it has been swallowed by a calf or a goat, which, finding a pocketbook carelessly left within its reach, proceeded to regale itself with the salt which the leather had absorbed from the perspiration, until the book was forced open and the contents exposed. The green notes had an inviting and familiar appearance, and the confiding animal eagerly swallowed them, and so sealed his own death warrant; for the owner, returning and seeing the wreck of the pocketbook, rightly conjectured where his money had disappeared, put the unwilling thief to death and recovered the half digested notes. Others have been found on the bodies of drowned or murdered men, weeks per chance after their death. Frequently they have been so burned that nothing remains but the charred resemblance of notes, so frail and brittle that a slight touch will change them to cinders.

The identification and restoration of notes which have been burnt is a difficult and interesting operation. Every one has observed that a printed paper, after having been burnt, if not subjected to a strong draft or roughly handled, retains its original form, and that the printing is distinct and legible, and appears as if it had been raised or embossed on the paper, but that if it is touched never so gently it crumbles into dust. Notes in this condition are frequently received at the Department for redemption. The counter subjects each note and fragment of a note to a careful inspection in a strong light, under a powerful glass, until she determines the denomination and issue, and then pastes it upon a piece of thin, tough paper, in order that it may be safely handled. But this pasting, by destroying the raised or embossed appearance, at once and for ever precludes all chance of again identifying the kind or denomination of the note. Henceforth it is but a plain, black piece of paper, giving no indication that it ever represented money. It is therefore very necessary that the counter should be quite sure that her judgment is correct before the note is pasted upon the paper. She must also—a most difficult task—determine whether the note is genuine or counterfeit. And yet counterfeits are discovered by these experts among the charred remains of notes with almost as much certainty as among perfect notes.

The whole basement floor of the north wing of the Treasury building, at Washington, including the large room under the cash room, is occupied by these busy counters. One hundred and eighty women are engaged in counting redeemed money in this division. The work is far from pleasant, for the money is often deplorably dirty and emits the most nauseating smells.

Such labor cannot fail to be detrimental to health, especially as want of space has necessitated the crowding of the counters almost as closely as they can sit. Hence we are not surprised to see that many of the women are pale and thin, and apparently weary and careworn.

Entering the last room to which our inspection will lead us, a busy scene is presented. Messengers, each accompanied by a counter, are hastening to and fro with boxes containing bundles of money carefully strapped and labeled, while a bevy of women surround a large table which they almost screen from our gaze, but which the continual "thud!" "thud!" that salutes our ears proclaims to be the site of the cancelling machine. Approaching, we find that



FIG. 1.—CANCELLING REDEEMED GREENBACKS.

the apparatus consists of two heavy horizontal steel bars, about five feet in length, working on pivots about a foot from the ends nearest to us. To the shorter end of each is attached a punch, while the other is connected by a lever with a crank in the sub-basement beneath, which is propelled by a turbine water wheel, furnished with Potomac water from one of the pipes which supply the building. The bundles of notes, each containing one hundred pieces, are passed rapidly and dexterously under the punch by a man whose fingers seem ever just on the verge of complete destruction, but which always escape in some marvelous manner unhurt and whole. The punch savagely and easily cuts a hole in each end of each bundle. This is done for the purpose of effectual cancellation. The bundles, when all have been punched, are returned to the box, the messenger picks it up, and the counter and he hasten away to turn over the money to the clerk who is to make up the cash account of the division and ascertain whether all the money received and delivered to the counters has been returned and accounted for. From the time when the money is received by her, until it is thus delivered, the counter is responsible for it, and is required to keep it constantly within sight, except when it is locked away for the night. For this reason she accompanies the messenger who carries her box to the cancelling room, superintends the punching, and returns with the money to the clerk, to whom it is delivered, when her responsibility ends.

Just beyond the punches, a knife of formidable aspect and

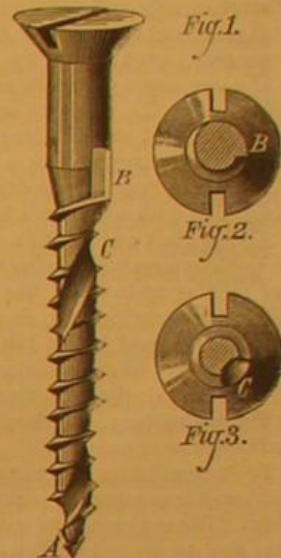


FIG. 2.—CUTTING CANCELLED GREENBACKS.

proportions is engaged in cutting the cancelled bundles in two in the middle of each note. After a sufficient quantity of money has been counted, it is made up into lots of about one hundred thousand dollars of fractional currency and proportionately larger amounts of legal tender notes, and sent in to be cut in two by this knife. The straps with which the bundles of notes are surrounded are so printed as to be also cut in two, and to show upon each half the denomination of the notes, the issue, and the number inclosed. The counter's initials and the date of counting are also written upon each end, as well as a number or letter to identify the bundle, so that if, upon recounting the money, errors are discovered, they can be traced in a moment to the proper counter, date, and bundle. One set of half notes is delivered to counters in the Secretary's office, the other to counters in the Register's office, in each of which the money is recounted. This is done as a check upon the Treasurer's counters, and for the purpose of securing as complete accuracy as possible.

IMPROVED WOOD SCREW.

Messrs. A. N. Ladd and C. N. Corning, of Concord, N. H., are the patentees of a novel and apparently useful form of wood screw herewith illustrated. The improvement consists in combining the German twist bit with the screw, in such a manner that the latter will cut its own way or hole in the wood, so as to enter the same easily and avoid splitting or other difficulty. The device may be used with the common straight bit, if desired, but the German twist bit, as shown at A, Fig. 1, is believed to be the best combination. A section of the screw is represented at Fig. 2, and Fig. 3 is a similar view of a cutter (B, Fig. 1) in the shaft of the screw, by which a hole is cut for the shaft of a larger size than is made by the bit portion of the screw. The channel or groove, C, is cut, not through the threads alone, but into the body of the screw, and retains the wood cut away by the bit.



DRAWING AND SKETCHING—PRACTICAL HINTS AND RECIPES.

We give below a number of useful suggestions and recipes relating to drawing, compiled from a variety of sources and comprising, so far as possible, the most recent improvements, as well as the plainest directions attainable, which seem to us likely to be of service to the student of the art.

In selecting a drawing board, choose wood of close grain, well seasoned, free from knots, and of even surface. Notice that the edges are perfectly straight and at right angles. A slight roundness may be given to the face with advantage in order that the drawing paper when stretched may rest tightly and flatly upon it. An apparently excellent form of board, lately introduced in the market, consists of strips of pine wood glued up to the required width with the heart side of each piece of wood to the surface. A pair of hard wood ledges are screwed to the back, the screws passing through the ledges in oblong slots bushed with brass, which fit closely under the heads and yet allow the screws to move freely when drawn by the contraction of the board. To give the ledges power to resist the tendency of the surface to warp, a series of grooves are sunk in, half the thickness of the board over the entire back. These grooves take the transverse strength out of the wood to allow it to be controlled by the ledges, leaving at the same time the longitudinal strength of the wood nearly unimpaired. A slip of hardwood is let into the edge of the board and sawn apart at about every inch to admit contraction. Its object is to make the two working edges perfectly smooth, thus allowing of an easy movement with the square.

Whatman's (English) drawing paper is generally preferred. It is known by the following names, according to dimensions of sheet: Demy 15 x 20 inches, medium 17 x 22, royal 19 x 24 super royal 19 x 27, elephant 23 x 28, imperial 22 x 30, colombier 23 x 34, atlas 26 x 34, double elephant 27 x 40, antiquarian 31 x 53. Its cost for "selected best" varies from \$1.00 to \$30.00 per quire. Paper can usually be bought ready mounted on muslin, but the process can be easily accomplished by first tacking the cloth tightly to a frame and covering it with a coat of strong size, leaving the same until nearly dry. The sheet is then well laid with paste, in two coats, the second being applied some ten minutes after the first. The paper must lastly be placed carefully upon the muslin, patted down all over with a clean cloth, and left to become thoroughly dry before removing from the board.

In fastening paper to the drawing board, there is no necessity of soaking the sheet, as is recommended in many handbooks on drawing. Lay the paper, back up, and go over it with a large flat camel's hair brush well filled with clean water. Wet the sheet to a distance of about an inch and a half from the edges. Two applications of water are sufficient, the second being applied when the wet gloss of the first disappears. Then turn the sheet over, wet side against the board, and bend up the edges, tightly all round, against a flat ruler, afterward passing the paste brush between the turned up edge and board. The ruler is afterward drawn

over the glued edge and pressed along. The next adjoining edge must be treated in the same manner and so on until all sides are secured. Wetting paper on the right side with a sponge or cloth is a bad habit and tends to destroy the fine surface, rendering it unsuitable to receive clean washes of ink or color. The right side of Whatman's paper can be told by holding the sheet up to the window, and noticing that the water mark reads from left to right; the reverse side should not be used except for rough sketching, as it generally has knots and other imperfections, which exhibit themselves when washed over.

As regards pencils, the market offers quite a number of excellent varieties from which a selection can be made. Faber's are standard articles, though a cheaper but equally good pencil is made by the Dixon Crucible Company. The latter is used by the artists of the SCIENTIFIC AMERICAN in drawing upon wood, no light test for the qualities of a pencil, by the way, and has proved of excellent quality. In sharpening a pencil, it should be remembered that, for sketching, a fine conical point is required, but for fine drawing it is much better to have the end thin and flat. To produce this, the wood is cut away from two sides only, so as to make a chisel-shaped extremity, and afterwards removed from the other sides only sufficient to slightly round the edge. This kind of a point can easily be kept sharp by rubbing the lead occasionally upon a bit of fine sand paper.

The best eraser is known as bottle rubber, which is quite soft. It has the merit of not fretting the surface of the paper. A good way of hiding small mistakes in ink lines, in places where scraping with a knife cannot be well accomplished, is to touch the spots over with flake white, mixed rather dry, with a fine sable brush.

A good black and indelible drawing ink, it is stated, may be made by dissolving shellac in a hot water solution of borax and rubbing up in this a fine quality of Indian ink. After using, the drawing pen should be dipped in alcohol and wiped dry. Good Indian ink will show, when the stick is broken, a very bright and almost prismatic colored fracture; if employed singly and without admixture, it should be used at the first rubbing. Redissolving renders its washes cloudy and irregular in tone.

To fix pencil drawings, various plans are in use. The simplest way is to cover the paper with new milk and dry carefully. Water starch, cold isinglass water, size or rice water, may also be applied with a camel's hair brush. Collodion mixed with paraffin, stearin, or castor oil, has been suggested for the same purpose, and is said to render the sketches much clearer and more easily copied.

Drawings may be copied in facsimile by the aid of various mechanical contrivances, or transferred by the use of transfer paper. The latter is made by rubbing white paper with a composition consisting of 2 ounces of tallow, $\frac{1}{2}$ ounce powdered black lead, $\frac{1}{2}$ pint linseed oil, and sufficient lamp black to make it of the consistency of cream. These should be melted together, and rubbed on the paper while hot. The prepared sheet is placed between the original and the blank paper, blackened side against the latter. The lines of the original are then gone over with a steel point (a darning needle with the point ground off will answer) and are thus caused to appear on the paper below. Copies may be multiplied by perforating the picture, or a copy of it if it be desirable not to destroy the original, with a number of fine needle holes along the outlines, and then laying upon the paper. A piece of cotton wool dipped in finely powdered blacklead, (or chalk, which is better), is then gently patted over the surface, so that the powder passes through the holes and appears on the sheet below. The outline is then filled out with pencil.

Réaumur's reproducing process consists in first making the drawing on strong glazed paper with glutinous ink and afterwards covering the lines with bronze powder. If the drawing thus prepared be pressed upon a sheet of sensitized paper, the lines of the original drawings are reproduced in black by the chemical action of the pulverized metal upon the sensitized paper. By softening the ink with the vapor of alcohol, and renewing the bronze when it is exhausted, many impressions may be produced.

Tracing paper can almost always be readily procured at a small expense. It is not difficult to make by washing thin paper with a mixture of spirits of turpentine 6, resin 1, and boiled nut oil 1, parts by weight, applied with a soft sponge; or a simpler way is to brush over thin unsized paper with a varnish of equal parts of Canada balsam and turpentine. Vegetable parchment, sometimes used for drawing purposes, is made by dipping ordinary paper for a few seconds in a solution containing one part water to six sulphuric acid. Careful washing at once is necessary to remove every trace of the acid.

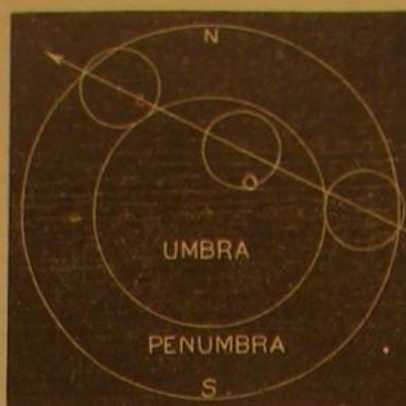
In using colors, at the outset purchase none but the very best, as with no other can purity of tone in washes be gained. The following table, showing the general indication of tints used in mechanical drawing, will perhaps prove useful: Carmine or crimson lake for brickwork in plan or section to be executed; Prussian blue, flint work, lead, or parts of brickwork to be removed by alteration; Venetian red, brick work in elevation; violet carmine, granite; raw sienna, timber not oak; burnt sienna, oak or teak; Indian yellow, fir; Indian red, mahogany; sepia, concrete or stone; burnt umber, clay earth; neutral tint or Payne's gray, cast iron, rough wrought iron; dark cadmium, gun metal; gamboge, brass; indigo, bright wrought iron; indigo with a little lake, bright steel; Hooker's green, meadow land; cobalt blue, sky. If washes do not flow well, owing to greasiness of the paper, a few drops of prepared ox gall in the water with which they are mixed will generally remedy the trouble. In coloring tracings on thin paper, work on the back and mix the colors quite dark.

Correspondence.

Total Eclipse of the Moon, October 24, 1874.

To the Editor of the Scientific American:

On October 24, 1874, a total eclipse of the moon will occur, which will be visible throughout the United States and Canada.



The accompanying diagram represents the path of the moon through the earth's shadow during the eclipse and the moon's position at the time of the middle of the eclipse. The first and last contact with the umbra, or shadow, are also shown. The Washington mean times of the different phases, as given in the *American Nautical Almanac* for 1874, are as follows:

First contact with penumbra.....	11h. 35-8m.
First contact with shadow.....	12h. 33-7m.
Total phase begins.....	13h. 51-7m.
Middle of eclipse.....	14h. 8-6m.
Total phase ends.....	14h. 25-4m.
Last contact with shadow.....	15h. 43-5m.
Last contact with penumbra.....	16h. 41-3m.
Magnitude of eclipse (moon's diameter = 1).....	1-053
Duration of total phase.....	33-7m.
Entire duration of eclipse.....	5h. 5-5m.

The mean time at which the phases occur at any other place may be easily found by simply adding or subtracting the longitude of the place from Washington, to or from the times above given, the correction being added when the longitude is east, or subtracted when it is west.

The times of the occurrence of this eclipse, as given above, are astronomical, being reckoned from 0h. at noon of October 24 upwards, so that the greater portion of the eclipse occurs on the morning of October 25, civil time.

St. Catharines, Ontario, Canada. J. M. BARR.

The Devil Fish of Newfoundland.

To the Editor of the Scientific American:

In your article on the devil fish, in No. 9, volume XXIX., you speak of "historians, otherwise credible, reporting the capture of some which measured 40 feet." As a proof of their veracity, I inclose you a photograph of an arm or sucker which measures 17 feet in length. It was coiled for the purpose of bringing the whole within the field of the camera, the diameter being 2 feet 6 inches as it lay on the table of the artist. It is of a nearly uniform circumference of $3\frac{1}{2}$ inches for 14 feet 6 inches of its length, and 6 inches at the thickest portion of the remainder containing the suckers.

While off the eastern end of Belleisle, in Conception Bay, the crew of a fishing boat noticed what they supposed to be an old sail upon the water, and proceeded to make prize by striking it with a boat hook, when, to their astonishment, the limb now photographed was thrown across the boat from gunwale to gunwale; it was broken from the creature some feet (not less than two) from the body, and subsequently pieces were cut off by the boys of the settlement to which the men belonged, before an attempt was made to preserve the specimen. How much was lost in this way cannot be told. When fresh, the length was taken by a reliable person as 19 feet, but with the same tape line, some time afterwards, I found it reduced to 17, probably by the strong pickle used for its preservation.

Another sucker, described as being as thick as a man's thigh, was also thrown into the boat, of which a length of five feet was chopped off but, unfortunately, lost. The men used their oars as levers over the gunwale to pry the boat from the creature, which shortly rushed off at great speed, then, stopping, went into a flurry, throwing the peculiar inky fluid of the squid with great violence over a space of two hundred yards, and in such quantities as would have swamped the boat had the discharge taken place close to it.

The hurried and alarmed observations of the crew are, of course, worth but little as to actual size, but the men think the total length could not have been less than 60 feet.

About three weeks previously a creature, described as of great length (probably 60 feet), was seen from the shore while swimming in the bay, within a few miles of the same place.

The specimen is now in spirits in the museum being formed by Alexander Murray, Esq., F.G.S., our geological surveyor.

Since writing the foregoing, an entire devil fish was captured by getting foul of some nets at Torbay, about nine miles from here. The body is about 6 feet 6 inches long, and the eight main tentacles about the same length, with two others of 22 feet each, measured from the head to the extreme point. To bring the entire length into view these were hung over a rail. The body and eight tentacles around the head are about of equal length, and this seems to be the

usual proportion of the structure of these creatures, with two other slenderer arms three and a half to four times longer.

The notice of this specimen has brought out many anecdotes of large squids having been stranded on our shores, in all cases reliable as to great size, and more or less so as to actual dimensions, which range (for the bodies) to eighty and even ninety feet. Without accepting them as authentic, the fact seems established that a considerable number of these creatures, of large size, exist in the Newfoundland and Labrador waters.

J. T. NEVILLE,

Inspector of Lighthouses.

St. John's, Newfoundland.

[Our thanks are due to our correspondent for the photographs mentioned in his letter, and which have safely reached us. They exhibit a hideous and formidable monster, and represent with great clearness, on the long tentacles, the suckers by which the animal attaches itself to whatever may come within its grasp. It is to this species that Victor Hugo alludes in his novel, "The Toilers of the Sea," in which one of the personages is clutched by a devil fish, and slowly drawn to a horrible death.—Ed.]

Poisonous Aniline Dyes.

To the Editor of the Scientific American:

I fully agree with you that aniline dyes should not be used in candles. I recently ate about three inches of stick candy, of a red color, and was taken sick with a burning pain in the stomach and upper intestines. I grew worse; in three days I was not able to walk without being faint and giddy, and had much pain all the time. A doctor prescribed for a case of aniline poisoning, and three doses of medicine put me out of danger. I am now about well again.

WILLIAM WARD.

Cleveland, Ohio.

Microscopical Exhibition.

The Odontographic Society lately gave a microscopical exhibition in the rooms of Philadelphia Dental College, before an audience of about five hundred ladies and gentlemen, who manifested the most marked interest in the display of instruments and objects.

The microscopes, forty in number, were placed upon the operating tables, extending one hundred feet. The instruments were arranged so as to be a distance apart sufficient to afford a fair view of the objects without inconvenience to the visitors. In addition to the microscopes belonging to the members of the society, a number of valuable instruments were kindly loaned for the occasion by the Biological and Microscopical Section of the Academy of Natural Sciences, and by several eminent microscopists. The microscopes included every variety of form, from the one thousand dollar grand microscope of Ross and the binocular of Beck, to the inexpensive student's microscope.

The objects exhibited were mainly confined to the teeth of man and animals. The sections of the teeth of man, the cat, horse, cow, sheep, elephant, hog, etc., afforded an excellent opportunity of observing and contrasting the difference in the arrangement of the enamel, dentine and cementum in those animals, while the gizzards of the cricket and the cockroach showed the provision made by Nature for the comminution of their food. Among the more notable specimens shown, in addition to those already named, may be mentioned: 1st, a longitudinal section of a dilacerated incisor, and section of a human incisor with the cementum covering a portion of the enamel; longitudinal section of a human molar with vascular canals in the dentine, and a human embryo of twenty-nine days; section of an adult human incisor and the lower jaw (tooth *in situ*) with the vessels of the dental pulp and Haversian canals injected with carmine; hypertrophied root of human molar; enamel columns of human tooth; transverse section of buck's horn and other sections of teeth; section of molar tooth and jaw of a cat, with vessels of dental pulp; periosteum and Haversian canals injected with carmine.

Dr. Joseph G. Richardson gave a very satisfactory demonstration of the circulation of the blood in the capillaries of the web of the frog's foot, in the museum of the college.

Professor S. B. Howell, aided by Professor Hunt, exhibited a number of interesting objects by means of the gas microscope, and demonstrated the importance of this instrument as a valuable and indispensable aid to the teacher of histology and physiology.

The success attending this effort on the part of the society has decided the members to give another microscopical exhibition at no distant day.—*Dental Cosmos*.

Physiology of the Siamese Twins.

Dr. Hollingsworth, of North Carolina, who examined the bodies of the Siamese twins at the time of their decease, found the band which connected them to be an extension of the sternum, for about four inches in length and two in breadth. The band was convex above and in front, and concave underneath. The two bodies had but one navel, which was in the center of the band, and it is supposed that there were two umbilical cords branching from this, one extending into each body. The connecting link was found to be the ensiform cartilage, and was as hard as bone, and did not yield in the least. [It may be here mentioned that, for some time previous to their death, no motions were observable in the band.] The doctor said that he did not think they would have survived a separation, not from the fact of being afraid of separating the arteries, but from fear of producing peritonitis. No hemorrhage would have been produced, so far as could be seen, as there were no arterial connections of any account.

SCIENTIFIC AND PRACTICAL INFORMATION.

PRESERVING ARMY CLOTHING FROM MILDEW.

An appropriation of \$100,000 has recently been asked from Congress to be expended during the next fiscal year in the preservation of army clothing from moth and mildew by a patent process. The process in question appears to be that patented by George A. Cowles and others, September 20, 1864, and is based on the preservative action of sulphate of copper on vegetable fibers. By the addition of alum, the preserving qualities of the mixture are, it is claimed, greatly enhanced; and when gelatin is also combined, the fibers are said to be not only proof against decay, but also impervious to water. The ingredients are proportioned as follows: Alum 2 lbs. dissolved in 60 lbs. of water, blue vitriol 2 lbs. dissolved in 8 lbs. of water, to which is added gelatin 1 lb. in 30 lbs. of water. A still further improvement is said to be effected by acetate of lead, $\frac{1}{2}$ lb. dissolved in 30 lbs. of water. The solutions are all hot and separately mixed, with the exception of the vitriol, which is added cold. The inventors claim that the process is cheap, and does not interfere with the strength of the goods.

THE HOME PRODUCTION OF STEEL RAILS.

Eight establishments in the United States are now making rails from steel made by the Bessemer process. Their annual production is 150,000 tons, an aggregate which, it is expected, will ere long be increased some thirty-three per cent. Steel rails are becoming stronger in popularity; and as the demand increases, there is every reason to believe that our productive power will eventually prove adequate to meet its full requirements without necessitating our dependence in any degree upon foreign makers for supplies.

A SUBSTITUTE FOR BRISTLES.

The fibrous bark of the sugar palm (*arenga saccharia*) proves to be a good substitute for bristles and animal and human hair. The treatment is simple. The bark is first immersed in water and boiled for some time in an alkaline solution; the fibers are then soaked in an emulsion of fat, alkali, and water for about 12 hours, after which time they are sufficiently hard and elastic for the above named use.

SULPHIDE OF CADMIUM FOR COLORING SOAP.

The coloring power of the above mentioned material is so great that its price is of little importance. It is, however, frequently adulterated with zinc white, which may be readily discovered by digesting the suspected substance in acetic acid, filtering, and adding a solution of carbonate of soda, which produces a white precipitate if zinc be present.

DYEING FELTS WITH ANILINE COLORS.

All aniline colors are suitable for the dyeing of felt, and the coloring matters can be repeatedly applied when a deepened effect is required. As brown is a color frequently used in felt-dyeing, it may be mentioned that fine shades of this color are obtained by using certain products from fuchsin (known in the trade as cerise, maroon, etc.) mixed with indigo, carmine, picric acid, and a little sulphuric acid. The shade known as "Bismark" may be prepared from Manchester brown mixed with the last named ingredients, substituting fuchsin for sulphuric acid.

NEW SURGICAL DEVICES.

Two great surgical novelties have lately been introduced into European hospital practice. The first is the aspirator, originated by Dr. P. Smith, which has been extensively employed by Dr. Dicalafay, of Paris. By this instrument fluids can be extracted from formations at some distance from the surface, with safety and certainty. The second novelty is the introduction of a bloodless method of amputation and other operations on the limbs by means of a compressing bandage, by which the limb is blanched with a circular elastic cord, which compresses both the arteries and veins of the limb. This plan, proposed by Professor Esmarch, has been adopted by many hospital surgeons. It remains to be seen whether there are any drawbacks to this system, and especially whether, in certain cases, embolism is likely to result from displacement of clot, which may have already formed in the veins of a damaged limb.

THE RAMIE INDUSTRY.

If any inventor has a good machine capable of thoroughly, quickly, and economically preparing ramie fiber for the market, there is a good prospect of its being largely to his interest to perfect the same, and bring it before the public at as early a day as possible. The great obstacle to the introduction of this valuable plant—which, from the fact of its being an excellent substitute for silk, is destined to be one of the most important of our American products—is the difficulty of separating the fiber from the bark that envelopes it. The Chinese do this work by hand, producing one or two pounds per day of marketable fiber, and using an ordinary knife. Of course this slow process will not pay here. Several machines, we are aware, have already been invented; but for some reason, the proprietors take but little pains to bring them into notice. The plant can be successfully cultivated in California and the Gulf States. It can be cut by an ordinary mowing machine, and an acre of land will produce from 400 to 500 pounds at a cutting. The crude ramie staple is worth from \$320 to \$340 per ton in Europe. American manufacturers offer for it from 20 to 25 cents per pound, when furnished in considerable quantities.

HIPPOPHAGY in France is increasing. During July, August, and September of 1873, the meat of 1,548 horses, 140 asses, and 15 mules, was consumed in Paris, showing an increase of nearly 100 per cent over the same months in 1872.

The Application of Solar Heat as a Motor Force.

That the heat of the sun may be transformed into mechanical force no one can doubt; for we see daily what masses of water solar heat raises into the air, to be precipitated to the earth; and we know what an enormous mechanical force is here represented.

But while solar heat is the cause of nearly all mechanical force developed on the earth, we have yet hitherto known of no means whereby it may be directly utilized for mechanical work. It has been proposed, indeed, to employ solar heat, concentrated by lenses or mirrors, for driving a steam or caloric machine. These machines, however, are not suited for this, as they involve too great a waste of heat. Moreover, in concentration a large quantity of heat must be lost.

Machines which serve for the transformation of heat into mechanical work rest on the principle that a liquid or gaseous substance, acted on by the heat, undergoes a molecular change, through which a certain mechanical force is developed. The changes of solid bodies, under influence of heat, are too small for transformation of the heat into mechanical work, or to render them means of movement, although, through such molecular change, a certain mechanical force is developed. Gaseous bodies have been applied as a means of movement in the caloric and gas machines; but with the small differences of temperature which occur in some machines, they cannot be employed as such, with advantage. Thus nothing remains but to employ a liquid; and it must be one whose boiling point is very low. There are several such liquids, sulphurous acid, methyl chloride, methyl ether, etc. Of all these, sulphurous acid best deserves attention, as it has several useful properties for the end in view. It is not difficult to condense. The keeping of it presents no difficulties, and it may quite well be put in ordinary steam boilers.

Take a vessel, A, filled with sulphurous acid, exposed to the sun's rays; the tension of the sulphurous acid vapor, if the temperature of this vessel exceeds that of the surrounding air by 10° or 20°, must be from 1 to 3 atmospheres higher than that of the sulphurous acid vapor in another vessel B, similarly filled with sulphurous acid, but which has only the temperature of the surrounding air. We can thus arrange an engine, which agrees in principle with the steam engine with merely this difference, that the water is replaced by sulphurous acid, the fuel by the solar heat; while the vessel exposed to the sun's rays represents the steam boiler, the vessel kept at ordinary temperature may represent the condenser. The sulphurous acid, condensed after doing work in vessel B, could easily be driven back by a force pump into the boiler representing vessel A. The capability of work of such a machine must naturally increase with the amount of the heat communicated to vessel A, or be proportional to the surface exposed to the solar rays.

If now, we conceive a factory or shop, the roof of which is covered with vessels containing sulphuric acid, and which is furnished with a sun machine, made on the above principle; such a machine might indeed work while there was sunshine but in default of this, the establishment would be brought to a standstill. True, the solar heat might be replaced by the heat of the air, if the temperature of the air were pretty high, and one had at hand a cooling substance like ice. But as this is not always the case, the establishment should have, besides the sun machine, an apparatus which might "store up" some of the work done by this. As such, Natterer's apparatus for condensing carbonic acid might with great advantage be used. If a supply of carbonic acid were kept in a large gasometer, like those in ordinary gasworks, the Natterer apparatus might be fed from this. In a wrought iron vessel thus filled with liquid carbonic acid, we should have an enormous store of mechanical force, which might be made to replace the action of solar heat in the sun machine, partially or wholly. After work done, the carbonic acid, becoming gaseous again, might be collected in the gasometer. Or, again, the sun machine, while in action, might drive an ice machine, and might, in default of sunshine, profit by the ice it had produced, for maintenance of its working.

We thus see that, from the present standpoint of Science, it is possible to construct a constantly working sun machine.—G. A. Bergh, in Poggendorff's Annalen.

To Inventors.

C. E. G. lays down the following maxims for the guidance of inventors.

1. Know definitely what you want to accomplish, stick to it, and let other matters go, for the time.
2. Post yourself thoroughly as to the laws governing the action of each part of your machine.
3. Always bear in mind that whatever is gained in time is lost in power, and vice versa.
4. Think over every machine, of a nature similar to yours, which you have seen; and when your idea is clear in your head, compare it with those of inventors who have preceded you in the same line.
5. Be sure that the cost of your device will not prevent its use.
6. Avoid all complicated arrangements; make every machine of as few parts as possible.
7. Imagination, judgment, and memory are the faculties to employ. Imagination will bring forth new forms and actions, judgment will compare them with other devices and determine their relative value, and memory will store up the results for future use.

As a TEST for red wine, which is sometimes artificially colored, Cottini recommends nitric acid: 50 parts wine are mixed with 6 parts of nitric acid (of 42° B.) and heated to 95° Fah. The natural wine will not change its color if left for some hours, but the artificially colored will lose its hue in a few minutes.

ABOUT OURSELVES.

"The steel engraving 'Men of Progress' is received, for which accept my thanks. The few subscribers I have sent you were not worthy the acknowledgment you have given for them."

"I beg to acknowledge the receipt of the magnificent steel plate engraving entitled 'Men of Progress,' and can assure you it surpasses anything I had the least conception of; it not only being collectively a most appropriate subject, but also one that cannot fail to be appreciated by all."

The above are extracts from a couple of letters received from patrons in Canada and in Indiana, who have obtained clubs of subscribers for us. Their views are but examples of many others, whose appreciative commendations of our efforts reach us daily.

The rapidity with which our subscription lists are augmenting and the constant addition of new names, not singly but by tens and twenties, indicate quite clearly that the stringency of the late panic has all but disappeared, and that business, especially in mechanical and manufacturing establishments, has resumed its wonted vigor. So far from our circulation having become diminished by the financial troubles, we are happy to announce that it never has been nearly as large at this season of the year, nor have we ever known a new year which, dating from its beginning, has brought us so large an accession of new subscribers or such prompt renewals from old patrons. It would indeed be ungrateful on our parts did we fail to acknowledge our appreciation of the kind words which reach us, and the more substantial, though not more agreeable, recognition of our efforts evinced by the constantly increasing ranks of our army of readers. It remains for us to strive to merit the praise already accorded, by making the SCIENTIFIC AMERICAN, for the coming year, better and more useful than ever before.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the months of October and November, 1873:

The number of visits made during these months was 2,449, and the number of boilers inspected, 4,919; of which inspections 1,441 were internal and entire. The hydraulic pressure was applied in 355 cases. The number of defects discovered was 2,083, of which 555 were regarded as dangerous. These defects in detail were as follows:

Furnaces out of shape, 80—14 dangerous; fractures, 194—93 dangerous; burned plates, 118—40 dangerous; blistered plates, 314—52 dangerous; deposit of sediment, 394 cases, of which 62 were regarded as dangerous; cases of incrustation and scale, 355—26 dangerous; cases of external corrosion, 127—37 dangerous; internal corrosion, 88—24 dangerous; internal grooving, 31—9 dangerous; water gages defective, 85—9 dangerous; blow-out defective, 38—12 dangerous; safety valve overloaded, 37—16 dangerous; pressure gages defective, 288—58 dangerously so. These variations were from —7 to +20. Boilers without gages, 157—5 of these were run at high pressures; deficiency of water, 23 cases—5 dangerous; braces and stays loose and broken, 102—49 dangerous; boilers condemned, 28. Corrosion, either internal or external, has in many cases been found to be making great injury during these two months. In one case, three boilers were found connected together by cast iron pipe over the bridge wall. The joints in this pipe were made with copper gaskets. At the connection on No. 1, the shell around the flange was badly eaten by corrosion, and very thin. In another case, eight soft patches of copper were found on a boiler. Flue boilers that had been long neglected were found in bad condition, the flues being corroded entirely through. When boilers are not blown down frequently, impurities in the water become concentrated, and act very injuriously on the iron. The number of condemned boilers was unusually large, and they were in a dangerous condition, liable to accident at any moment.

Chainmakers' Peculiarities.

"The Troy chainmakers in that city," says the Troy Times, "are a peculiar set of men. They are eighteen in number, and are all English. Each chainmaker employs three assistants, and earns, when at work, about \$25 per day. After paying three helpers, the chainmakers have from \$10 to \$13 per day for themselves. They are stubborn, industrious and saving. This branch of manufacturing is in its infancy in this country; and as the workers are few, they have a practical control of the trade. When strikes and lock-outs occur, they are able to hold out longer than other mechanics. Their extraordinary wages and their disposition to save what they earn almost invariably enable them to hold out until their employers yield. Their stubbornness was well illustrated two or three years ago. They held out until their savings were all gone; then they went to work upon the streets and elsewhere for \$1.50 per day until matters were arranged between the owners of the chain works and themselves."

"Last spring these men were working at an advance of ten per cent over the wages paid when gold was selling at fifty cents premium. During the summer they demanded and received another advance of ten per cent. In November, the lack of work compelled the owners to close the works. A few weeks since they secured an order for about sixty tons of chain cable of a peculiar kind. Only three of the chainmakers can work upon these cables, and to these three the owners offered work at the highest wages. They refused to go to work unless the other chainmakers were also furnished employment. In this position affairs are at present. The firms have work for only three chainmakers."

IMPROVED GAINING MACHINE.

Grooves cut at right angles to the fiber of timber are termed gains in the technical language of carpentry. These gains, which in the present method of erecting the heavy work of the period are very numerous, especially in bridges and railroad car timbers, have heretofore been done in a great measure by hand labor, or by rotary cutter heads projected through the surface of a table sufficient for the depth of the gain, over which the timber was carried to complete the gain transversely.

These methods, however, have not the advantages claimed to be attainable by the use of the improved gainer, produced by the extensive wood working tool builders, Messrs. J. A. Fay & Co., of Cincinnati, Ohio, and represented in the annexed engraving.

This is a very massive and substantial machine, occupying an area of ten by twenty feet upon the floor. Timbers of any size to twelve inches thick by twenty-four inches wide can, we are informed, be gained at any desired angle upon it. The limit of

depth of gain is four inches, the width indefinite.

By means of the stops, to be seen in front of the table in connection with the treadle and spring pin through the way, duplicates of timbers may be produced indefinitely, the stops indicating the width and distance apart of the gains.

The depth of the gains is determined by the position of the stops placed in the slots in the cutter slide, and which will indicate four depths of gains. The table is moved longitudinally upon friction rollers by means of a rack and pinion underneath operated by a hand wheel in front. The cutter head, with its slide, has a vertical movement governed by the lever in front and counterbalanced by a combination of springs inclosed in the moving frame. The cutter head can be placed anywhere within its range of movement without changing the position of the governing hand lever. This is accomplished by turning the hand wheel on top of the cutter slide.

The sliding frame, which conveys the cutter head in its traverse movement over the table, is actuated by means of a series of gearing driving a pinion in a fixed rack. This mechanism is contained within the frame, in self stopped at any point by means of a shipper and adjustable stops on the side of the column, and started by the operator turning the handle under the hand lever which engages the belt with the tight pulley. The motion of this sliding frame is at a fixed speed, whether for wide or narrow timber, a peculiarity no other gainer possesses. This equal speed in either direction enables the cutting to be done both ways, the cutter head being so constructed as to facilitate the operation.

The countershaft from which the machine is driven is placed vertically over the center of the distance of the travel of the pulley shaft, in the rear end of the sliding frame. The arc of the circle struck from the countershaft being but slightly different from its chord, the tension of the belt is not affected sufficiently to be any detriment to the working of the machine.

The improvements in this machine consist of the equable traverse movement of the cutter head, the ease of adjustments, the fixed positions of the handles for the operator, and other mechanical refinements introduced where they will be appreciated by every mechanic. Patented January 20, 1874.

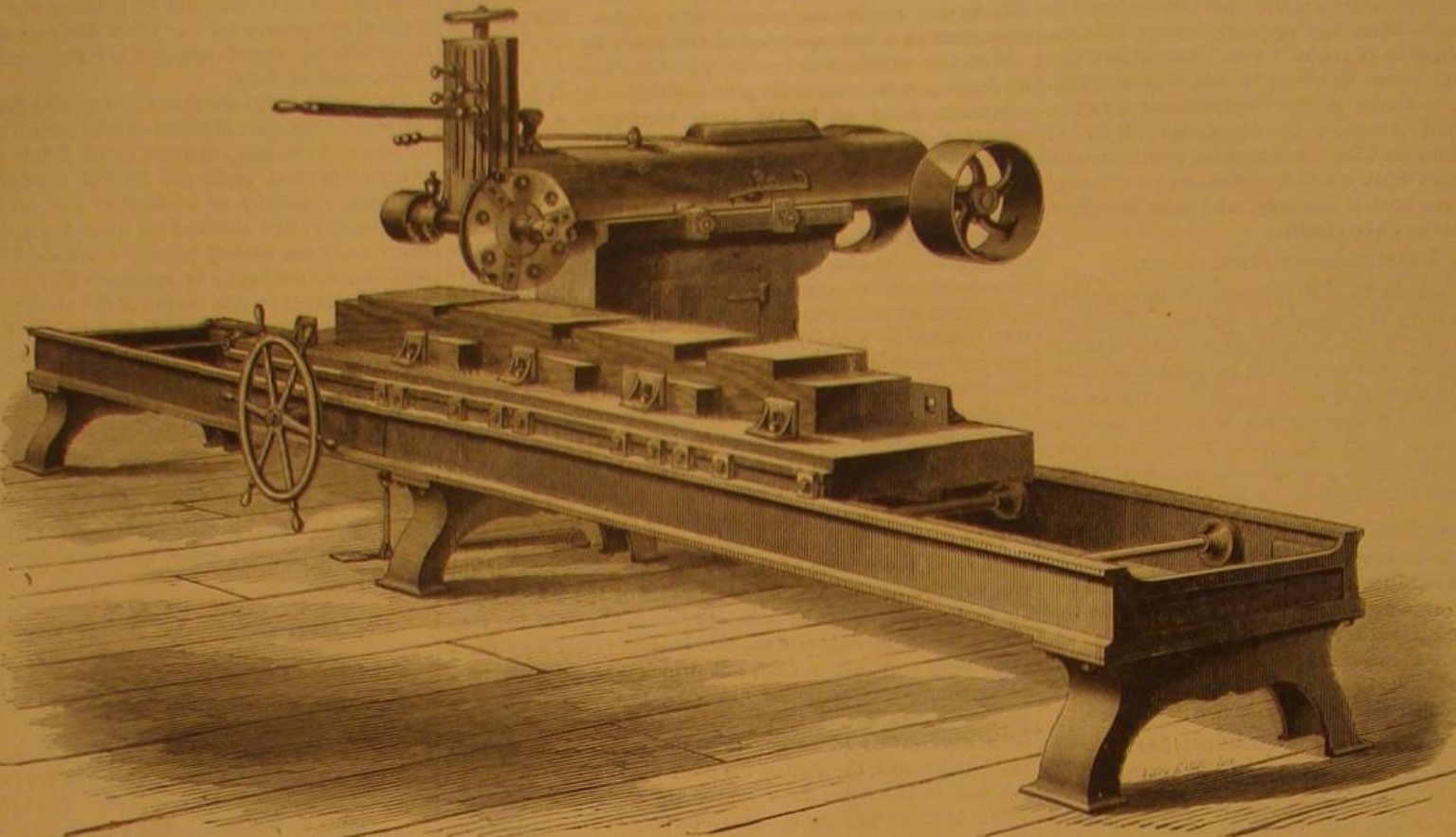
MONSON'S IMPROVED AUGER.

Mr. Christian Monson, of Moscow, Iowa county, Wis., has invented a novel and, we should judge, very useful form of auger, which, he states, is capable of boring orifices of different sizes, and is, besides, adapted to making holes for screws.

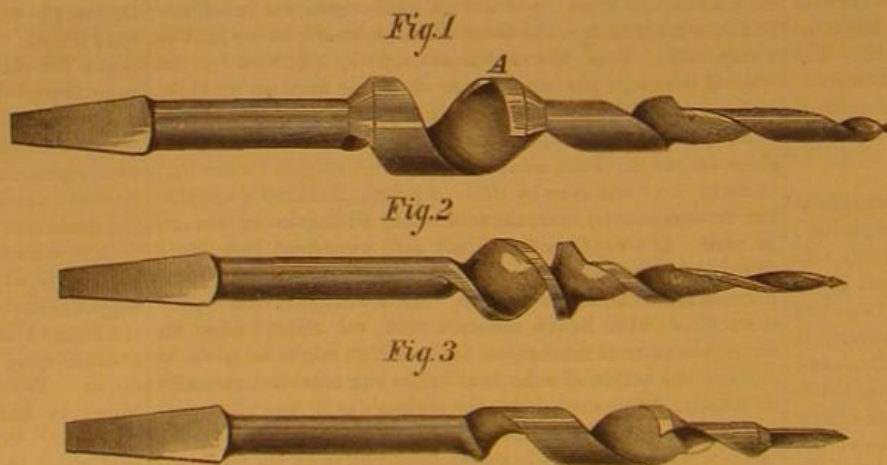
The bit, as will be remarked from Fig. 1, is provided with three distinct sizes of screw, each of which parts is made tapering in form. The larger of the three, A, is provided with a projection by means of which it is rendered

suitable for countersinking. Fig. 2 is a modification of the above and has two sizes of screw and a double thread. The point also, it will be noticed, is somewhat differently constructed, being provided with slight projections which, according to the inventor, are not easily worn or broken. Fig. 3 is still another modification of the first form, having also two sizes of screws but a triangular shaped point. This latter is well suited for easily penetrating wood, and is said not to be liable to become broken or dull.

The tapering form of the tool makes the hole for the blank

**IMPROVED GAINING MACHINE.**

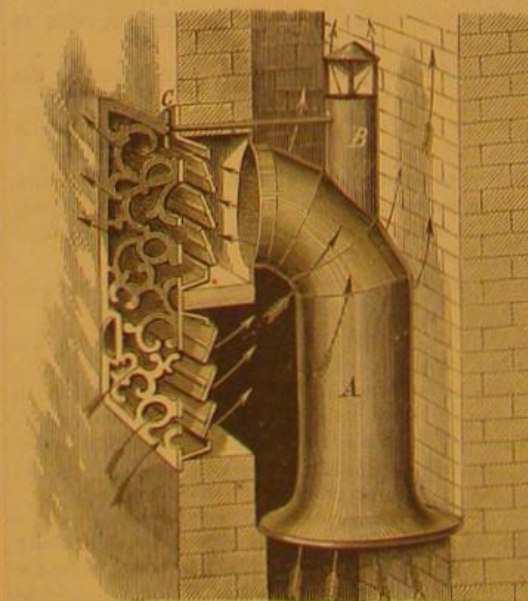
part of the screw, that portion being, of course, larger than the threaded part, while the countersinking and boring are both accomplished by the single operation. The invention will commend itself to wood workers, on the score of economy, as it tends to save the expense of a number of separate

**MONSON'S IMPROVED AUGER.**

augers of different sizes. Further particulars may be obtained by addressing the patentee as above.

BARKER'S HEATING AND VENTILATING APPARATUS.

The recent disclosures made concerning the very defective



heating and ventilating arrangements in the public schools and court rooms of this city have, to a considerable degree, aroused the attention of the public, not only in this but in

other localities, to the existing necessity of improved and simple means for securing constant supplies of pure fresh warm air in crowded apartments. We illustrate in this issue the Galton fireplace, lately introduced in England and strongly commended by high sanitary authority. We herewith present another device of equal timely importance, consisting in a novel adaptation of the furnace flue and register. The apparatus, the construction of which will be readily understood from the annexed engraving, seems to us, judging from the explanation of the inventor as below given, a plan

of much merit, and hence worthy of the careful examination of health boards, architects, builders, and property owners generally.

Our illustration, partly in perspective and partly in section, shows the invention quite clearly. A supplementary flue, A, flared at its lower end, surmounts the flue leading from the furnace. Its upper extremity is curved to terminate in the upper half of a register through which the hot air is delivered into the room. It will be observed that the register, though having a sin-

gle grating of the usual size, is divided by a horizontal partition, and each portion is provided with a separate set of slats, either of which may be opened or closed at will. While the hot air from the flue, A, pours into the room in an ascending current, as indicated by the arrows, the cold and heavy vitiated air, which sinks to the floor, makes its exit into the lower half of the register, entering the main flue in the space between the supplementary pipe and the brick work, and thence passing up the chimney. By this means, it is claimed, a constant circulation of air is maintained in the apartment.

The small pipe, B, arranged above the flue, A, is provided within with a valve operated by a suitable rod and handle, C, outside the register. By this device either a portion or the whole of the hot air rising in the flue, A, may be discharged with the vitiated air flue, the register of the hot air pipe being either opened or closed accordingly, and thus increasing the warmth and consequently the draft of the vitiated air flue, a result of much importance in crowded rooms, where the heat becomes excessive and the air very impure. The inventor informs us that, in practice, the truth of the views above noted is fully proved; a candle or handkerchief held before the two portions of the combined register indicating clearly the

direction of the ingress and egress currents. By a simple modification the device is adapted for floor registers, and in cases where several flues pass up the wall side by side, a metal partition is used to separate each at the point of location of its register, enabling the apparatus to be conveniently and readily applied. The invention has already elicited favorable notice from eminent sanitary authorities in this city, Philadelphia, and Washington. It is covered by four patents of quite recent date. For further information address the inventor, Mr. George R. Barker, Germantown, Philadelphia, Pa.

Gold for Illuminating.

Procure a book of leaf gold, take out of the leaves gently and grind them in a mortar with a piece of honey about the size of a hazel nut, until it is thoroughly intermixed with the gold, then add a little water and re-work it; put the whole into a phial and shake it well. Let it remain an hour or two, and the gold will deposit at the bottom of the phial. Pour off the liquor, and add weak prepared gum in its stead, sufficient to make it flow freely from the pen or camel's hair pencil. When required for use, shake it occasionally.—*Revell's Potichomanie.*

PISCICULTURE IN CANADA.—Several correspondents having sent us inquiries on this subject, we are desired by the author of the letter signed "Canadian" (on page 36 of our current volume) to state that he will be happy to give information and advice to any one interested in the subject. His name is Rev. J. Alexander Morris, Ottawa, Ontario.

THE AUSTRALIAN FEVER TREE.

A question of considerable general interest was recently discussed at a meeting of the French Academy of Sciences. The subject was the remarkable sanitary influence of the *eucalyptus globulus*, when planted in marshy grounds; and the tree, in brief, it seems, has the curious and valuable power of destroying the malarious element in any atmosphere where it grows.

The species is indigenous to Tasmania, and is known among the colonists by the name of the Tasmanian blue gum tree, on account of its dark bluish tinged leaves. Growing in the valleys and on thickly wooded mountain slopes it, often attains a height of from 180 to 220 feet, with a circumference of trunk of from 33 to 64 feet. The foliage is thin and oddly twisted, surmounting, with a thin crown, the top of the pillar-like stem. The wood exhales an aromatic odor, and, after seasoning, is said to be incorruptible. For this reason, it is largely used in the building of piers, vessels, and other structures exposed to the ravages of the weather. It is largely exported, to the aggregate value, an authority states, of \$4,000,000 per year.

To the peculiar camphor-like odor of the leaves and the large absorption of water by the roots is doubtless owing the fact of the beneficial influence of the tree. Where it is thickly planted in marshy tracts, the sub-soil is said to be drained, as if by extensive piping.

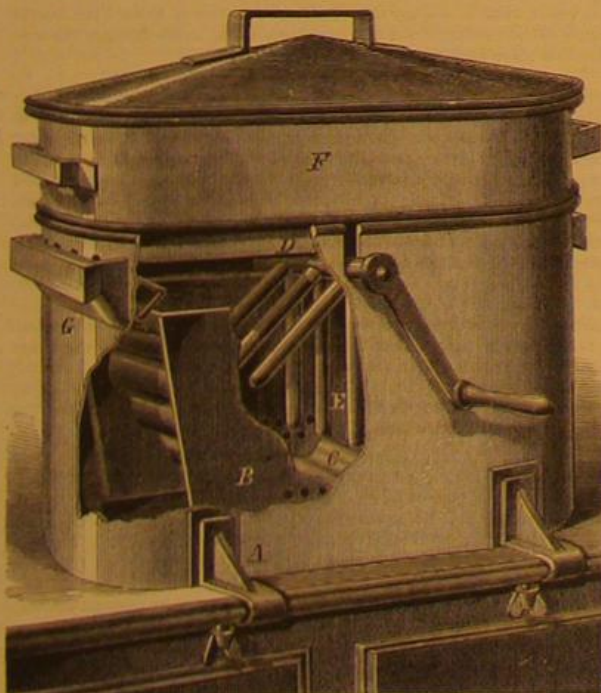
Miasma ceases, we are told, wherever the *eucalyptus* flourishes. It has been tried, for this purpose, at the Cape; and, within two or three years, completely changed the climatic condition of the unhealthy parts of that colony. Somewhat later, its plantation was undertaken, on a large scale, in various parts of Algiers, situated on the banks of a river, and noted for its extremely pestilential air; about 13,000 *eucalypti* were planted. In the same year, at the time when the fever season used to set in, not a single case occurred, yet the trees were not more than nine feet high. Since then, complete immunity from fever has been maintained. In the neighborhood of Constantina, it is also stated, was another noted fever spot, covered with marsh water both in winter and summer; in five years, the whole ground was dried up by 14,000 of these trees, and farmers and children enjoy excellent health. Throughout Cuba, marsh diseases are fast disappearing from all the unhealthy districts where this tree has been introduced. A station house, again, at one end of a railway viaduct in the department of the Var, was so pestilential that the officials could not be kept there longer than a year; forty of the trees were planted, and it is now as healthy as any other place on the line.

La Nature, to which journal we are indebted for the annexed engraving of the peculiar leaves and flowers of the tree, adds that careful experiments have proved that, in a medicinal preparation, it cures the worst cases of intermittent fever, against which quinine proves powerless. It is also valuable as a disinfectant, and as a dressing for wounds; while more recent investigations point to the fact that it may be rendered of great service in catarrhal affections.

The tree has been acclimatized, to a certain extent, in the South of France, Algiers, Corsica, Spain, Cuba, and Mexico. We should imagine that it might be cultivated, with immense advantages, in the swamps of our Southern States.

IMPROVED WASH BOILER.

In the novel form of wash boiler represented in our engraving, the laundress is provided with a means of boiling, washing, and rinsing clothes in, it is claimed, a most rapid



and efficient manner. The garments, it is further stated, are thoroughly cleansed, and this without injuring the most delicate fabrics.

The boiler proper is akin in shape to that usually employed, and is supplied with clamps, A, so that it may be firmly secured to the edge of the top of the stove or range by means of set screws. Inside the main receptacle is placed a vessel, B, the sides of which are vertical and support a circular corrugated bottom, disposed as shown at C. In the

lower part of the sides are formed a number of perforations to allow of the free passage of the water. D is a shaft, one end of which is journaled in a socket secured to the main receptacle, and the other passes through a short vertical slot made in the edge of the latter, carrying at its extremity a crank. The shaft, which may be secured in this slot by a suitable latch, not shown, is provided with a number of radial arms, E, which project from its lower part, so as nearly to touch the corrugated bottom of the vessel, B. The water and soap being placed in the boiler, the clothes are laid in the inner receptacle, and, the crank being rocked, are caused by the arms, E, to sweep back and forth upon the corrugations, thus quickly being cleansed.



THE AUSTRALIAN FEVER TREE.

In order to prevent the spattering of water out of the boiler, during the rinsing, an extension, F, is provided, which fits in the mouth of the latter, and this is surmounted by the cover, which conforms in shape to the opening of either extension or boiler. At one end of the boiler is secured a spout, G, to which is attached a cleat to receive a wringer. The water pressed from the clothes is conducted by the spout back into the boiler, through the perforations in the side of the latter for the purpose. Handles are provided for lifting the apparatus, and a faucet may be placed at its lower part for drawing off the water.

The device is the invention of Mrs. Mary A. Barnes, of Olympia, Thurston county, Washington Territory. Patent is ordered to issue through the Scientific American Patent Agency.

New Marine Propeller.

A new propeller has been introduced by Dr. Collis Browne, which differs considerably from any other in use, somewhat resembling, when at rest, the letter X, as shown by the illustration, and claiming to offer many advantages over those commonly employed. These are absence of vibration, reduction of wear and tear to machinery, ready adaptability to any screw steamship, and facility of checking a ship's way, with the power of driving her full speed astern in a few seconds on reversal, as well as giving considerable increase of speed, and effecting a great saving of coal. This propeller has been tried at a measured mile by the steam yacht *Lapwing*.

During a trial under 58 lbs. pressure of steam, with a consumption of 81 lbs. of coal per hour, the propeller made 220 revolutions per minute with the tide slack, and the furnace burning hard steam coal, the measured mile being run in five minutes. During a trial under 64 lbs. pressure, with a consumption of 112 lbs. of coal per hour, and using the ordinary fan propeller making 280 revolutions per minute, with the tide slack and the furnace burning best Welsh coal, the vessel made the measured mile in six and a half minutes.

As far as this experiment goes, the new propeller shows a superiority over the fan form.—*Iron*.

SOME experiments made by the directorate of the government railroads of the Netherlands, in regard to the preservation of exposed sheet iron, have lately been published. Plates prepared in various ways were placed in exposed situations, and examined after three years. The result of the examination showed that as good a method as any of preparing the plates was to clean them by scraping and brushing, and then paint them with red lead.

The Dry Inkstand an Old Device.

"An inkstand containing carbonaceous and extractive matter in a dry state, which, with the addition of water only, will supply ink." Patented in England in 1820, by John Moody.

The outside of the inkstand may be made of brass, tin, or other metal, and of any shape that may be thought desirable. Within must be introduced a small vessel, which may be made of lead, earthenware, or glass, with a hole to admit a pen, in which the composition is placed; and the whole of the interior may be filled up with a cement, which may be made as follows: Melt two pounds of sulphur over a slow fire in a glazed pipkin; when melted, take it off the fire, and let it stand ten minutes or a quarter of an hour, until it is of the consistency of oil, then add to it lamp black, or any other color that may be thought proper, and stir it well together, and then pour it into the inkstand. The composition of carbonaceous and extractive matter is made and produced as follows: Take half a pound of fine honey, and the yolk of a new laid egg, mix them, and let them stand three days, frequently stirring them well together; then add half a pint of strong extract of galls, which extract is made by infusing one pound and a quarter of best blue galls, powdered, into three pints of soft or salt water; let them stand for six days, often stirring them; then filter the whole through a fine wire sieve, and evaporate the liquor to one half (that is to say, one pint and a half), over a gentle fire, in an iron pot.

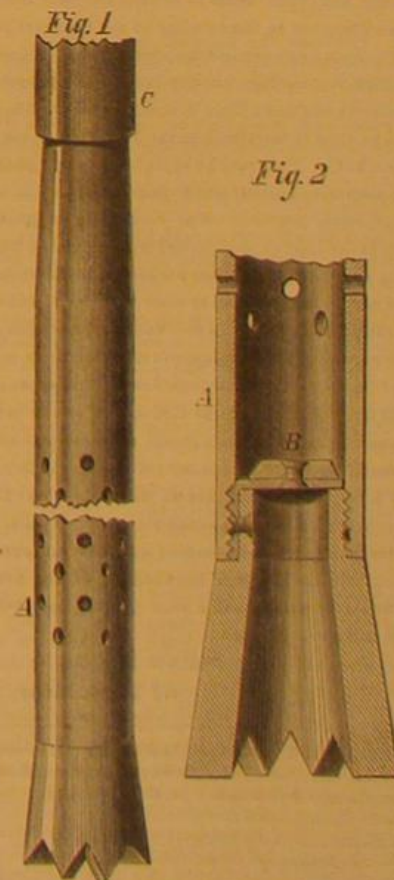
Then take another half a pint of extract of galls, as above prepared, in which dissolve three ounces of gum arabic, one ounce of white sugar candy, and one ounce of indigo, all in powder. Then take the remaining half pint of extract of galls, a half pint of strong decoction of logwood (which decoction must be made by boiling half a pound of logwood in powder, in a pint and a half of soft or salt water, until reduced to half a pint), into which put two ounces of blue galls in powder, two ounces of lamp black, two ounces of willow wood charcoal, ground very fine, and three ounces of sulphate of iron calcined to whiteness in powder, and stir them well together. Then knead the whole well together, in a marble mortar, into a stiff paste, which put into the stands, and let it harden in the air, over which paste must be placed a small quantity of cotton that has previously been soaked in vinegar that has been well saturated with salt.

Fixing Slates.

Slates, instead of being nailed to the roof, may be fastened by movable hooks, about 2 inches long, which are soldered to conically formed zinc plates, 4 to 6 inches long. The slates are thus kept securely between the hook and zinc plate, and can be removed simply, with the greatest facility, by turning the hook. Thus one or more of the slates can be taken out for repair, or new ones inserted, without interfering with the rest. The method is said to make a roof watertight.

SELF-PUMPING WELL-BORING DRILL.

With the improved drill represented in the annexed illustrations, the inventors claim that not only faster and better work can be accomplished, but that the apparatus can be more conveniently manipulated, and will penetrate further



into the ground before its removal for cleaning is required, than the borers in common use. It is also stated that a hole, with this device, may be sunk by hand to a distance of 200 feet, and with a lever to any desired depth; while the operator is enabled, during the progress of the boring, to know exactly the kind and depth of strata through which the tool is passing.

The drill is made tubular and somewhat flaring, so that it

forms an orifice a little larger than its body. Its lower edge is serrated, so as to cut a ring groove into the strata, the core of the bore passing up through the cavity in the drill. The upper end of the latter is rabbeted, and, by means of a screw thread cut thereon, is attached to a perforated tube, A, Figs. 1 and 2. The object of the holes in the tube is to allow the water to escape, and thus lessen the weight of the drill as it is moved up and down. To the upper end of the drill is hinged a valve, B, represented in section, Fig. 2, which opens upwards into tube A, so as, when the tool is raised, to carry the contents of the pipe up with it. Sections of tubing—part of one of which is shown at G Fig. 1—are screwed to the part B, and increase in number with the depth of bore.

Another advantage claimed is that, should the portions of the device become detached, a screw rod may be readily inserted and the separated parts drawn out.

Patented through the Scientific American Patent Agency, November 11, 1873, by Messrs. Timothy Phillips and Joseph Gollitz. Further particulars may be obtained by addressing the inventors at Leavenworth, Leavenworth county, Kansas.

AN old subscriber, P. H. W., writes to say that he owns a propeller steamer of the following dimensions: Length 42 feet, beam 7 feet; boiler 4 feet 8 inches high, with 78 one inch tubes 2 feet long, and 31 two inch drop tubes 18 inches long; the engine has a cylinder 5½ inches diameter x 7 inches stroke; the screw is 38 inches in diameter with 5 feet pitch. She has run 7 miles in 40 minutes, carrying 65 lbs. steam, the screw making 165 revolutions per minute. The boiler is of ⅝ inch iron, and will carry 180 lbs. on the inch if required.

MR. R. F. MUSHET has lately written a letter to the editor of the *London Engineer*, in relation to the age of a Bessemer steel rail which, he says, was the first cast steel rail ever laid down. The rail was laid down on the Midland railway, in the early part of 1857, and was taken up in 1873. It thus appears that it was in use for 16 years, sustaining daily, Sundays excepted, the passage of 250 trains, and at least 250 detached engines and tenders, or, during the 16 years, about 1,352,000 trains, and the same number of detached engines and tenders.

THE HOOSAC TUNNEL ALIGNMENT.—Mr. H. W. N. Cole claims the credit of this for Mr. C. O. Wederkinch, who has had entire charge of the work, has run all the lines, and invented his own instruments for doing it.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the *SCIENTIFIC AMERICAN*. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and constructors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the *SCIENTIFIC AMERICAN* is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the *SCIENTIFIC AMERICAN*, the parties ordering having seen the article illustrated or advertised in these columns. Address

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Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From January 6 to January 12, 1874, inclusive.

ADJUSTABLE PULLEY.—E. F. Allen, Providence, R. I.
CONVEYOR OF FUEL, ETC.—D. T. Casement, Painesville, O.
DETERMINING FILLING.—C. E. Blake, San Francisco, Cal.
ELECTRIC BRAKE.—S. W. Wilson (of Philadelphia, Pa.), London, England.
ELECTRIC MOTOR.—J. B. Stone, Boston, N. J.
FLUID PRESSURE REGULATOR.—D. T. Casement, Painesville, O.
HYDRATE OF MAGNESIA.—C. H. Phillips, New York city.
HYDROCARBON FURNACE.—G. W. Morris et al., Baltimore, Md.
PUMP VALVE.—W. Painter, Baltimore, Md.
RAISING SUNKEN VESSELS.—H. F. Knapp, New York city.
RENDERING TALLOW, ETC.—J. A. Miller, Providence, R. I.
SCREW MAKING MACHINE.—W. H. Post, Hartford, Conn.
SNAP CONNECTOR.—S. Reynolds, Pittsburgh, Pa.
TESTING WOOD, IRON, ETC.—R. H. Thurston, Hoboken, N. J.
VENTILATING WINDOW.—Bradley Window Company, New York city.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

MELODEON PATENT.—ANDREW H. HAMMOND et al. vs. THE MASON & HAMLIN ORGAN CO.

(Decided December 2, 1873.)

SHEPLEY, J.

This is a bill in equity by the complainants as assignees and owners of the letters patent released to El Dora Louis, as administratrix of Lafayette Louis, on the 25th of July, 1871, for an improvement in melodeons or reed instruments, consisting of the application of mechanism to produce a "tremolo" in the musical notes on said instruments. The original patent to Lafayette Louis was issued November 13, 1856.

Defendants by their plea admit that they manufacture and sell in connection with their own organs tremolo attachments made precisely in accordance with the specification, drawings, and model of an application for letters patent, dated September 25, 1865, made by Lafayette Louis, the assignor of the complainants. The plea admits for the purpose of this hearing that this mechanism embodies the invention described in the patent of said Louis, on which this bill in equity is brought.

The plea sets up a justification in using these mechanisms under a license under the original patent granted by Louis to Mason & Hamlin, the assignors of these defendants, and also under a series of contracts between Louis and the defendants themselves relating to the specific device used by them. It is not necessary to consider the questions discussed at the bar in relation to the license set up in the plea under the original patent, as we are satisfied that the defendants are protected under their agreements with Louis, dated September 25, 1865.

It appears that Louis, prior to the 25th of September, 1865, made an invention of a combination of the fan tremolo with a rotary wheel, and applied for a patent for this combination. On the same day he entered into three contracts with these defendants. The first was an absolute conveyance to the defendants of all his "right, title, and interest in and to said invention and letters patent which may issue therefor," and authorized the Commissioner of Patents to issue said patent to the Mason & Hamlin Organ Company, as the assignees of all his right, title, and interest in and to said invention and letters patent.

The second agreement grants to the defendants the right to make, use, and sell the invention above named, and assigned to them, as above stated, in connection with so much of the inventions secured by the letters patent of November 10, 1856, (on which this suit is brought,) and by a patent of June 10, 1862, "as is contained in the said mechanism." The defendants agree to pay a royalty for each and every tremolo mechanism substantially the same as that described and shown in the said application and accompanying specifications, drawings, and model, until the expiration of the term for which the said letters patent were granted, he granted, referring to the letters patent for which application was on that day made.

This contract provided for one contingency—that was the granting of letters patent on the application then made. The invention and the right to use the specific mechanism had been conveyed to the defendants. If, by the granting of letters patent to them as assignees of Louis, they should obtain the exclusive right to use the invention, then in such case they were to pay Louis a royalty of one dollar for each and every mechanism made during the term of the patent. The contingency contemplated did not happen—letters patent were not granted for the combination applied for.

The third agreement provided for another contingency—namely, the failure of the defendants to obtain a patent for the invention of 1865, which is the case as it now exists. This agreement provided that—Whereas the said Louis has invented an improvement in keyed reed musical instruments, and has this day executed his application for the grant of letters patent of the United States to secure the same, and has also made and executed an assignment thereof to the said Mason & Hamlin Organ Company, and a license to make, use, and sell the mechanism described in the specification, drawings, and model accompanying the said application, under letters patent originally issued as number 16,094, and dated November 18, 1856, and subsequently released as number 2,493, dated February 18, 1867, and again renewed as number 2,944, dated May 25, 1868, and also under letters patent numbers 35,523, and dated June 10, 1862; and now, therefore, in consideration of one dollar to him paid and for other good and valuable consideration, the said Louis hereby covenants and agrees with the said company, that if the said company fail to procure said letters patent for which application has been executed as aforesaid, then he, the said Louis, will and does hereby grant unto the said Mason & Hamlin Organ Company the exclusive right under the said letters patent already granted, and under all and all releases thereof, to make, use, and sell the specific mechanism described and set forth in the said executed application and the specification, drawings, and model accompanying the same.

Taking into consideration the three contracts, it is plain that Louis had invented a new combination of the old parts patented by him. He applied for letters patent for this new combination. He conveyed to defendants for a valuable consideration the right to use the invention and the right to make, use, and sell the specific mechanism described in the application including the old parts as well as the new combination.

If the defendants succeeded in obtaining a patent for the new combination, they were to pay a royalty in addition to the consideration they had already paid for the invention; but if no letters patent could be obtained the defendants were none the less the owners of the right to make, use, and sell the "invention" and the mechanism it contains, and "the specific mechanism" described in the application.

Independent of the granting, renewing, or extension of any letters patent, without limitation of time, they had purchased and taken a conveyance of the right to make, use, and sell those specific devices in that specific combination. This is what they do use and this only, and this they have a right to use. Their right is not limited to the term of the original patents covering the parts of the combination. It is true that the third contract, in case of failure to obtain a patent for the new combination, grants to the defendants the exclusive right, under the patents already granted for the parts, to make, use, and sell the specific mechanism described in the application for letters patent for the new combination; but they had the right to use this specific mechanism. The license under the old patents was only intended to make this right exclusive. Their exclusive right under them might end with the expiration of the term of the old patents; but their right was independent of their existence or duration.

Bill dismissed.

United States Circuit Court—District of Massachusetts.

BUTTON PATENT.—CHARLES L. POTTER vs. OSCAR S. TRAYER et al.

(In Equity.—Before Shepley, Judge.—Decided December 2, 1873.)

A patent for attaching a helical shaft to a button by soldering it to a circular disk which is sunk into a corresponding recess in the button, and is prevented from turning by a cross bar also sunk into the button, is not infringed by a button similar in other respects, but in which the shaft is prevented from turning by serrations on the edges of the disk and of the recess into which the disk is jammed.

Bill dismissed.

NEW BOOKS AND PUBLICATIONS.

JOHNSON'S DENTAL MISCELLANY, a Monthly Journal of American and Foreign Dental, Surgical, Chemical, and Mechanical Literature. Per annum, \$2.50. Volume I, No. 1. New York: Johnston Brothers, 812 Broadway.

This is an ably edited and readable periodical, which has, we believe, an excellent prospect of success.

QUANTITATIVE CHEMICAL ANALYSIS. By T. E. Thorpe, Ph.D., F.R.S.E., Professor of Chemistry in the Andersonian Institution, Glasgow. New York: John Wiley & Son, 15 Astor Place.

This very excellent and original work has long been waited for by scientific men. The rapid growth of chemical science soon makes our text books become antiquated, and the best works on analytical investigations hitherto published have not been able to embody many theories and results which are universally recognized as true. It is not probable that Fresenius will ever fail to be read by students in chemistry; but we must look to more modern writers for works dealing with contemporary science, of which Professor Thorpe's book is an admirable specimen.

MECHANICS' GEOMETRY, Plainly Teaching the Carpenter, Joiner, Mason, Metal Plate Worker, and Other Artisan, the Constructive Principles of his Calling. Illustrated by Accurate Explanatory Cardboard Models and Diagrams. By Robert Riddell, Author of "Hand Railing Simplified," "Practical Geometry," "The Carpenter and Joiner," etc. Philadelphia: Published by the Author, 1214 Hancock street.

This is one of the most valuable practical works which has come under our notice. The problems dealt with are judiciously selected, and contain directions for nearly every useful form. But its especial merit lies in the illustrations, of which the parts are movable from the cardboard on which they are printed, so that the desired pyramid, octagon, sloping roof, cone, or other form may be made by the reader, at once affording a practical idea of the construction intended to be illustrated. The text of the book is clear and concise, and any mechanic who wishes to ascertain the first principles of rules of construction in common use, as well as those in search of improved methods, will be able to acquire from it a good knowledge of practical geometry. It is altogether a volume of the highest value, and is likely to do much to promulgate scientific knowledge of the useful arts. In the interests of our skilled workmen and the cause of technical education, we wish it an extended circulation.

THE LARYNX THE SOURCE OF THE VOWEL SOUNDS. By Thomas Brian Gunning, New York. Baltimore: Journal of Dental Science Office, 86 West Fayette street.

An elaborate resume of the statements of Professors Tyndall, Helmholtz and others, in support of the author's own views and reasoning.

THE ANIMAL KINGDOM. Volume II, No. 1. Published by the American Society for the Prevention of Cruelty to Animals.

A pleasant and useful little publication, well suited for the perusal of young people, in whom it is likely to create a sympathy for the objects of the praiseworthy institution by which it is issued, and to teach all of us to respect and help those who cannot help themselves.

THE WORKSHOP for January contains a continuation of a valuable article on the Vienna Exposition in connection with art industry—more especially, in the present number, with reference to gold and silver work. The usual large proportion of admirably executed engravings of the finest products of European decorative artists are added, and comprise some exquisite designs in cabinet work, mural decoration, jewelry, etc. In order to render the advantages offered of practical utility, a large sheet of working drawings is supplied. Published by E. Steiger, Nos. 23 and 24 Frankfort street, New York city. Subscription, \$5.40 per year.

We have also received from the same publisher the first number of *ART WORKMANSHIP*, a superbly printed periodical which is designed to form a complete historical atlas of art work. Its object is to present, by finely executed engravings on separate and detached pages, together with the necessary letter press, full descriptions of the treasures of public and private collections, the admitted masterpieces of churches, monasteries, and town halls, and, in fact, of all known objects of art which will serve both to educate the taste and supply good models. The work is to cover a wide ground and embrace the subjects of wearing apparel, embroidery, and lace, vessels in clay, glass, and crystals, goldsmith's work, wrought and cast iron work, paneling and wood mosaic, wall decoration, bookbinding, and, in brief, every thing of value to followers of artistic pursuits. Each part contains a colored plate and some six or seven plain engravings on heavy paper. Issued in twelve monthly parts, at \$1 each, or at \$10 per year.

Recent American and Foreign Patents.

Improved Seed Sowing Machine.

We have recently been favored with a description of an improved seeder the patent of which is owned by Mr. Christian Monson, of Moscow, Iowa county, Wis., the inventor of the new sower illustrated elsewhere in this issue. The machine, it is stated, has been in successful use for some time, and has developed many important advantages. The essential features of the device consist in the seed-distributing mechanism, which includes two seed boxes, one in front of the other. The bottom of the larger box is formed of alternate plates and angular surfaced blocks, in the former of which are holes. Beneath these orifices and extending across the frame is a cylinder, around the circumference of which circular recesses are cut to correspond with the apertures in the bottom of the receptacle. The cylinder is so arranged as to slide in its bearings longitudinally, so that each hole in the seed box may be over one of three sets of circumferential recesses at will, and govern the quantity of seed to be delivered. These sets are of different sizes. There is a revolving shaft inside the cylinder having arms passed loosely through holes made therein. By this means the seed is agitated and caused to fall through the apertures in the bottom and fill the recesses in the cylinder as it rotates below. A brush suitably arranged cuts off the flow, and the cylinder, continuing its revolution, throws the grain into tubes, and thence into other conduits, the lower ends of which furrow up the ground in advance. The smaller seed box also has a beater shaft within, and supplies its seed to a cylinder below, in which, however, there is but a single radial recess, the size of which can be governed by suitable means. This may be used, the other mechanism being out of gear, to distribute the seed at intervals, the grain being delivered to the tubes of course but once at each rotation of the cylinder. There are three seed tubes or drills which enter the ground, and which make rows five inches apart. They are governed by suitable mechanism so as to be easily raised from the ground, and are also prevented from becoming easily clogged. Attached to the rear of the machine, which is mounted on wheels in a suitable frame by a draft bar and drawhead, is a roller above which the driver's seat is disposed. This attachment is provided with all machines, or, if the apparatus be first purchased separately, it can be supplied at, we are informed, a small cost. The use of brushes in cutting off the grain prevents any injury to the kernels, and the mechanism, it is stated, measures out the seed with exactness. The machine can be used for planting corn or other grain, either in drills, hills, or check rows. It is readily adjusted to suit the distance apart of the hills and the quantity of seed to be delivered. The owner of the patent adds that the invention has been quite thoroughly tested and extensively manufactured. He is desirous of increasing his facilities, however, and wishes to dispose of territorial rights. Patterns furnished at small cost. Further particulars may be obtained by addressing as above.

Improved Device for Cleaning Steam Generators.

David L. Latourette, New York city.—This invention proposes to provide steam boilers with independent and permanent pipe connections, the same having cocks or valves, whereby, as soon as they are blown off, a current of steam or other fluid may be forced through the boilers, said current being impelled by suitable means. The injection pipe is attached to the boiler at one end on the upper side, and the discharge pipe or connection at the diagonally opposite end. Thus the current of steam or other fluid acts on the sedimentary deposit immediately around the point of entrance, and thence extends its influence to all the remaining parts of the inner surface of the boiler, and, driving the same before it, carries it toward the lowest and most distant point, where it is forced out of the boiler through the pipe connection there applied.

Improved Compound Tool.

John Dillon, New York city.—The hammer head is provided with a short handle, which is made hollow and with a square socket in the outer end to adapt it to be used as a wrench for turning bolts, nuts, etc. Upon the outer surface of the end of the handle is formed a screw thread to fit into the hollow handle. The shanks of a small gimlet and of a bradawl are attached to the opposite sides of the button, which has a screw thread cut upon its edge to fit into the screw thread of the handle. By reversing the button, the bradawl or gimlet may be made to project as one or the other may be required for use. A small set screw, which screws in through a small hole in the handle, prevents the disk from turning when the tool is turned backward. The outer end of the handle is notched, and the inner surface of one or both the jaws thus formed is serrated to adapt them to serve as a wrench. One of the jaws is sharpened to serve as a fine screw driver, and the other is made to serve as a coarse screw driver. In the hammer head, near the claws, is formed a socket, into which fits the bradawl, where it is secured in place by a set screw. As thus arranged, the tool becomes a crank for turning a shank or other object.

Improved Shoe Fastening.

Samuel Babbitt, Brazil, Ind., assignor to himself and William E. Sibley, Boston, Mass.—The flap of one quarter covers the slit at the instep and overlaps the other quarter, so as to close the slit as tight as possible against water and dust. A strap is attached, near one end, to the flap near the bottom of the slit, passes through metal loops on both flap and body of the shoe, in a zigzag course to the top, and is doubled through a buckle, and attached at its upper end to the flap. The doubled portions passing through the loop allow of loosening the shoe sufficiently without drawing the strap out of the buckle, thus saving considerable inconvenience that would attend the pulling of it out.

Improved Grain Drill.

Samuel Hart, Fulton, N. Y.—A long grain hopper extends across the front portion of the machine with a chamber into which the grain escapes through the passage, which is regulated by a gate. The side of this chamber is made to fit nearly half around a small dropping roller containing pockets, opposite which there are slots, through which the grain passes into the pockets. The roller has as many pockets as there are to be drills in the machine, and each pocket discharges into a spout for sowing in drills. The drill stocks may be readily released for adjustment or removal. The dropping spouts terminate over the drill tubes, and have, when the machine is to be used for planting, a gate or valve closing against the lower end by a spring shank to retain the grain until it should fall into the hill.

Improved Printer's Side Stick and Quoin.

Francis Keehn, Milwaukee, Wis.—The object of this invention is one for the use of printers, consisting of an improved side stick and quoin, by which the forms may be easily set without injuring the imposing stone, and firmly retained during the printing process. The invention also consists in constructing the side stick with wedge-shaped sections, which are wider at the base, forming a projecting step, along which the wedge-shaped quoin, with a similarly projecting top step, are guided, so as to confine the type in the chase.

Improved Piano and Organ Attachment.

Leon J. Fremaux, New Orleans, La.—This invention consists of movable boards, having pins and bridges arranged on one side in the order of the music, like the projections of the barrel of a music box. This is caused to slide along the top of a box by a hand crank and suitable gearing. In the box are levers corresponding to all the keys of the piano and organs, connected by suitable contrivances with cushioned plungers or hammers which are made to strike the keys of the instrument when the projections on the moving board come in contact with the levers. The piano or organ is thus caused to play the piece represented on the board by the projections. Different boards will be used for different tunes. The box containing the apparatus is so contrived that it can be applied to any piano and organ by simply placing it on the front above the keys, and securing it by clamps and adjusting devices attached to the box, forming a simple and ingenious contrivance. It requires four or more boards for each tune, as the parts are always repeated alternately, and each board is used in the order in which its part of the tune is played, the others being removed.

Improved Adjustable Hanger for Mirrors, etc.

James Wright, New York city.—This invention has for its object to furnish an improved device enabling the mirror or picture to be hung without injuring the plastering or cutting the woodwork of the house, and without the use of step ladders or other contrivances for attaining the requisite height. The device consists of an upper strip of wood which is hung upon a nail in the wall. The lower part of this strip forms a tongue which is slotted, and which enters a dovetail groove made longitudinally in a second strip. A square bodied bolt and thumb screw passes through the lower strip and tongue, so that the two may be clamped in any position. The upper end of the lower strip terminates in a band which encircles the upper strip, serving as a keeper for the latter, and also as a support for the hook which sustains the mirror.

Improved Sewing Machine.

Theodore A. Weber, Philadelphia, Pa., assignor to Albert Lathrop Runyon.—The first part of the invention consists of an arrangement of a rotating looper and a vibrating loop spreader for opening the loops wide enough for passing a commercial spool, so that the rotating looper shall first take the thread from the needle and open the loop to some extent before the vibrating spreader takes it, instead of the reverse arrangement, which has been before used. By this arrangement, it is claimed, a much shorter and stiffer needle can be used, and there is less liability of the needle springing away from the looper and missing stitches. The second part of the invention consists in the arrangement of an upper thread take-up, to operate in connection with the under bulged plate take-up, heretofore used. When the spool has passed through the loops, and the spreader begins to go back to release the loops, the bulged plate enters it, and draws the thread laterally over its swell, so as to keep the necessary tension on the slack given up by the spreader. At the same time the upper take-up begins to rise, the needle arm, having previously reached the upper limit of its movement and begun to descend again, acts, in conjunction with the bulged plate, to keep the loops taut. The bulged plate escapes through the loop as fast as it is taken up, and the latter passes off the horn as it vanishes, the horn preventing it from being caught by the needle and the spreader.

Improved Curtain Fixture.

Henry K. Warner and Charles E. Smith, Rochester, Minn.—Two wooden bars are connected together longitudinally, so as to be at right angles to each other, and are provided with suitable eye bolts, so as to be suspended from the upper part of the window casing. The curtain roller is pivoted in suitable brackets secured in the angle between the bars. One bracket is detachably secured to the bars by a pin, so that by drawing out said pin the bracket may be swung outward and the roller detached. The shade is wound upon the roller by means of a cord, one end of which is attached to a spool attached to one end of the roller, and which is wound upon said spool by drawing down or unwinding the shade. The cord passes through a guide notch formed in the lower edge of the vertical bar, where it is kept in place by a pin, so that by withdrawing the said pin the cord will be released, so as to be detached with the shade and roller. The cornice is hinged to the forward edge of the horizontal and upper bar, and is so formed as to pass around the forward side of the roller, so as to cover the said roller and protect the shade from the falling dust. The end parts of the cornice fit and rest upon the brackets. To the lower edge of the bar is attached a catch which is made with a tapering slot, so that by moving the cord into the narrow part of said slot it will be held securely, holding the shade in any desired position.

Improved Carpet Stretcher and Tacker.

Zadock A. Ward, Pittsfield, Mass.—This invention is an improvement in the class of implements for simultaneously stretching and nailing carpets, in which a hammer and tack or nail conducting channel and toothed pusher are main elements. To the lower end of the handle is rigidly connected, under suitable angle, an upright guide piece, which is provided at its broader lower part with forward curved teeth for the taking hold and stretching of the carpet. In a recess in this guide piece, and supported by a spiral spring above the same, is a sliding bolt, the upper end of which is struck by a hammer head. The latter is secured to a curved lever pivoted to the handle. The lever projects at some distance below its fulcrum, and is connected at its end with a curved rod which is operated by a shorter handle. The tack conducting and feeding arrangement is placed into a recess at the upper side of the lower part of the handle, adjoining and opening into the T shaped recess of the guide piece. A T shaped tack conductor slides in inverted position in the recess by the action of a coiled spring, on its upper part, projecting into the recessed part of the guide piece. The U shaped carpet tacks are placed one adjoining the other on the central part of the conductor, and held thereon by means of a covering plate. The tacks are fed into the recess of the guide piece and acted upon by the spring bolt, which drives them into the carpet at the required time.

Improved Steam Cooker.

John Bents, Parkersburg, West Va.—This invention is a steam cooking apparatus, which admits the steam to the victuals in each part or drawer thereof on closing the drawers, shutting off the steam on opening the drawers. No steam can thereby escape and burn the fingers, but the cooker works uniformly with the full heating power. The different parts of the cooker are arranged above each other, separated by partitions, and connected at their rear sides with a vertical extension of the boiler. The steam enters through short tubes, with valves applied therein, opening into larger tubes of the drawers, with horizontal guide pins, which push the valves open when the drawers are within the cooker, and shut off the steam when the drawers are opened for inspection.

Improved Hemmer for Sewing Machines.

Louis Seixner, Brooklyn, N. Y., assignor to himself and John B. Christoffel, Brooklyn, E. D., N. Y.—The invention consists of an auxiliary presser which is employed in combination with an extension hemmer. It consists of a spring plate bolted on the plate of the hemmer, and a secondary plate provided with an adjusting screw. The spring plate is secured adjustably, and so arranged that the end will rest on the top of the machine presser, to be lifted up by it, while the plate itself tends to spring down on the cloth. The secondary plate is to be forced down upon the cloth at the outer end, to press and smooth the fold down flat, so as to run along the guide properly to guide the hem to the needle. The adjusting screw is to regulate the distance of the secondary plate from the spring plate, according to the thickness of the cloth. For example, if the cloth be light and thin, it should be adjusted lower than if the cloth be thick, because the sewing machine presser presses down into the thick cloth, and the latter will adjust itself relatively to the point of support of the secondary presser.

Improved Bridge.

James Valleley, Canton, O.—For constructing metal arches for bridges this inventor proposes to make hollow trunks, either of four or six sides, formed of flat plates, or some of flat plates and some of lattice bars, united at the angles by angle bars. These trunks have a section of the form of a trapezoid when four sided, and of the form of two trapezoids, placed base to base, when constructed with six sides. The shoe for the end of the arch or chord is formed of two metal pieces, one of which receives the end of the chord on its face, and is supported by trunnions in bearings on the top of the other piece, which is bedded in the foundation, so that the piece supporting the end can turn readily, as required by the expansion and contraction of the arch.

Improved Draft Equalizer.

William McClelland, Sr., Fowler, Ill.—The object of this invention is to produce an equalizing attachment for three horses, to be applied to reapers and other vehicles, by which a greater effect is obtained, and the side draft regulated, as required. The weight of the tongue on the neck of the horses may also be adjusted. The invention consists of a curved bar which is attached to the tongue, and carries the rear extending bar, with regulating rod, which connects with and is adjustable on a cross bar of the hounds. Both bars together support the equalizing bar, and allow the adjustment of the same into any required position.

Improved Car Coupling.

Thomas Reas Land, Grass Valley, Cal.—The link has at each end a flat, spear-shaped head which, when the cars come together, enters a spiral opening in a circular block. As the link is pushed through this spiral opening, it turns a block one quarter around and lifts up a weighted lever attached. When the spear-shaped head of the link has passed entirely through, the weighted lever drops and returns the block to its original position, which position is such that the narrower width of the spiral opening will be crossed by the broader part of the spear head of the link, and therefore the link will be prevented from being withdrawn through the opening. The block is held in the drawhead by a circular flange or a second block, which enters a corresponding circumferential groove in said first block. The flanged block is secured to the plates by bolts. The link is sustained in a horizontal position, and guided to enter the spiral opening by the assistance of the socket piece, which has a square stem which plays back and forth in a square hole in the center of the blocks. The spiral springs connecting the stem to the blocks operate to relieve the cars from the effects of the shock of meeting when in the act of coupling. The end of the link closely fits in this socket piece, the other end of the link being held in a similar manner in the coupling iron of the car adjoining.

Improvement in the Propulsion of Vessels.

Charles P. Macowitzky, Corpus Christi, Texas.—This invention has for its object to improve the construction of the device for which letters patent No. 135,394 were granted February 18, 1873. The piston rod of a steam engine is secured to an arm which passes through a slot in the bottom or side of the vessel and a slot in a sliding frame, and is rigidly attached to a rack bar. The latter slides upon the frame and engages with a gear wheel, attached to the paddle, so that the said paddle may be projected and withdrawn by the movements of the said rack bar. The paddles are pivoted to the sliding frame, so that they may be carried back and forth by and with said frame or plate in its movements. By suitable construction the arm and rack bar will be first moved to adjust the paddles, and the rack bar, paddles, and arms will then be moved together to make the stroke. The mechanism of the parts may be so adjusted with respect to the piston rod, that the paddles will be projected upon the forward or back stroke, as may be desired.

Improved Valve.

George R. Crane, Painesville, O.—The disk of the valve is surmounted by a hollow cylindrical extension, which is enclosed in a cage formed of three vertical standards, suitably secured at their lower ends. These standards prevent the valve from tilting laterally, and have studs at their upper ends to keep the same in place. The valve is secured with a ring of leather, fitted into a recess in its face which is secured by a clamping disk, nut and bolt. The valve seat in the bottom plate is made in two parts, of which one is in a flat plane, and the other is conical or concave. With the flexible bushing of the valve constructed to correspond with these forms, all the advantages of both for securing a tight joint are claimed to be obtained, as the elastic substance will shape itself to both parts, and afford greater security. The valve can be removed readily for repairing the bushing by unscrewing the fastening of one of the standards, and the bushing can be easily taken out.

Improved Car Coupling.

Hamlin G. Russell, Lincoln, Ill.—Each drawbar is provided with a coupling hook which is pivoted, at the rear end of the same, to a strong vertical rod. A strong band spring is connected to a hook and placed in such a manner between it and the side of the drawbar that the force of the same presses the hook toward that side of the drawbar. The opposite side of the drawbar is made with a solid inclined part at the mouth for the easy entering of the coupling hook of the adjoining car, which part is supplied with a vertical groove along its rear edge, into which the hook locks. A catch plate is secured to the side of the drawbar in the rear, so that its front part has an elastic spring-like action. On the approaching of the cars, the hooks lock into the vertical grooves. For uncoupling, a suitably arranged lever is carried sidewise, so that the catch plates act on the ends of the hooks and disengage them from grooves. The play in vertical direction which is given to the hooks along the grooved parts allows the coupling of cars of different heights, while the side play of the hooks instantly disconnects the cars when any one should get off the track.

Improved Sash Holder.

Samuel Chard, Milwaukie, Conn.—This invention is intended to furnish means for holding window sashes in any desired position, and for fastening them when they are down. The sash is raised by pushing back the catch by means of a knob which releases a lip. The catch is held back until the sash is in the desired position, when the knob is let go. The pressure of the spring is designed to counteract the weight of the sash to some extent, but the catch, being free to turn on its knob pivot, acts as an eccentric and securely holds the sash.

Improved Mechanism for Towing Boats.

Giles S. Olin, Deer Lodge, Montana Terr.—The tug boat is provided with engines for furnishing motive power, and a propeller wheel is made to operate at the stern. A drum is supported on a horizontal shaft by stands which are attached to the sides of a frame. This drum is revolved by the motive power with the shaft when winding up the two ropes, and on the shaft when unwinding it. The drum is given a slight longitudinal motion by means of a lever, which couples it with the gear wheel on the drum shaft. The motive power is applied to the propeller by means of a central shaft. The propeller shaft and the two shafts are coupled together and uncoupled by means of a shifting lever, the propeller wheel being used only periodically, or to move the tug ahead and unwind the rope. The towing of the boat, or train of boats, is done while the tug is anchored and stationary. The towing rope may be of any length which can be conveniently wound on the drum. One end of the rope is attached to the drum, and the other end to the train of boats. The drum is thrown into gear with the shaft, and the train of boats is drawn near to the tug by revolving the drum and winding up the rope. When this is accomplished, the propeller wheel is slipped into gear and the tug is driven ahead, while the drum is uncoupled, so that it revolves freely on the shaft and unwinds the rope. When the rope is unwound, the propeller wheel is uncoupled, the tug is anchored, the drum is thrown into gear, and the rope is again wound up, and this process is repeated as rapidly as desired.

Improved Glove Turning Machine.

Frederick Vanderpool, Mayfield, N. Y., assignor to himself and James E. Wood, of same place.—The object of this invention is to furnish a convenient glove-turning machine, by which all the fingers and the hand part, with the exception of the thumb, may be turned simultaneously in a rapid and easy manner. The invention consists of a stationary frame with finger tubes, over which the glove to be turned is placed. A spring frame with hand board and finger rod slides in the stationary frame, and serves, by being pressed down on the finger ends, to carry the glove and hand part over it by one upward motion of the same.

Improved Grinding Mill.

David A. Caldwell, Jacksonville, Ill.—A spur gear of ordinary construction is arranged loose on a shaft, with its toothed rim meshing with a pinion on the runner spindle. The supplementary driving wheel is placed under and supports the gear, being itself fast on the same shaft. It has radial slots or notches in the upwardly projecting flange formed around its periphery, to receive the arms of the gear; and sockets are formed in the opposite sides or walls of said slots, to receive springs, which bear against the opposite sides of arms of the wheel. The springs are so arranged, as to strength and length, that one only will come in contact with the wheel when driving one run of stone; but, when driving two, the longest one will contract enough for the shorter one to come into action, thus making the elastic and yielding capacity alike applicable in the use of part or all of the power. To secure the springs in place, and connect the two wheels together, plates are bolted at their ends to the wheel, and cover the sockets, confining the arms of the gear wheel in the slots of the wheel. The spindle step is mounted in a steel box, which is fixed on the end of the short arm of a lever, pivoted on a pedestal which is to be supported on an independent foundation. The long arm, which is forked or notched, extends to and embraces the lower part of a temper screw, under a follower working up and down on guide rods, and operated by the screw, which is stepped in a pedestal which supports the said rods by a bar, the upper ends being connected to and stayed by another bar, through which the temper screw passes, but not screwing in it. The temper screw rod extends up through the stone floor and a dial plate thereon, and has a pointer and hand crank or wheel, the one for turning it, and the other for indicating on the dial the extent of the movement of the screw. This screw is provided with a collar at its bearings in the stone floor, so that it cannot move endwise, by which, when turned, it works the follower up or down, according to which way it is turned, and thereby causes the vertical adjustment of the stone.

Improved Blade for Agricultural Implements.

Winfield Scott, Floyd Court House, Va.—The object of this invention is to render hoes and other agricultural implements more durable, and it consists in making the outer corners of the blade thick and rigid, and making the blade thin, or bringing it to an edge between the corners.

Improved Transfer Apparatus for Railroads, etc.

Joseph Jones, Alfred Harley, and Charles H. Fisher, Albany, N. Y.—This invention consists in an apparatus for gradually overcoming the inertia of and attaching cars, carriages, or other vehicles to a cable or belt, while the latter is in continuous motion, and for increasing or diminishing the adhesion of the cable.

Improved Mill Pick and Hammer.

Allen H. Vanfossen, North Wales, Pa.—This invention consists in a mill pick hammer, which has a tap hole on one edge of the holder, and whose head is provided with a set screw, an oblong rectangular socket, and tap holes on side and edge.

Improved Breech Loading Fire Arm.

Joseph C. Dane, La Crosse, Wis.—This invention is an improvement in breech loading, of the class in which the firing pin or striker acts by momentum, the movement of the hammer being arrested just previous to the delivery of the blow on the cartridge. The improvement relates to the construction of the striker with an annular recess in its lower end, to adapt it to receive the spiral spring which encircles the firing pin proper, and to arrest its movement and impart the requisite weight.

Improved Farm Fence.

Jacob Haish, De Kalb, Ill.—This invention relates to means whereby the rails of a wire fence panel may be not only made much stronger, but whereby it will be enabled to turn stock and allow for expansion and contraction by heat and cold. It consists in making the rail of several pieces of wire, each fastened at one end to the post or another piece of wire, and then carried out and hooked by a bent end with a corresponding one from the opposite direction, spikes being thrown out on each side of the fence at the point of junction. With two wires to each rail, spikes will thus be thrown out on each rail preferably at intervals of about a foot, more or less.

Improved Rotary Engine.

John B. Adt, Baltimore, Md.—This invention relates to means whereby rotary engines may be more conveniently packed, the piston kept always radial to the center of the shell, and the usual clapping noise avoided. The invention consists in a combination with the case and the eccentric shaft that carries the disk of the ring plates and carrying piston, and slotted to allow the said shaft to move.

Improved Self-Adjusting Track Cleaner.

James S. Hagerty, Baltimore, Md.—This invention relates to means whereby the dust, dirt, snow, or other obstacles which are found upon railway tracks, may be speedily and effectually removed in advance of the wheels, while all liability to fracture or displacement of the scraper may be avoided. This is done by means of a scraper, a scraper stock, a bar and a grooved lug, jointed and operating together in a novel and effective manner.

Improved Damper for Stoves.

Edward F. Cook, Omaha, Neb.—The object of this invention is provide means for retaining stove dampers in any desired position when they are in use; and it consists in a hoop or ring attached to the damper plate at right angles with the damper spindle, so that the hoop or ring will bear against the pipe in which the damper is placed and hold the latter in position by the friction thus produced.

Improved Lubricating Journal Box.

Jean Morin, New York city.—The object of this invention is to furnish a self-lubricating journal box for axles and shafts of all kinds, which secures an even and regular supply of oil to the bearings. Chambers extend vertically at the sides of the outer case of the journal box, and contain the lubricating oil, which is filled in by means of tube from the outside, which also indicates the quantity of oil in the chambers by the height of the oil therein, so that the requisite supply can easily and readily be regulated and kept up. The oil receptacles connect with each other by means of flat, lateral, and longitudinal channels, at some distance below the axle, which channels are connected by central and symmetrically arranged side channels with the bearing and axle. The side channels are wider at the base, narrowing toward the upper end, and contain the wicks, which touch with their upper ends the axle, and feed the oil evenly to the same. The semi-cylindrical axle bearing is cast of bronze and provided with top recesses and a downward projecting central guide tube, which fits into the central channel of the case. The wicks extend to the flat lateral channels, take up the lubricating oil and convey it by capillary attraction to the lower part and sides of the journal in proportion to the number of rotations of the same. The cap piece serves to keep the side wicks in contact with the axle.

Improved Dropper for Seed Planters.

Hermann H. Koeller, Camp Point, Ill.—The bottom of the seed box is formed with a circular recess in its center, in the sides of which are formed slots to receive the sliding bar, by the movements of which the dropper is operated. To the center of the bottom is attached a projection which passes up through the sliding bar and forms a pivot for a star wheel, which is made with seven rays, the outer ends of which are made more inclined upon one edge than the other, so that the point or extreme end of the arms may be at one side of the radius passing through the centers of the said arms. To the upper side of the sliding bar are attached two wedge-shaped projections, which fit into the space between the rays of the star wheel, and which alternately strike an arm of the wheel and turn it through half the space of one arm. The dropping plate is made in the form of a circle with its middle part cut away, and is carried around by and with the star wheel. In the dropping plate, near its outer edge, are formed fourteen holes, arranged in a circle and at equal distances apart, which receive the seed from the hopper and carry it to the discharge hole through the bottom, through which it falls into the guide spout that conducts it to the ground. Upon the lower side of the sliding bar is formed a projection which works in a slot in the bottom, and to the end of which is pivoted the end of a bar, the other end of which is pivoted to a bar, which is in turn pivoted to the conductor spout so as to detain the corn in the conductor spout. This is operated at each movement of the sliding bar to allow the corn to drop to the ground.

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S. C. C. will find a description of Mure and Clamond's thermo-electric battery on p. 24, vol. 29.—C. R. H. can temper steel plow molds by the process for case hardening described on p. 362, vol. 25.—S. C. C. can brown gun barrels by following the directions on pp. 154, 206, vol. 26.—T. T. C. and others write to point out that the explanation of the compound lever on p. 11, vol. 30, should be "86x17.5x20, weight balanced at A," and not "86x18x20," etc.—N. K. L. will find recipes for brass lacquer and dip on pp. 219, 222, vol. 29. Booksellers' addresses appear in our advertising columns.—A. W. can arrange his lenses in a wooden telescope, according to the description on p. 7, vol. 30.—H. E. S. will find directions for making paste on p. 280, vol. 28.—A. G. S. will find directions for making cider vinegar in our answer to J. F. A. on p. 58, vol. 30, the process described in which will serve as well with cider as with malt.

H. C. asks: How large should a cylinder be for a circular wrought iron boiler 18 inches in length, 14 inches in height, with 5 two inch flues, capable of standing 75 lbs. pressure to the square inch? A. Diameter one inch, stroke three.

J. G. asks: What is the percentage of fuel saved by feeding water into a boiler at 200° when before it was fed in at 125°? A. You do not send enough data to enable us to answer this question. We can give you the general method of finding the gain by increasing the heat of the feed water, and you can apply it to your case. Let H=total heat of the steam. F=one temperature of feed. f=a higher temperature of feed. Then $\frac{H-F}{H} \times 100$ =per cent of gain by increasing the temperature of the feed water. EXAMPLE: Suppose, in the case mentioned by you, that the steam has a pressure of 60 lbs. by gage. $H=1207.8$ per cent of gain= $\frac{200-125}{1207.8} \times 100 = 6.2$

N. G. asks: Can I transmit the power to a grist mill by friction bevel wheels, one on the horizontal shaft which runs at 225 revolutions per minute, the other on a perpendicular shaft whence a belt leads to the spindle? What would be the dimensions of the wheels, and of what should I make them? A. You do not state how much power you desire to transmit. We think, however, that you would experience trouble in the use of wooden wheels.

J. H. O. says: One of your correspondents states that the heated hydrocarbon vapors are liable to spontaneous explosions when mixed with atmospheric air. May not such explosions occur in ordinary temperatures in the use of any of the light hydrocarbon oils? A. From the great volatility of some of the hydrocarbon compounds, we are inclined to think that what seemed like spontaneous explosion was really caused by some hydrocarbon vapor coming in contact with flame at some distant point. In this respect impure or imperfectly refined kerosene is sometimes more dangerous than gunpowder, the volatile inflammable vapors even at a great distance taking fire in contact with flames, and leading like a train to inflammable fluid. We think, however, that there is a field here for careful experiment to determine the precise conditions under which these volatile compounds inflame or explode.

H. A. W. says: "I read that, to make imitation sapphires, I should take one ounce of paste and mix with two grains of precipitated oxide of cobalt. What does the paste alluded to consist of? What is oxide of cobalt?" A. The paste you mean is a very fusible, highly transparent, dense glass, also called strass, frit, etc., and is the base of all artificial gems. There are various recipes for making paste: the following is an imitation of the diamond: Rock crystal, 1,600 grains, borax 560 grains, carbonate of lead, 3,200 grains, oxide of manganese $\frac{1}{4}$ to 1 grain. Powder each separately, mix together, fuse in a clean crucible, pour into water, separate any reduced lead, and again powder and remelt. Precipitated oxide of cobalt is prepared by adding a solution of carbonate of soda to a solution of sulphate of cobalt, washing, drying, and igniting the powder which falls. This is what gives the transparent paste the blue color, characteristic of the oriental sapphire.

N. A. T. asks: 1. What is the best compound for making artificial ice, and how must it be applied? A. A very convenient freezing mixture without ice may be made by rapidly dissolving 1 part nitrate of ammonia in 1 part of water. This is said to cause a reduction of temperature of 46° Fah., or from 60° to 14° above zero. 2. What is the average cost per hundred lbs. of ice frozen by artificial process? A. Ice in New Orleans manufactured by artificial means is said to be produced for \$3 per ton; but with improved machinery the time is probably coming when it will be made in our great cities for \$1 per ton. 3. Where can I get the best advice on pisciculture? A. See the *Science Record* for 1874.

A. H. W. asks: 1. What sized wire (insulated) and how much should be used for a helix made of iron one inch by two feet, and bent in the common U shape? Should the iron be painted? A. 1. It is not necessary to paint the iron. The force of an electromagnet varies in proportion to the number of convolutions of the wire, the quantity of electricity in circulation, and the square root of the diameter of the soft iron. 2. Why does water feel so cold, after having percolated in your mouth? A. It may be because the nerves are rendered more sensitive.

G. S. R. asks: What is the stowage capacity in cubic feet of a ton of Franklin coal, also of Lehigh coal? A. We gave average values for the space in feet occupied by a ton of coal on p. 60, 135, vol. 29, and stated that there was so much difference of weight in the various qualities that it was impossible to give definite figures without more data.

W. S. M. asks: 1. How shall I proceed to fill the boxes for a foot lathe spindle with rabbit metal? Should the spindle be wrapped with a thickness of paper before the metal is poured in? A. It will be better to use a piece of paper. 2. Please give directions for making a hard, heavy, black paint for the unfinished cast iron parts. A. There is a black varnish made from petroleum that answers very well. 3. How much should the back gears diminish the speed so as to turn wrought iron 3 inches in diameter? A. You should arrange the gears to give the iron a surface velocity of about 80 feet a minute. In regard to your other questions, they are rather indefinite, as the dimensions you ask for are dependent upon many circumstances. It would be well for you to inspect some good lathes, and take measurements.

A. R. G. asks: 1. Should I gain any power in a small turbine water wheel by continuing two of the buckets spirally up the shaft to the top of the penstock, or would the wheel run too fast for the water at the top of penstock? Would a close fitting or a wide penstock be best if the wheel is used under heads from 16 feet upwards? If this is an improvement, would it be patentable? A. These matters could best be determined by experiment. An examination of previous patents (see prospectus in our advertising pages) would be necessary to enable us to answer your last question.

R. C. M. asks: Could a steel saw be used with economy in sawing stone, using adjustable teeth? "I have been experimenting with black carbons, but find it impossible to make them stay in their places." A. We believe the diamond tooth saw is found to be more economical.

S. A. G. says: We have a 30 horse engine, with a cut-off, and we find that the cylinder has worn more at each end than at the center. We have been told that this is a common occurrence with cut-off engines; is it so? As we have a good deal of trouble with the cut-off, we thought of going away with it, and using a governor to regulate at throttle. Will this cause the cylinder to wear in the center so as eventually to make it more uniform? A. We think the best way to remedy the trouble will be to re-bore the cylinder.

H. R. says: We are engaged in a manufacture requiring iron of great tensile strength. What kinds would you recommend? A. Pure gray cast iron, and Ulster wrought iron.

P. J. D. asks: 1. How do you calculate the thickness of a horizontal stationary engine frame? A. It is treated as a beam. 2. In your answer to J. O. R. about the length of lever for a roll valve, what does the decimal 0.672 represent, and how do you get it? A. There is a slight mistake in this example, which occurred through an oversight. Referring to the figure, the chord R C is equal to twice A B, multiplied by the sine of half the angle B A C. $B A C = 97^\circ 31'$, $A B = 3$ inches. Hence, $B C = 2 \times 3 \times \sin 47^\circ 45' = 6 \times 0.74 = 4.44$ inches and lever A E = $3 \times 11 + 4.44 = 7.66$ inches, nearly.

A. C. F. asks: What is tinsel? How could I make the red kind? A. Tinsel is thin metallic foil coated or plated with silver or gold. The red kind of which you speak is probably copper. You could not make it without expensive machinery and skill. The makers and dealers in fancy boxes could probably supply you.

R. A. McL. asks: 1. What pressure of steam will a tin boiler of the following dimensions stand: Eight one foot, diameter of top and bottom respectively four and eight inches? A. Treat it as a cylindrical boiler having the diameter of the largest part. 2. Has a rotary steam engine ever been constructed on the principle of the turbine water wheel? If so, did it work? 3. Such engines have been made and have worked, how economically we are not able to state.

M. H. P. asks: Is coal tar good to put on an old tin roof to keep it from rusting? How shall I apply it? A. Coal tar is often used for roofing purposes. For particulars as to its preparation, correspond with some manufacturer of roofing materials.

C. asks: 1. Can you give me a description of the circular slide valves for steam engines? A. There are several patent valves of this description in the market, and, by addressing their manufacturers, you can obtain the necessary information. 2. Why is it that they have not succeeded in navigating submarine boats with men in them? Is it because there is no motor suitable to propel them, or because they roll over and become unmanageable, and are likely to turn upside down? A. We believe this has been accomplished on several occasions.

Z. E. H. asks: 1. What is the simplest way of drawing a meridian line? A. We gave a method on page 409, vol. 29, which is quite simple and tolerably accurate. 2. How is mean time calculated? A. Mean time is calculated by supposing that an imaginary sun, called the mean sun, moves uniformly with the mean velocity of the true sun. 3. What is meant by "sun fast" and "sun slow" and "true midday"? A. The difference of time, as given by the true and mean suns, shows a correction of "sun fast" or "sun slow." True midday is the time of the passage of the sun over the meridian. 4. What is equinoctial time? A. Equinoctial time is reckoned from the moment when the point of Aries passes the vernal equinox. 5. What is the simplest method of finding the variation or error of a watch or clock? A. By observing the meridian transit of the sun. 6. Have we a national standard of time? A. The calculations in the *Nautical Almanac* are generally made for Washington time.

J. C. S. asks: When the strain is between the head of a bolt and the nuts, which of the nuts bears the strain, the first or the last nut? A. A great deal depends upon the adjustment. With the threads accurately cut, the strain might be equally divided. 2. I have a little girl who often amuses herself by looking in my eyes. We sit facing a lighted lamp. She places her right eye as close as possible to my left, and we turn our eyes toward each other. They are then partially shaded, and we see all the interior fluid and optic nerves. Do I see her eyes or the reflection of my own? A. We suppose you see into her eyes.

A. R. P. asks: How far is it possible for the naked eye to see any object at sea, above the curvature of the earth? How far is it possible for the naked eye to see on land within a radius of 200 miles of Pittsburgh, at an elevation of 1,000 feet. A. In general it may be stated that a white object illuminated by the light of the sun can be seen at a distance of 17,230 times its own diameter. A red object, under the same circumstances, would be seen only half as far, and a blue object a still less distance. An object can be seen in ordinary daylight only about half as far as it could be if directly illuminated by the rays of the sun. These figures will of course vary somewhat with different eyes.

W. H. G. asks: 1. How does the duplex telegraph work? A. Consult some good work on the electric telegraph for particulars. 2. Must I wind the wire around the core of an electromagnet in one direction? A. The wire must be wound in one direction.

R. H. G. asks: 1. Is there any method of keeping powdered alum and bicarbonate of soda together, without destroying the properties of either? A. You can mix dry powdered alum and dry bicarbonate of soda together without any fear of decomposition taking place. 2. How can alum be dried, as in its commercial condition it contains about 50 per cent water? A. By exposing ordinary alum to heat, as by throwing a piece upon a hot iron plate, it melts, loses its water of crystallization, and becomes reduced to what is termed burnt alum. At a white heat, alum decomposes.

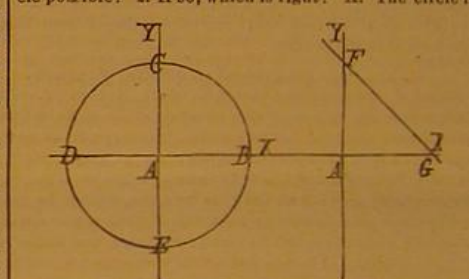
G. B. asks: Which is the most injurious to drink, Japan tea or Java coffee? What effect has it upon the nervous system when drunk at night just before retiring? Does coffee of moderate strength produce thickness of the blood and cause dizziness and headache? A. Very strong coffee and tea are considered injurious when drunk to excess, and the effect of either when taken by a person not accustomed to their use before retiring is to stimulate the nervous system and cause sleeplessness. They may cause dizziness and headache in some constitutions, but we have doubts about their thickening the blood.

G. W. C. says: I wish to make a sand paper with considerable grit. What can I use better than sand or emery? I want something that will last, to rub down a hard substance. A. Perhaps an emery wheel will answer your purpose.

O. M. C. asks: What is the process of making potato flour? A. The tubers, after being washed and peeled, are rasped by a revolving grater, and the pulp washed on a hair sieve to free it from feculous matter. When a sufficient quantity has passed through the sieves, the starch particles are allowed to subside, and the water is drawn out. Fresh water is let in, and the whole stirred up and again allowed to subside; this process is repeated till the starch is pure. It can be dried in perforated boxes, or placed on porous bricks to absorb the moisture, or dried by heat or the air.

J. S. H. asks: Where was the first locomotive built and run in the United States? A. Mr. Cady Staley mentions, as the first locomotive in the United States, one constructed by Oliver Evans, in Philadelphia in 1801.

W. L. C. says: The teacher of our geometry class asserts that "an infinite circle is coincident with an infinite straight line." He argues that, as long as a line is in the least curved, if produced, it will form a circle; and that the curve may be made less, and therefore the circle is not infinite, and from this conclusion argues that an infinite circle is a straight line. I hold that if it is possible to come to this, the circle ceases, and the line is neither an infinite or any other kind of a circle. 1. According to his definition, is an infinite circle possible? 2. If so, which is right? A. The circle is



a line of the second order, and the straight line is of the first order; hence they can never coincide. This may be shown from their equations: $x^2 + y^2 = r^2$ is the equation of a circle, B C D E, referred to rectangular axes with origin at the center. $y = ax + b$ is the equation of a straight line, F G, referred to rectangular axes. Make $r = \infty$, then $x^2 + y^2 = \infty$. Make $x = 0$, then $y = \pm \infty$. Make $y = 0$, then $x = \pm \infty$. This shows that the circle cuts the axis of Y in two points, on different sides of the origin, and at an infinite distance from it; also the axis of X, in two similar points. Now, in the equation of the straight line, make $b = \infty$, then $y = ax + \infty$. Make $x = 0$, then $y = \infty$. Make $y = 0$, then $x = -\infty$. Hence the straight line cuts the axis Y in one point, and the axis of X in one point, at an infinite distance from the origin.

J. C. K. says: A press with movable type, suitable for desk use, not larger than an ordinary seal press, would meet with a ready sale. A. Such presses are commonly sold in our large cities.

A. W. C. asks: 1. How can I tan bear skins with the hair on, so that the hair will not fall out? A. Pulverize and mix one part alum and two saltpeper; sprinkle on the flesh of the skins, and lay two flesh sides together; fold up tight and hang in a dry place. Rub over the edge of a board to make them supple. 2. How can I paste labels on tin or iron, so that they will not fall off? A. Add 1 tablespoonful of brown sugar to every quart of flour paste, and mix thoroughly.

D. R. S. asks: How can I ventilate show windows, so as to prevent sweating and freezing in cold weather? A. Make some small holes at the bottom and top, so that the exterior air will circulate through your show window.

M. W. J. asks: 1. Is there any machine for breaking stone for railroad beds, macadamized roads, etc.? A. Yes. 2. Can I raise fish, such as bass, trout, etc., in a large artificial pool, by running a small stream of spring water through it? A. Yes.

H. N. asks: 1. If any one invents an article which is partly made of rubber, has he to pay a royalty to a rubber company? A. There are several patents in force which protect the use of certain processes of treating rubber. 2. Can anything be done with old scraps of tin? A. The tin may be melted off the iron by heat, or dissolved in hydrochloric acid, making muriate of tin. 3. Is broken window glass valuable? A. Glass makers buy it to melt up.

L. M. C. asks: What is the weight of an ordinary passenger engine of 4 feet 8 1/2 inches gage? A. From 25 to 40 tons. How long a circuit will the Tom Thumb telegraph operate? A. 15 or more miles.

W. T. R. asks: Will the Tom Thumb battery answer for silver plating on a small scale? A. Yes.

M. M. asks: If I hang a rope over a loose pulley and put my feet in a loop in one end and take the other in my hands to elevate myself, what proportion of my weight do I pull down with my hands? My friend says I have no advantage over a single rope. I say I gain nearly half. Which is right? A. We think that your friend is right.

E. M. C. asks: 1. Can you inform me of any process by which steel springs exposed to the action of sea water may be prevented from rusting, which will not impair the temper as galvanizing does? In response to a similar enquiry some time since you advised plating with nickel. But nickel plating does not protect iron or steel when exposed to sea water or sea air. Articles so plated seem to have even an increased tendency to rust, owing possibly to a slow galvanic action. A. Sea water is a compound that few metals (and those are rare and expensive) can successfully resist for a great length of time. Zinc and iron are rapidly corroded. This is probably owing to the affinity which chlorine possesses for the metallic elements. Gold and platinum, the most unalterable of metals, are rapidly dissolved in nitro-muriatic acid, where the attacking element is nascent chlorine. We would suggest some strong transparent varnish for the steel. 2. I have been told by a plater that the passage of a current of electricity or galvanism through tempered steel (as in electro-plating) destroys the temper. Is this correct, or an error? A. We are not aware of any reliable experiments on this point. 3. Can you give a reliable recipe for marine glue? A. In making marine glue, the India rubber and naphtha should be heated and agitated in a covered vessel until solution is complete, and then the powdered shellac added, and heat and stirring continued until liquefaction has taken place.

A. H. D. asks: 1. What is the process of japanning on iron to get a finish like that on sewing machines? Is the varnish baked on or not? A. Japanning consists merely in covering the surface of the metal with a black varnish. The principal ingredients of this varnish are amber and asphaltum dissolved in oil. Oil of turpentine is afterwards added to promote drying. Is bronze or gold leaf used most in ornamenting? A. We should say bronze leaf, from its cheapness. 3. Is there any book that gives explicit directions for the same? A. Ure's "Dictionary" will give you some information.

W. B. says: "If a galvanic battery consists of a number of cells, each cell containing a lead and a zinc plate, with a solution of sulphate of copper, will any electricity be generated if I join all the lead plates together and the zinc, or will I have to join a lead to a zinc and so on through all the cells before any electricity will be generated? A. By joining all the lead plates together, and all the copper, we obtain a quantity current, and by joining the lead of one cell to the copper of the next, and so on, an intensity current is produced.

E. V. asks: Is there any trustworthy means of making benzine or benzoline non-explosive? A. The dangerous nature of benzine and similar hydrocarbons is due to their volatility, and the fact that their vapors form with the oxygen of the air a mixture which explodes on the application of flame. We can only prevent this by enclosing these compounds in airtight vessels, or by combining them to such an extent with non-volatile substances of which they are natural solvents that their vapors have but feeble tension. We know of no chemical means to preserve the chemical constitution of pure benzine intact, and yet deprive it of one of its most characteristic properties.

J. L. A. asks: 1. How is adhesive court plaster made? A. Dissolve 1 part of isinglass in 10 parts of water; strain and add gradually 2 parts tincture of benzoin. Apply the mixture, gently warmed, to the surface of thin silk, black or white, by means of a camel's hair brush. Give as many coats as necessary, allowing each to become dry before applying the next, and lastly give the prepared surface one coat of the tincture of benzoin alone. The silk should be stretched on a frame. 2. How can I dissolve copper, nickel, brass, and other metals easily, so as to mold them? A. You can melt the metals named by exposing them to a strong heat, in crucibles made of a mixture of plumbago and clay. They can then be cast in molds.

J. B. H. asks: How can I remove black ink stains from a white plaster wall? A. Rub the spot with a cloth dipped in a weak solution of oxalic acid, until the stain is removed, and then with a damp cloth. Afterwards rub dry with a dry cloth.

D. M. asks: What metals expand on cooling? A. An alloy that expands on cooling may be made by melting together 2 parts antimony, 9 parts lead, 1 part bismuth.

C. D. M. asks: What gums or equivalents are insoluble in coal oil? A. The ordinary vegetable gums, properly so called, of which gum arabic is the type, are insoluble in alcohol, ether, and oils. Their action with coal oil might properly be made the subject of experiment.

V. R. C. asks: What quantities each of acetate of lime, sulphuric acid, and water are necessary to make acetone, such as is sometimes used for corroding lead? A. You have reference, we suppose, to the production primarily of acetic acid, from which acetone is formed. An ordinary acetic acid may be made without distillation by pouring 60 parts sulphuric acid, diluted with 5 parts water, on well dried acetic lime, 100 parts. Digest well in a close vessel, with a gentle heat, stirring occasionally; and afterwards pour off the clear liquid. Acetone is formed by passing the vapor of acetic acid through an iron tube heated to dull redness, and condensing.

J. O. T. asks: 1. How can I remove common India ink from mechanical drawings without injuring the paper? A. India ink must be removed by the edge of a sharp eraser or penknife, and the part carefully rubbed over with any hard smooth substance. Fine sand paper is also useful for this purpose. For small errors, it is perhaps best to paint them out with thick Chinese or lake white. 2. How can the drawings be cleaned, without injury to either paper or ink? A. A good quality of fine vulcanized rubber should clean your paper without leaving dirt. Try stale bread. 3. Can the four roots of the following equations be obtained? If so, how? $\begin{cases} x^2+y=7 \\ y^2+x=11 \end{cases}$ A. These equations involve the higher mathematics, and we could not publish the solution in these columns. A glance will show that $x=2$ and $y=3$.

4. How can I best secure a place as assistant to some civil engineer? A. Under the circumstances, we can offer little practical advice. There is always a fair demand for skilled and experienced engineers, but in order to start in this, as well, indeed, as in any other profession, the influence and aid of friends is of incalculable advantage. You might make it a point to call upon the superintendents of railroads in your vicinity and prefer your request in person for a place, or perhaps endeavor gain room in the office of some well known engineer, where you could learn much of the profession, and besides form acquaintances which would lead to a more lucrative position.

F. M. D. asks: Is there any invention, patented or otherwise, for the purpose of aiding pedestrians, such as a spring attached to the foot? A. Devices so assist the feet in walking have been made.

L. E. G. asks: 1. What is the idea of amalgamating the zinc of a galvanic battery? Can I use common sheet zinc? A. The object of amalgamating the zinc is to prevent the action of the acid upon it except when the electric current is passing. You can use common sheet zinc, but it will soon wear out. 2. How can I make porous cups? A. The porous cups are made of unglazed earthenware. A potter will probably bake them for you, of any shape desired. 3. Does the acid of the porous cup flow into the fluid of the zinc, or does it evaporate? A. In Grove's battery the nitric acid in the porous cup is gradually decomposed. It merely comes in contact through the porous cup with the fluid in the zinc cell, and this is necessary to allow the passage of the electric current. 4. How is Smee's voltaic battery constructed? A. Smee's battery consists of a strip of silver or platinum suspended between two plates of zinc, and the whole immersed in dilute sulphuric acid.

G. B. G. asks: What is the composition and mode of preparation of the enamel, black and white, used on clock and watch faces, and are the letters and figures printed on or put in with a pen by hand? A. Black enamel: Peroxide of manganese 3 parts, zaffre 1 part. Mix, and add as required to white enamel, which is: Washed diaphoretic antimony 1 part, fine glass, free from lead, 3 parts. Mix, melt, pour into water, powder, melt again; and repeat this three or four times. Figures are put on white enamels on china, while in the "bisquit" state, before vitrification.

A. & B. ask: If there were a hole through the earth, and a ball were dropped in the hole, would the ball ever stop, or would it pass through and through as a pendulum swings? B. says that the ball would stop as a pendulum does when it has no power to move it, that is, shorten its stroke every time it swings until it stops. A. We think B. is right.

F. L. K. asks: How can I find the weight of a solid ball 15 inches in diameter? A. Multiply the cube of the diameter of the ball in inches by 0.5236, and by the weight of a cubic inch of the material of which the ball is composed.

F. P. H. asks: Why does a star, seen with the naked eye, look irregular? When viewed through a telescope, it appears round. A. The twinkling of stars is due both to the varying density of the atmosphere and to the defects in the eye. Stars do not appear round through the telescope except when the latter is out of focus, and then the cause is obvious.

J. C. asks: How can I exterminate red roaches? A. Take flowers of sulphur $\frac{1}{2}$ lb., potash 4 ozs. Melt in an earthen pan over the fire; pulverize and make a strong solution in water, and sprinkle the places which they frequent.

J. A. asks: How can I bronze small iron castings? A. Take 1 pint methylated linseed oil, 4 ozs. gum shellac, $\frac{1}{2}$ oz. gum benzoin; put in a bottle in a warm place, and shake occasionally. When the gum is dissolved, let it stand in a cool place two or three days to settle; then pour off the clear into another bottle, cork it well, and keep it for the finest work. The sediment left in the first bottle is to be thinned with spirit to make it workable for first coats or coarse work. It must be strained through a cloth. Then take $\frac{1}{2}$ lb. finely ground bronze green, varying the shade as required by adding lampblack or red or yellow ochre. Let the iron be clean and smooth; take as much varnish and bronze powder as required, and lay on, with a brush, in a thin coat, having slightly warmed the articles to be bronzed. When dry, add another coat if necessary, and touch up where required with a little of the bronze on a pencil. Just before it is dry, gold powder may be put on. Varnish over all finally.

J. A. asks: How can I separate albumen from blood? A. By receiving the blood in moderately deep vessels and allowing it to coagulate, much of the serum or albumen will separate and rise to the top, whence it may be skimmed off.

R. M. W. asks: What does "Patented, S. G. D. G." mean? The paper on which I saw it came from Europe, and I think the article patented is a French or Belgian invention. A. The French authorities require these letters to be marked on patented articles. They stand for "Sans Garantie du Gouvernement," "without guarantee of the government." 2. Is there any patent on the rubber hand stamp? A. You can readily find this out by examining one. Patented articles are required by law to be marked "patented," with date of patent. We believe it is patented. 3. Is there any successful stump extractor? A. We have illustrated several stump extractors. 4. What is the best compound for printer's rollers? A. You can make composition rollers by dissolving with heat, in two pounds of treacle, one pound of good glue, previously soaked a night in water. For greater hardness, use more glue. 5. Is it possible to analyze a mixture of chemicals in order to tell what the ingredients are? A. Yes.

C. W. says: I had occasion to mend a topaz ring, and did it in the usual manner, using a round stick of charcoal and imbedding the stone in plaster of Paris. The stone was a dark one and was changed through the operation to a very light one. What was the cause of its changing, and how can I restore it? A. We suspect that heat had something to do with the change of color. The yellow Brazilian topaz, strongly heated, becomes rose red, and the Saxon topaz, when gently heated, white. We are afraid nothing can be done to restore the color.

H. G. B. asks: 1. Will platinized silver do for the negative metal of a Grove battery? If so, what is the best way to platinate it? Will it do to platinate copper instead of silver? A. Either platinized silver, lead, or copper will answer in Grove's battery, but it must be well plated. The platinum solution used is the double chloride of platinum and potassium, dissolved in a solution of caustic potash.

G. H. J. asks: 1. What are the so-called glass cards made of, and how are they colored? A. You probably mean cards glazed with soluble glass. This can be applied in the liquid state like a varnish. When dry, it forms a hard, glassy, transparent surface. Various pigments can be used for coloring. See our advertising columns.

J. D. says: I produce an orange color with bichromate of potash, alum, litharge, acid, and soda. What must I add to deepen it? A. This is a matter to be determined by experiment. Consult some practical chemist, who may have facilities at hand to make the necessary experiments.

W. V. D. asks: How much worm surface is required to condense a gallon of proof spirit in an hour? I am told that, to condense 200 gallons of proof spirit in 12 hours, about 180 feet of $\frac{3}{4}$ or $\frac{1}{2}$ inch copper pipe would be required. A. This is a question which we can hardly dismiss satisfactorily in a few lines in this column. You should read the article on evaporation in Ure's "Dictionary."

M. T. asks: Why does coffee, either ground or in the berry, even if closely kept in a tin can, lose its aroma, and become disagreeable and bitter? A. The aromatic principles of coffee, on which its flavor depends, are volatile, and consequently, unless the roasted coffee is rigidly excluded from the air (which is almost impossible in ordinary vessels), the flavor is soon lost, and the bitter principles, among which is tannin, are left behind. The best coffee is made from the freshly roasted and ground berry, by infusing it in boiling water for a few minutes. The coffee should not be boiled in the water.

W. C. asks: What is tungstate of soda, recommended for making clothing unflammable? Would it make wooden tobacco pipes unflammable? A. Tungstate of soda is a compound of tungstic acid and soda. Tungstic acid can be readily made from the native tungstate of lime. The compound in solution, to which a little phosphate of soda has been added, has long been used in England for the purpose of rendering fine fabrics unflammable. It does not prevent charring from the action of fire, however; its only use being to prevent substances burning with flame. It would be difficult to permeate hard wood with the solution.

S. B. R. asks: On what stuffs can the aniline dyes be used? How can I dye cotton goods with aniline black? A. All fabrics of silk, wool, and cotton can be dyed with aniline preparations. To get an intense black, it is necessary to mordant in chloride of manganese, working the cotton in it for about an hour, wringing out well and, without rinsing, pass into boiling soda lye, holding lime in suspension. After the fixation of the manganese salt, wash the cotton in water and pass into a lukewarm chloride of lime bath, taking care that the chloride be not used in excess.

H. A. C. asks: What is the best manner of sticking tinfoil to glass for Leyden jars, disks, etc.? A. We think gum tragacanth will answer very well.

P. says: I wish to be an engineer. Which would be the best city for me to go to, to get instruction? Is mechanical drawing taught free at the Cooper Institute in New York? Is there anything of the kind in Boston, Philadelphia, or any other large city? A. You can obtain all necessary instruction, including drawing, at the Cooper Institute. We scarcely think you will find as good a free school in any other city in this country.

E. B. W. says: On page 43 of your current volume, W. S. B. asks if a block can be squared on all sides. It is quite common for mechanics to affirm, in the most positive manner, that this cannot be done. There are a few points connected with this question, which, not being generally understood, cause them to come to this erroneous conclusion. If a good workman will take a try square, such as is commonly found in machine shops, and commence on a block of metal say two inches square, and work as close as possible, he will find that when he has reached the fourth side, it and the blade of his square will not coincide. There is a cause for this, and it lays mainly in the angle of the square being a small fraction less or more than 90°. When he has reached the fourth side, this error in the square has been multiplied by four, and becomes plainly visible. The whole experiment, then, becomes simply a delicate test of the square. If he will take a piece of sheet steel and form a try square out of it, and with this commence and square the block, noting when he has reached the fourth side, which way his square is out, and carefully correct it with a fine file or scraper, he will, after several patient efforts, have it so nearly perfect that no error will appear at the fourth side of the block. In a word, he will have made a perfect try square, and with it he can square other blocks, coming out at the fourth side correctly the first time. The secret of the "impossibility" in this problem rests in the inexactness of tools and workmanship; for certainly if the four corners of the block are just 90° each, the opposite sides will be parallel.

J. S. says, in reply to L. and H., who have difficulty in burning sawdust: "I have a boiler of similar dimensions and I burn my sawdust successfully. I use a fan (costing only about 12 or 15 dollars) of 24 inches diameter, with 6 inch wings, driven at 1,000 revolutions per minute. I also employ a trunk made of inch boards to conduct the blast into the ash pit. I use a grate bar which is lighter than the common bar, with the spaces ($\frac{1}{4}$ inch) running crosswise and of zigzag shape. I use also a little wood or slack coal to keep the fire going."

A. J. K. says, in answer to J. W. B.'s query as to calculating machines: There are machines which add, divide, subtract, and multiply six figures into six figures. "I used one in San Francisco. There are two in use in that city now. They are manufactured in Paris."

J. C. says, in reply to J. F., who inquired about a certain clock with a glass dial on which the hands turn without any apparent motive power: "I believe the timepiece is nothing but Robert Houdin's clock, which works as follows: At one end of each hand there is a large disk; these seem to be only counterpoises, but, in reality, they contain concealed watch movements, which, working on the center by means of appropriate levers, cause each hand to move on the dial and mark the correct time in a mysterious manner. If J. F. looks closely on these disks, he will probably see, on some part of their surfaces, squares, used to wind them up with a key, like an ordinary watch."

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

C. L. McC. & Co.—Your specimen is galena in quartz. H. M. H.—Your specimens contain copper and iron. 2 and 4 contain carbonate of copper and copper pyrites. No 1 is white pyrites. No. 3 resembles quartz and white pyrites.

E. G. A.—Your specimen did not reach us. Send us a small sample.

T. M. B.—This is a specimen of earthy chlorite, consisting chiefly of silica, magnesia, alumina, and oxide of iron. The term chlorite is derived from a Greek word meaning green, on account of the greenish appearance of the mineral. It is of no economical importance, although the compact variety was employed by the Indians for pipes.

J. W.—Your specimens are others, that is, clays charged with oxide of iron, to which their color is due. The red especially seems to be a valuable mineral paint. You should correspond with some one who is interested in the use or sale of such articles.

S. B. B.—Your mineral is decomposed hornblende.

J. W. Jr.—The enclosed is blue clay, a silicate of alumina. When clay burns white, it is used in the manufacture of white earthenware.

R. M. L.—Your mineral is specular oxide of iron.

S. C.—Clay containing much free silica and brown oxide of iron.

B. F. M.—Dark colored clay, a silicate of alumina. J. E. S.—Your mineral is white quartz, sometimes, though improperly, called diamond. The purest variety, which is crystalline and transparent, is used by jewelers, and is also made sometimes into spectacle lenses, called pebble lenses. Quartz is silica, while the diamond is pure carbon. Quartz will scratch and sometimes cut glass, but not with the facility of the diamond.

M. R. L.—The minerals sent are oxide of iron, chiefly micaceous oxide, so called from its occurring in small bright spangles like mica. From its glimmering, splendent appearance you have probably mistaken it for silver. The other ores are galena, a valuable ore of lead. This sometimes contains a paying quantity of silver, but this can only be estimated by an analysis.

J. E. G.—1, epidote; 2, quartzite; 3, copper pyrites; 4, serpentine; 5, chlorite schist; 6, carbonate of lime.

G. S. R. asks: How can I reduce leather, buffalo hides, for instance, to a pulp, which will set into a hard and durable mass?—A. M. asks: How can I find the weight of a person's head without cutting it off?—J. V. B. asks: Is there any substance with which I can coat cardboard, to make a white slate, to be written on with a lead pencil?—G. W. F. asks: 1. Can you give me a rule for setting out circular saw teeth? 2. How can I temper a burr for gumming out saw teeth?—C. P. asks: In taking impressions of the human head in plaster, I have trouble in making the hair and whiskers stand out naturally. What can I do to remedy this?

COMMUNICATIONS RECEIVED.

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

On the Morse System of Telegraph Signals. By W. L.
On Utilizing Coal Dust. By J. H.
On the Preservation of Timber. By J. H. M.
On the Principles of Ventilation. By C. A. W.
On Asphalt. By C. F. D.
On the Relative Attraction of the Earth and Sun. By W. M. D.
On a Substitute for Mica in Stoves. By A. A. H.
On Mr. R. A. Proctor and the Million Dollar Telescope. By S. H. M. Jr.
On Preventing Incrustation in Boilers. By E.
On Ocean Towers. By W. K.

Also enquiries from the following:

S. H. W.—H. C. A.—H. S. W.—H. B.—W. W. A.—L. A. C.—G. S.—W. W. S.

Correspondents in different parts of the country ask: Who makes a centrifugal clothes wringer? Who makes smoke-consuming devices for boiler furnaces? Who makes corn-shucking machines? Who makes wood-working machinery bits? Who makes an instrument, other than the ear trumpet, for helping the partially deaf to hear? 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.]

Index of Inventions

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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:

27,598.—REFLECTOR.—I. P. Frink. April 1.
27,901.—HARVESTING MACHINE.—M. Hallenbeck. April 1.
27,923.—FENCE MAKING MACHINE.—J. Moore & al. Ap. 1.
28,328.—GRAIN BINDING MACHINE.—D. W. Ayres. May 6.

EXTENSIONS GRANTED.

26,960.—TINWARE MAKING MACHINE.—S. J. Olmsted.
258 (whole No. 31,362).—FARE BOX.—J. B. Slawson.

DISCLAIMER.

26,980.—TINWARE MAKING MACHINE.—S. J. Olmsted.
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DESIGNS PATENTED.

7,104.—WATCH CASES.—L. Bushnell, New Bedford, Mass.
7,105.—BOTTLES.—A. Michael, New York City.
7,106.—BATH TUBS.—J. L. Mott, Mott Haven, N. Y.
7,107.—PICTURE FRAME.—E. Renaud & al., New York City.
7,108.—CARPET.—T. J. Stearns, Boston, Mass.
7,109.—PACKING BOX.—S. F. Whitman, Philadelphia, Pa.
7,110.—TABLE CASTER HANDLES.—H. C. Wilcox, West Meriden, Conn.
7,111.—CAKE OR FRUIT BASKETS.—H. C. Wilcox, West Meriden, Conn.

TRADE MARKS REGISTERED.

1,595.—PHARMACEUTICAL PREPARATION.—J. Carrick, New York City.
1,596.—SHIRTS.—W. H. Cole, New York City.
1,597.—TOBACCO, ETC.—F. Miranda, New York City.

SCHEDULE OF PATENT FEES.

On each Caveat.....	\$10
On each Trade Mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3½ years).....	\$10
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 23, 1873.

3,054.—H. M. Baker, W. F. Stone and J. H. Vermilya, Washington, D. C., U. S., assignees of G. W. Hunter, same place. Improvements on sewing machines, called "Hunter's Sewing Machines." Jan. 23, 1874.
3,055.—J. Pratt and A. Roy, Montreal, P. Q., assignees of J. Goulloud, same place. Nouvelles et utiles améliorations aux machines à tisser les corsets, les gilets, etc., called "Temple Entrainneur Amélioré." New and useful improvements in machine for weaving corsets, gilets, etc. Jan. 23, 1874.
3,056.—H. Martin, Chicago, Ill., U. S., M. H. King, Springfield, Hampden county, Mass., U. S. Improvements on brick machines, called "Martin's Brick Machine." Jan. 23, 1874.
3,057.—E. N. Randall, West Troy, Vt., U. S., and G. E. Braley, same place. Improvements on milk vats, called "Randall's Improved Milk Vat." Jan. 23, 1874.

HOW TO OBTAIN Patents and Caveats IN CANADA.

PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

The total expense, in ordinary cases, to apply for a Canadian patent, is \$15, U. S. currency. This includes the government fees for the first five years, and also our (Munn & Co.'s) charges for preparing drawings, specifications and papers, and attending to the entire business. The holder of the patent is entitled to two extensions of the patent, each for five years, making fifteen years in all.

If the inventor assigns the patent, the assignee enjoys all the rights of the inventor.

A small working model must be furnished, made to any convenient scale. The dimensions of the model should not exceed twelve inches.

If the invention consists of a composition of matter, samples of the composition, and also of the several ingredients, must be furnished.

Persons who desire to apply for patents in Canada are requested to send to us (Munn & Co.), by express, a model with a description, in their own language, showing the merits and operation of the invention, remitting also the fees as above for such term for the patent as they may elect. We will then immediately prepare the drawings and specification, and send the latter to the applicant for his examination, signature, and affidavit. It requires from four to twelve weeks' time, after completion of the papers, to obtain the decision of the Canadian Patent Office. Remit the fees by check, draft, or postal order. Do not send the money in the box with model. Give us your name in full, middle name included. Inventions that have already been patented in the United States for not more than one year may also be patented in Canada.

On filing an application for a Canadian patent, the Commissioner causes an examination as to the novelty and utility of the invention. If found lacking in either of these particulars, the application will be rejected, in which case no portion of the fees paid will be returned to the applicant. Inventors may temporarily secure their improvements in Canada by filing caveats; expense thereof, \$30 in full. For further information about Canadian patents, assignments, etc., address

MUNN & CO.,
37 Park Row,
New York.

VALUE OF PATENTS, And How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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[NEW SERIES.]

NEW YORK, FEBRUARY 21, 1874.

[83 per Annum
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THE BATTERING RAM AS A TUNNEL BORER.

Mr. Charles Bergeron, C. E., in a recent issue of the *Engineer*, contributes a paper on the St. Gothard Tunnel, and more especially relating to the modes of drilling which have been adopted. The Dubois and François perforators, which are of more simple construction and of higher efficiency than the similar machines employed at Mont Cenis, have been mainly employed, but more recently the McKean apparatus has been substituted. Compressed air is furnished at a pressure of from five to eight atmospheres, by means of three powerful turbines of 220 horse power each, forming a total amount of 660 horse power, at each end of the tunnel. With such powerful engines, M. Favre, the contractor expects to execute three blastings by dynamite per day, advancing each time 48 feet at each end of the gallery, the entire extent of which it is believed will be completed in less than five years.

Mr. Bergeron, in considering the plans of M. Favre for the use of dynamite, points out a number of different operations, as well as objections incident to the employment of the same, and thinks that there is a way of accomplishing the work in less time and with a much smaller amount of trouble and inconvenience.

In making their long subterranean aqueducts, it is stated that the Romans used a battering ram to pierce the way through rock. This engine consisted of a long wooden beam suspended at its center of gravity and heavily weighted. A number of men on each side, acting together, gave it a swinging motion, so that it struck with great force any obstacle in its path. When the instrument was to cut hard rocks for tunnels, the metallic head was armed with points like a stonecutter's hammer, intended to divide and reduce the stone to fragments or dust. Captain Penrice, an English engineer, some time ago conceived the idea of constructing a rock drill on the same principle, and to employ steam or compressed air for pushing, like a steam hammer, a perforator of four or five feet diameter. This was tried in the Vaugirard quarries near Paris, and made five feet advancement per hour; and since, another has been

built, 3 feet 6 inches in diameter, which, it is asserted, will penetrate a distance of from two to three feet in similar time. By suitable mounting of the cylinder on the trunnions of a gun carriage, it can be made to take all the positions of a marine or siege gun, and strike the rock with blows of eight or ten tons weight. The hammer weighs two tons and a half. The engraving of the apparatus will render its construction clear. A is the framing, suspended on the wheels, B B. The end wheel serves to direct the carriage, and the whole is moved forward by the aid of the hand spike, Fig. 6, inserted in the holes, O O, in the wheel, B. D is the steam cylinder, mounted on trunnions, and its angle is determined by the segment, N, and pinion and handle, M. E is the valve chest; K, the hand lever by which the valve is actuated; H' is a heavy balance weight; H is the ram head fitted with cutters, shown on an enlarged scale in Figs. 2, 3, 4, and 5. The holes, O, are used to extract the cutters when worn. J is the air pipe, to which a flexible pipe is attached. By moving K backwards and forwards, H will be made to act as a battering ram on the face of the heading in a way that will be obvious.

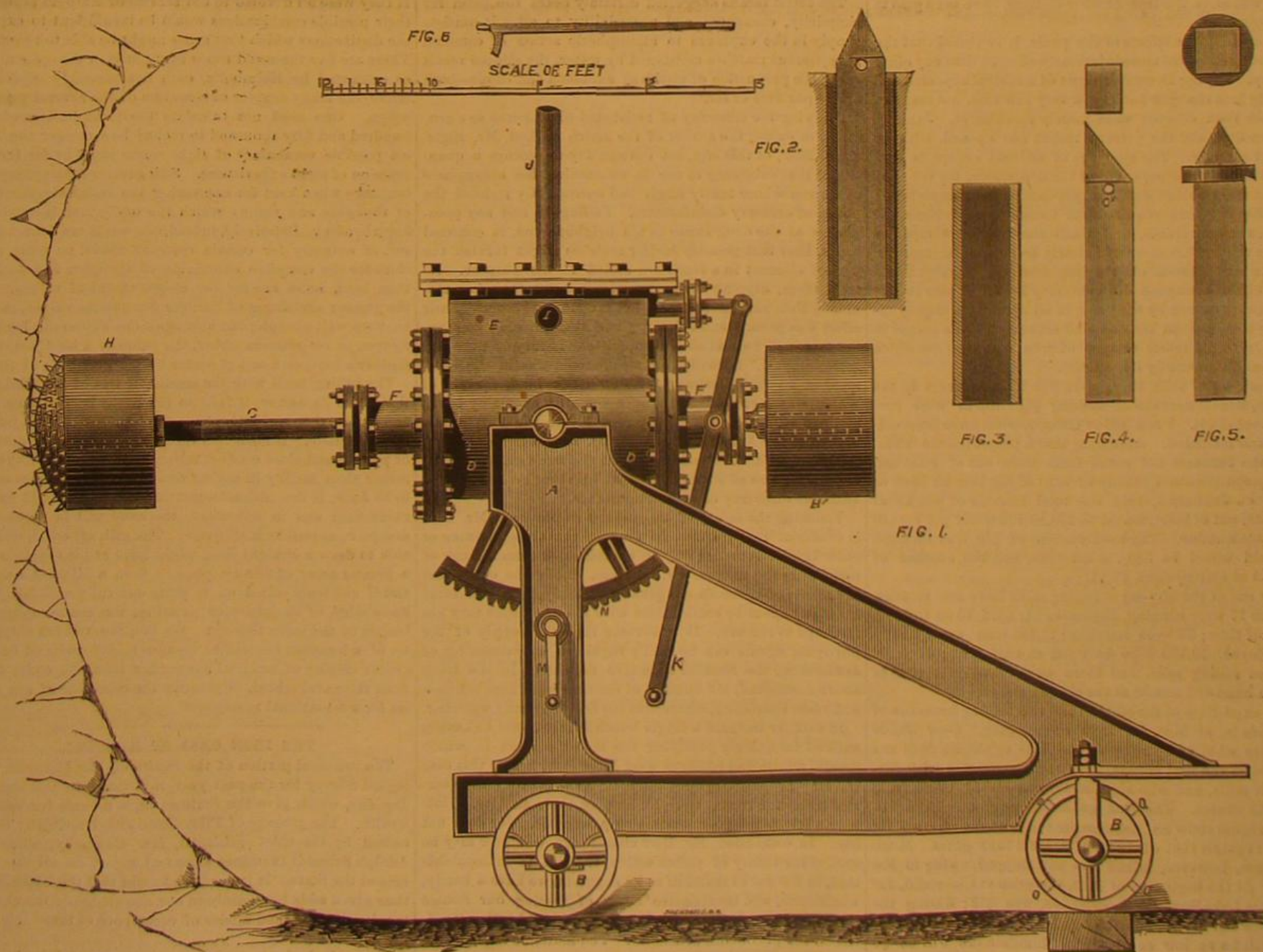
The gun carriage may be placed upon a turntable; and jets of water, projected against the place where the hammer is striking, will serve to carry off the rubbish. The operation would suppress the transport of the latter by wagons; and the work, it is stated, would be continuous, which is not the case when blasting the rock by gunpowder or dynamite.

In connection with the St. Gothard tunnel, we note that, up to November 30, 1873, the drift had reached an extent of 3,353 feet. The total length of the bore is to be 47,680 feet.

PURE glycerin should not produce, when locally applied, a burning sensation, which it always does when the fatty acids are not all extracted. But even absolutely pure glycerin, when undiluted, is a water-extracting body. It should therefore, when used as a cosmetic, or for medical application, be always diluted with water.

Uniform Mean Time.

The extent of the territory of the United States forbids the adoption of one mean time for railroad use, found so convenient in the countries of Europe. It is therefore the practice, on our railroads, to run by Portland time, New York time, Altoona time, or by the mean time of some other center of railroad traffic. The Pennsylvania Railroad and some of its dependencies, extending from New York to St. Louis, use Pittsburgh time, which is transmitted by electricity from the Allegheny observatory, an astronomical clock of the best construction being used. This clock is regulated by a telescope, aided by other mechanism, such as the chronograph, which records, by the aid of electricity, the time that the clock keeps, to the hundredth part of a second. The telescope shows its return, every twenty-four hours, to the point of observation of a fixed star, so that the earth itself becomes the regulating clock of the observatory. Four lines of telegraph, says the *American Exchange and Review*, enter the observatory, one of which connects with the railroad wires. The circuit is led through the standard clock, in which a wheel with sixty teeth revolves once a minute. One of the gold terminals of the wires is in contact with a jewel, which is moved slightly every second by a passing tooth. At this instant the circuit is broken, and, by filing away some of the teeth, certain beats may be omitted, to designate the end of the minute, while another piece of mechanism holds the circuit open for the last minute in each hour. The action is purely automatic and continuous, and the clock beats are repeated, through the twenty-four hours, in the principal offices at Pittsburgh, with which they are united by a line specially devoted to their use. At a certain hour the current is switched into the main circuit, and then the clock may virtually be heard ticking in New York and Chicago, and at every intermediate station, at the same instant. The system has been in use, as the official standard of the Pennsylvania Central Railroad and its eastern connections, for some years; more recently it has been extended to the western roads. The aggregate length of main and branch lines thus supplied is several thousand miles.



THE BATTERING RAM AS A TUNNEL BORER

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THE STATE OF THE IRON TRADE.

The present condition of the iron trade of the country is fully set forth in the recent report of the American Iron and Steel Association. Rather a discouraging view is taken of matters on the whole, and to the panic is ascribed a state of affairs on which no immediate improvement is predicted. The question of British competition is dwelt upon at length; and judging from the tone of the English industrial journals, there seems foundation for the belief that the foreign iron masters expect a reduction of duties in their favor, and, in any event, can afford to reduce their profits and continue shipments. The report strongly deprecates any reduction of tariff and advocates an increase, pointing its argument by citing the fact that during last year the British ironmasters sent to this country 371,164 tons of iron and steel, valued at \$25,000,000, and this while our own blast furnaces and rolling mills were lying idle. In other words, we paid to foreign manufacturers, prices for their goods which our own producers would, in the time of their distress, have been glad to have accepted.

In discussing the effects of the panic, it is stated that the home iron trade was more injuriously affected than any other industry. During December, signs of a revival appeared and some pig iron changed hands at a very low rate, but many of the sales then effected were merely speculative. January has been dull, and the present month has opened with no brighter promise. The stoppage of railroad orders is considered as the principal cause of the depression, for the reason that fully half of our iron production and importation has ordinarily been required for locomotives, bridges, car wheels, relaying tracks, etc. Until the railroad companies re-enter the market, there can clearly be no general improvement in any branch of the iron business. Subordinate causes of the continued dullness may be found also in the interruption caused by the panic in all operations largely requiring iron, and in the enforced economy of the people in dispensing with minor articles of iron manufacture which they could temporarily do without.

At the close of 1873, there were 650 blast furnaces in the country, which were either making pig iron or were prepared to make it. From 385 of these, reports have been collected and tabulated. Assuming that a proportionate number of the furnaces not heard from were out of blast and had a proportionate quantity of tons of pig iron on hand or unsold, on January 1, 1874, the total number of stacks at that date, out of blast, would be 233, or thirty-six per cent of the whole number. The total amount of pig iron on hand or unsold would be 520,726 net tons, and the number of men out of employment, 21,141.

Fifty out of the fifty-seven rolling mills have sent returns. Of these 17 were running, December 31, 1873, 10 on full and 7 on half time; 33 were standing; 11,490 men were wholly unemployed, 10,150 were at work at half time; 37 mills were not selling rails, and there were 36,744 net tons of rails on hand and unsold at the above date.

This exposition of the state of the two leading branches of the trade is, at best, far from encouraging. Over 30,000 hands are wholly unemployed; and this aggregate does not include ore and coal miners, not directly connected with furnaces or mills, and who are also thrown out of work from the same causes. The iron ore statistics of the Lake Superior region show an increase in the amount shipped for 1873, as against that of 1872, of 211,002 tons gross. Much of the ore, however, mined was not shipped, owing to the panic. At the beginning of 1873, the price at Cleveland, for first class Lake Superior specular ore, was \$12; during the panic this fell to \$10, and it is believed that for 1874 the price will be as low as \$9. Iron Mountain ore will be \$8 delivered at St. Louis.

The total number of miles of railroad in operation, January 1, 1874, was 71,100, as against 67,104 a year back. Increase, 4,005 miles built, or considerably less than the figures of 1872, when 6,427 miles were constructed.

The report gives extended statistics of the comparative status of the British iron trade. The total export of 1873, of iron and steel, was 2,959,314 tons, estimated at \$188,897,940 less in amount than for either of two previous years, but greater in value. The export to the United States has fallen off fully one half; the figures for 1872-3 and 4, being 840,085, 795,734 and 371,164 tons. During the latter part of 1873, there was a decline in the cost of fuel and labor, which bids fair to be permanent, and the coming year, it is believed, will witness lower prices for iron in the British markets than prevailed during the previous year. The vessels built on the Clyde were 194 against 227 in 1872; the tonnage, however, exhibits considerable increase. The coal trade is said to be a reflex of the iron business, with declining prices as the rule.

The Iron and Steel Association is now in session at Philadelphia, and all the great establishments are fully represented. Such a gathering of capital and influence has never taken place in any iron convention, heretofore held in the United States. A memorial has been prepared for transmission to Congress, which prays for the repeal of the substance of the ten per cent reduction act, passed in 1872, affecting a large number of staple articles, suggests amendments to the bankrupt act, protests against proposed alterations in the tariff laws, against changes in the customs duties to be effected by laws now pending in the House, advocates the establishment of a department of industry, with subordinate bureaux of agriculture, commerce and manufactures, and discusses financial topics and a protective policy.

Two objects of considerable interest have thus far been exhibited. One is a twisted steel Bessemer rail from the Joliet Iron and Steel Company's Works, which is a beautiful piece of work, the rail being made into a complete spiral without developing the slightest flaw or fracture. The other is an ingot of steel, weighing 1,000 pounds, made direct from the ore, for the first time in this country, by the Blair Iron and Steel Company of Pittsburgh.

The proceedings of the convention bid fair to be of considerable importance, and will be made the subject of future comment in these columns.

OZONE—A NEW AND CORRECT METHOD OF SUPPLY.

The use of ozone as a disinfectant in hospital wards and public buildings has amply demonstrated its virtue as a purifier of air exhausted by breathing or poisoned with emanations from corrupt or decaying organic matter. The only bar to its more extended use has been the lack of a simple and trustworthy means of generating it, safely and continuously, by a process not involving scientific skill or costly materials.

The latest means suggested certainly bears the palm for simplicity, cheapness, and accessibility to all. It consists simply in the exposure to atmospheric action of common phosphorous matches moistened by water, the alleged result being the production of nitrite of ammonia and ozone—both active purifiers of air.

Knowing the efficiency of moistened phosphorus as a generator of ozone, the author of the match method, Mr. Sigismund Beer, of this city, set out one day to procure a quantity of that substance to use in sweetening the atmosphere of a room whose musty smell had successfully resisted the power of ordinary disinfectants. Failing to find any phosphorus at the drug stores in his neighborhood, it occurred to Mr. Beer that possibly lucifer matches might furnish the needed element in a condition suited to his purpose. He tried them, dipping them into warm water for a few moments, then suspending them in the obnoxious room. Their effect was prompt and salutary; and thereafter, by continuing their use, he was able to enjoy "the luxury of pure and refreshing air," notwithstanding the room was in the basement of an old cellarless house on made land, the air of which was further tainted by a quantity of moldy books and papers. In a paper lately read before the Polytechnic branch of the American Institute, Mr. Beer narrates a number of subsequent experiments with the same simple materials, the success of which convinced him that he had made a veritable discovery of great importance.

Touching the safety of the method he proposes, Mr. Beer is confident that no overcharging of the air with ozone or other injurious matter may be apprehended from the use of matches in the manner he describes. Both the ozone and the nitrite of ammonia are generated slowly, and their force is swiftly spent by combination with the impurities they are intended to remove. It is obvious that the supply of the purifying agents can be easily regulated by increasing or diminishing the number of active matches. In the room above mentioned, six bundles of matches were kept active—some near the ceiling, others near the floor—by daily watering.

In another instance a single bunch is mentioned as having sufficed for quickly purifying the air of a room in which several adults and children were lying sick, but in this case the air was fanned against the matches while they were carried about the room, thus heightening their activity. How long a match retains its ozonizing power, Mr. Beer does not say. In conclusion, Mr. Beer claims that, whatever may be said of his theory of match action, the fact is indisputable that, in the use of matches as he suggests, we have a handy, wholesome, and inexpensive means of freeing our houses from noxious exhalations and the long train of evils attendant on the prevalence of bad air. The matter is easily tested and certainly well worth trying.

EDUCATION AND BOOK KNOWLEDGE.

The high water mark of a very prevalent theory in education is reached in an assertion, by one of the foremost educators of the day, to the effect that what a man can write out fully and fairly concerning any matter, that he knows, and no more. Whatever falls short of this simple and certain test, we are told, is no better than sheer ignorance.

The phrase expresses, with axiomatic terseness, the controlling spirit of the schools; and for this reason, we suppose, it has been echoed right and left as a settled dogma in education. From the primary school up to the highest, excepting a few scientific schools, the grand test of knowledge is verbal expression. The pupil that recites best wins the prize; and as the most credit goes to that teacher whose pupils meet the standard required most completely, the tendency is to narrow the range of teaching to those things which can be most readily reproduced in formal phrases. The premium is paid for words, and naturally the teacher gives more attention to them than to the pupils' mental health or mental development.

Not that facility of verbal expression is to be despised or neglected. It is an art second to none, and worthy of proportionate culture. In many cases it is also a first rate test of knowledge; but to make it the ultimate test, in all cases, involves a double fallacy, subversive of the highest aim in education. It implies that all knowledge worth having can be expressed in words, and consequently can be communicated by words, either for informing another or for testing his information. It implies, too, that the possession of knowledge necessarily carries with it the power of ready and accurate expression.

The fact is, on the contrary, that relatively but a small part of what one may know can possibly be expressed in words; and much, even of that which can be formulated, may be thoroughly apprehended and practically used by one who could not begin to set it down in logical sentences.

Time was when book knowledge was thought to be the sole basis of scholarship. All teaching was book teaching, and it was no more than fair to expect students to prove their knowledge in book fashion. But that time is past. The bookish estimate of culture no longer satisfies. The library alone can no longer make a scholar; and every scheme of culture which pins the pupil's attention to letters is little better than a wall set round him to keep him from learning what he ought to know. That much of what passes for legitimate schooling is such a wall is recognized by everybody except the pedagogue.

Men of real culture are well aware that ability to do is vastly superior to ability to say; and they believe that the development of skill and power ought to receive at least as much attention in schooling as the mere accumulation of second hand facts; but all that sort of basic culture is not merely slighted but suppressed as soon as the test of verbal description is made supreme.

There are less than fifty sounds in the English language. If they were all devoted to the service of a single sense, all their possible combinations would be insufficient to express the distinctions which that sense might be able to recognize. There are five thousand times fifty fibrils in the optic nerve, as estimated by Helmholtz, each demonstrably capable of conveying many degrees of sensation of the several primary colors. One need not calculate the permutations of two hundred and fifty thousand to realize how meager the richest possible vocabulary of sight terms must be for the expression of sight experiences. Still greater is the poverty of language when used for expressing the infinite distinctions of thoughts and things which the whole man is capable of apprehending. Relatively, indeed, our words are but a clumsy sort of currency for certain common needs, no more sufficient for the complete expression of thoughts and feelings than bank notes are for the measurement of values. For the grosser exchanges of life, for marketable values, money answers well enough; but how shall one express in banker's figures, or set phrases either, the value of a kindly word, a mother's love, or a cup of water to one perishing of thirst?

The killing fault with the scholastic test of knowledge is that, from its nature, it fails to reach—as it fails to encourage—more than a single phase of culture, and that one of inferior grade. It measures verbal acquisition only, not skill or power; and since conduct rather than words, ability to do rather than facility in saying what has been done or ought to be done, is the ultimate test in life, and should be the paramount aim in education, the word test is necessarily deceptive as well as inadequate. The glib art critic, scarcely able to draw a straight line, might have at his tongue's end a greater array of fine art phrases than a Michael Angelo; and if suddenly called on to write out fully and fairly his knowledge of sculpture or painting, the master might be beaten by the mere theorist. So, too, the veteran shipmaster of a hundred successful voyages might make off hand a poorer display of nautical knowledge than the cadet fresh from the naval school, or possibly the concoctor of sea stories for a sensational newspaper.

THE IRON ORES OF MISSOURI.

The principal portion of the report of the Missouri Geological Survey for the past year is devoted to the iron ore deposits, which give the State so high a rank for mineral wealth. The geology of Pilot Knob and its vicinity is discussed by the chief geologist, Mr. Pumpelly, while Dr. Adolph Schmidt furnishes a general report on all the iron ores of the State. It is needless to add that the information thus given adds immensely to our knowledge of the character, distribution, and modes of occurrence of these interesting deposits.

Two principal mineral species are represented in the Mis-

souri iron ores, the hematite and the limonite (sometimes called brown hematite), the former occurring in two distinct varieties, namely, specular ore and red hematite. The first variety is found in the midst of broken and partially disintegrated porphyry, and in the (geologically) overlying lower silurian sandstone. The red hematite forms strata in the carboniferous system. The limonites occur chiefly as deposits on the second and third magnesian limestones, except in the Osage River district, where they lie on subcarboniferous limestone. Besides these four classes of original deposits, Dr. Schmidt recognizes with each a secondary class of disturbed or drifted ores, making in all eight distinct classes of deposits.

The region of workable iron ore reaches north of the Missouri River at one point only, in Callaway county, where red hematite occurs in the subcarboniferous. South of the river, deposits are frequent throughout the whole southern part of the State. That portion richest in iron ores, however, is comprised in a broad belt crossing the State in a direction about parallel to the course of the Missouri river, between the 30th and 40th township lines. This belt is divided into three distinct regions. The first and more easterly embraces the deposits of limonite in the counties of Ballinger, Wayne, and Madison, and the small but immensely productive Iron Mountain district, with its two enormous deposits of specular ore in porphyry, Iron Mountain and Pilot Knob, besides numerous smaller deposits. The second or central region comprises the deposits of specular ore in sandstone, chiefly in the counties of Crawford, Phelps, and Dent. The third region contains the limonite and red hematite deposits of the Middle and Upper Osage, a district too remote from present markets to add very much to the immediate wealth of the State.

The oldest as well as richest deposits are in the iron-bearing porphyries of the eastern district, a formation regarded as a near equivalent, in point of age, to the iron-bearing rocks of Lake Superior, New Jersey, and Sweden. The deposits occur in the most variable shapes, and of every variety of size. There are regular veins as in Shepherd Mountain and Iron Mountain; regular beds as in Pilot Knob and in some localities east of it; irregular deposits, some of which approach veins by their shape, as in Lewis Mountain; while others have proved to be but isolated pockets, as on Hogan Mountain. In all cases, however, the mode of their formation is thought by Dr. Schmidt to have been practically the same, that is, by precipitation from iron-bearing waters, as ore deposits are still forming in numerous localities from the waters of chalybeate springs. The geological history of Iron Mountain affords a fair illustration of the manner in which the formation of all these beds of specular ore may be interpreted.

Originally the mountain was composed of porphyries, which also filled the valley east and south. In process of time the porphyries became fissured, by contraction or otherwise, and during long periods these fissures were kept filled with constantly renewed chalybeate waters, which slowly deposited the oxides of iron which they contain. As the fissures were gradually filled, the flow of the iron solutions was lessened and finally stopped. Then the ore dried, undergoing thereby a small contraction, which cracked and broke most of the veins without displacing the parts. Subsequently the porphyry was acted on by atmospheric or other waters, probably containing carbonic acid, which decomposed the rock, removing the alkalies and leaving a silicious clay. By the after erosion of the softened masses by rain and flood waters, the cracked and disjointed ore veins lost their support and fell to the ground, thus forming the beds of surface ore which cover the slopes of the hill and fill a part of the valley.

In the main body of the hill, the ore masses remain undisturbed, with more or less decomposed porphyry between, the ore constituting but a small percentage of the entire volume of the hill. The surface layer of ore boulders, pebbles, and ore sand, with very little clay, was originally from four to twenty feet thick, and must have represented a vast amount of erosion. The Iron Mountain ore may be taken as a type of all the Missouri specular ores. It is nearly pure peroxide, containing about seventy per cent of metallic iron, and is nearly free from mechanical admixture of foreign matter. Color, bluish black to steel gray. The surface ore is a little richer than the vein ore and has less phosphorus; both are nearly free from sulphur. Dispersed through all the Iron Mountain ores are magnetic particles, which can be separated from the mass with a magnet when the ore is reduced to powder. No ore with active magnetism, constituting a natural magnet and attracting iron filings, is found on the mountain. The Pilot Knob ore is slightly peculiar; color, steel gray to pearl gray, with a marked tint of sky blue. Its structure is crystalline to granular, with a very fine grain. None of these ores affect the compass needle, though all are slightly attracted by a magnet when ground fine. The quality is less uniform than that of the Iron Mountain ores, the principal impurity being silica. The proportions of sulphur are very small.

The ore from Shepherd Mountain is a little more like a magnetite than any other ore in Missouri, but in the main is a specular ore, very similar to that of Iron Mountain. Its magnetic qualities are much more pronounced than those of either of the ores above described, many specimens being strong natural magnets. The ore is very uniform in chemical composition, very rich in metallic iron, and almost entirely free from phosphorus and sulphur. It is nearly as rich as the Iron Mountain ores, and much purer than either those or the ores of Pilot Knob.

At Buford Mountain the ore is rich in both iron and manganese, and is likely to prove a very valuable material for

the manufacture of spiegeleisen, now so extensively used in the Bessemer process.

The specular ores in sandstone differ from those in porphyry chiefly in their tendency to change, on exposure to atmospheric influences, into brown and yellow limonites and red hematites: rarely into spathic ore. Generally these deposits are of a lenticular shape, with circular or elliptical outlines, and may have been formed either by deposition from chalybeate waters in depressions in the sandstone, or by a gradual replacement of lenticular limestone deposits. When inclined, the beds dip with the slope of the hill.

The disturbed deposits of specular ore are of two kinds: Masses of ore which have been removed from their original position by underwashing or otherwise and deposited elsewhere in a more or less irregular manner; and the remaining portions of original deposits, from which other portions have been removed. Ore banks having the appearance of drifted deposits are numerous in the central ore district, but they have not been sufficiently opened to be satisfactorily studied.

The red hematites of the carboniferous formation differ from all the other ores of the State in that they do not occur as deposits with definite limits, lying as independent and foreign developments between and across other rocks, but form and compose in themselves regular geological strata. These iron-bearing sandstones frequently extend over large areas, with varying richness. None, however, have been sufficiently opened to make it possible to decide whether the ore was formed directly after and on the surface of the underlying sandstone, or whether it was infiltrated afterwards, gradually replacing beds of limestone or the sandstone itself as it happened to be more or less readily soluble.

The deposits of limonite occur neither in veins, nor in beds, nor as strata, nor in pockets of regular shape, but in irregular cracks and crevices on or near the surface of the various limestones. These cavities sometimes have very large dimensions both in depth and width, and are generally near the present surface of the ground. So far as opened these deposits afford a denser, harder, and richer ore in the upper part than in the lower, where it is more inclined to be light, porous, ochery and clayish. This fact and the invariably stalactic structure of the ore are proofs that the solutions from which the ore was deposited was infiltrated from above. One of the largest and most coherent of these banks is the Ford Bank in the eastern district. It extends some 1,500 by 500 feet along a low flat hill; the thickness is irregular, ranging from 10 to 30 feet.

The disturbed and drifted deposits of limonite have not been sufficiently opened to enable a judgment to be formed in regard to their character. The more important deposits in the entire list are as follows, the most of them being described at length in the report:

1. Containing more than 2,000,000 tons of workable ore: Iron Mountain, in St. Francis county (specular ore).
2. With less than 2,000,000 tons and more than 500,000 tons: Pilot Knob (quartzose specular), in Iron county; Benton creek (specular in sandstone), Crawford county; and Simmons Mountain (specular in sandstone), Dent county.
3. Estimated to contain between 100,000 and 500,000 tons: Shepherd Mountain (specular and magnetic), Iron county. Scotia No. 1, (specular and red hematite in sandstone), Iron county. Cherry Valley No. 1 (specular in sandstone), Crawford county. Laub Bank (specular in sandstone), Phelps county. Pomeroy Bank (specular in sandstone and limonite), Dent county. Iron Ridge No. 1 (specular and red hematite in sandstone), Crawford county. And the Meramee bank, (specular and red hematite in sandstone), Phelps county.

MODERN PROGRESS OF CHEMICAL INDUSTRIES IN EUROPE.

In the course of a recent lecture before the French Association for the Advancement of Science, M. Aimé Gérard gave a very interesting and instructive sketch of the rise and progress of many of the principal chemical industries of Europe. Beginning with sulphuric acid, which he regarded as a common pivot about which turn all the industries which call in chemical reactions to their aid, it was pointed out that, heated with rock or marine salt, the product gives us on one hand sulphate of soda, and on the other hydrochloric acid, in other words, the primary agents for the manufacture of soap, of glass wares, of paper stuff, of bleaching matters, of dye, etc. Heated with saltpeter, it gives nitric acid, the creative agent of the beautiful coloring matters used for dyeing silks. Again, by the aid of sulphuric acid we clean metals, purify oils, manufacture candles, and plate and gild by galvanic action. It is quite clear that it would be impossible to obtain the enormous amounts of the product now required from the limited sources of supply of forty years ago. Then native sulphur, obtained from the volcanic ground of Sicily, was burned at the top of large leaden chambers, and about 20,000 tons sufficed for the manufacture of the sulphuric acid consumed in Europe. Now 275,000 tons would barely meet the demand. This vast drain could not be met by the Sicilian sulphur grounds, and hence were engendered the attempts to utilize iron pyrites obtained in the French mines of Chessy, near Villefranche. These successful, the industry spread to England and Germany, and now the estimated production of Europe, of concentrated sulphuric acid from iron pyrites, is 880,000 tons, enough to fill a canal 64 feet deep, 32 feet wide, and from 15 to 18 miles long.

In Marseilles, thousands of tons of salt from the marshes are made into soap maker's alkali. Formerly the hydrochloric acid gas produced from the decomposition was lost and, escaping in white clouds from the chimney of the factory, brought destruction to crops and vegetation near. It was in England that the condensation of this gas was made obligatory on manufacturers, and laws were passed in Parliament

to that effect, resulting in the transformation of the fumes into the yellow liquid from which decolorating chlorides, products which render valuable service in the bleaching, dyeing, and making of paper, are obtained. It is a strange fact that the importance of these secondary manufactures has greatly increased, and it is to the perfecting of the processes through which chemistry may manufacture these decolorating agents that the efforts of inventors are tending. In England, Weldon regenerates manganese, which generally serves for the transformation of hydrochloric acid into chlorine. Deacon seeks from the air itself the oxygen necessary to the transformation, and announces the production, now almost certain, of chloride of lime at \$2 per 220 pounds: an immense progress, for, whenever we are able to extract readily from hydrochloric acid the chlorine it contains, we shall have furnished to textile industry a means of inexpensive bleaching, and to the paper manufacturer a mode of utilizing now waste products.

With the hydrochloric acid there is obtained sulphate of soda, and this is converted into soda and carbonate of soda. To effect this, it is used to be heated to 2120° Fah., in a reverberatory furnace, mixed with zinc and charcoal. In front of the door stood two or three workmen, who, with huge iron pokers, kept up a continual agitation of the molten mass: brutal work, but now gradually disappearing. In England a rotating furnace is used, which consists of a horizontal cylinder, 16 feet long by 10 feet in diameter, on which a small steam engine impresses the movement of rotation about its axis. This is traversed from end to end by the flame from the hearth, and the matters, violently agitated, react upon each other without requiring the muscular force of man.

In the production of the potassic compounds, we probably meet with the most remarkable progress presented by the modern history of chemical industries. The ash left by wood, burnt in our fireplaces, is no other than a mixture of calcareous compounds, insoluble in water, and soluble salts of potash, among which the carbonate predominates. This mode of making potash from wood now only exists in America, Hungary, and Russia, and bids fair to become entirely extinct. The sources from which potash is now derived are, first, the sugar industry. A sugar beet of 4-4 pounds weight contains from 15 to 30 grains of potassic compounds. From the molasses, these in concentrated form are obtained. The molasses by fermentation is formed on the one hand into alcohol, which is obtained by distillation, and on the other into distiller's wash, which, evaporated and calcined, reproduces in the saline state the potash which the beet originally held fixed in its tissues; 6,000 tons of potassic compounds, valued at \$6,000,000, are thus annually obtained. But even this vast amount would not suffice for commerce, and hence we turn to a second source, sea water. In every quart there are 375 grains of marine salt (chloride of sodium) and 15 grains of chloride of potassium. Imagine, now, this sea water introduced into salt marshes, over immense areas, and left to evaporation. The salt is finally deposited in a crystalline state, and when some 3 inches thick it is gathered. Formerly the mother water, rich in potassic compounds, was drained off and wasted; but by M. Balard's refrigerating processes, the valuable potash is now extracted. The discovery of large mines of rock salt in Stassfurt, Prussian Saxony (where it was only necessary to hew out the potash mineral, the carnallite, with the pick axe, and boil it with a little water, to obtain chloride of potassium almost pure) dealt a powerful blow to the French industries; but after a ten years' contest, the latter, by the aid of improved processes, are again firmly established in commerce. From 10,000 to 12,000 tons of potassic compound are now produced yearly at Camarque, France.

M. Gérard continues at some length regarding ammoniacal compounds, phosphates, sulphate of ammonia, etc. A few facts relative to the progress realized, by industries which make use of chemical products, will serve as a conclusion for our *resumé* of his discourse. As regards paper, it is stated that the production in 1873 was 143,000 tons. Each Frenchman consumes annually in different forms more than 6-9 pounds of paper, and the entire amount yearly used in France would be sufficient to encircle the earth at the equator with a belt 192 feet wide.

The cultivation of wine in France covers 60,000,000 acres. Owing to the ravages of the *oidium* between 1850 and 1860, the production fell from 115 to 73 quarts per head per annum. Brief notice is made of the present trouble with the phylloxera. As regards the sugar beet industry, the yield for 1873 is stated at 495,000 tons.

Operations of the Patent Office in 1873.

The annual report of the Commissioner of Patents, for the year ending December 31, 1873, shows the following:

Number of applications for patents during the year 1873.....	30,414
Number of patents issued, including reissues and designs.....	12,564
Number of applications for extensions of patents.....	378
Number of patents extended.....	231
Number of caveats filed during the year.....	3,248
Number of patents expired during the year.....	4,452
Number of patents allowed but not issued for want of final fee.....	2,783
Number of applications for registering of trademarks.....	534
Number of trademarks registered.....	492

Of the patents granted, there were to—

Citizens of the United States.....	12,371
Subjects of Great Britain.....	241
Subjects of France.....	64
Subjects of other foreign governments.....	88
—	12,864

STATEMENT OF THE PATENT FUND.

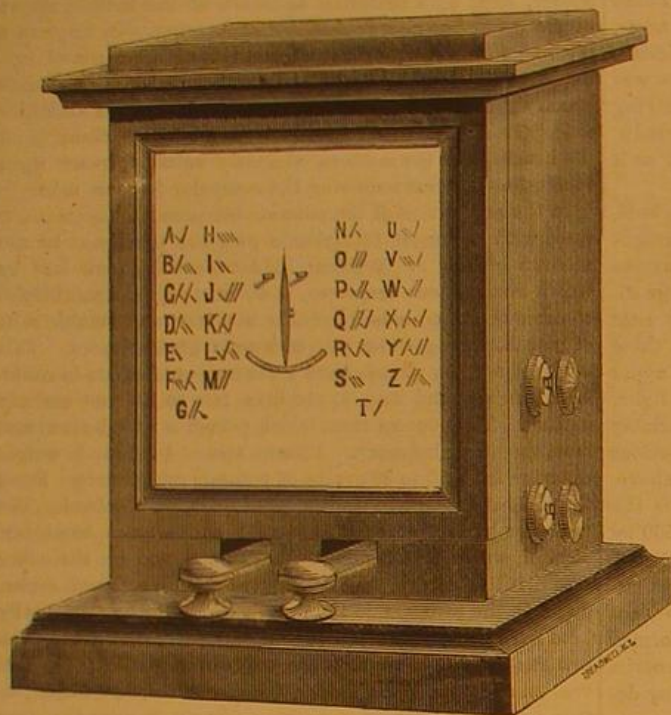
Amount to the credit of the patent fund, January 1, 1873.....	\$794,111 42
Amount of receipts during the year 1873.....	703,191 77
Total.....	1,497,303 19
From which deduct expenditures for the year 1873.....	691,178 98
Balance January 1, 1874.....	\$806,124 21

A NEW Bunsen gas burner has been recently invented, which gives a heat of about 3,000° Fah. A furnace of thirty burners generates steam enough to run an engine of one and a half horse power.

THE ENGLISH TELEGRAPHS.

The apparatus employed upon the English lines embraces almost every form which has ever been practically used, but the bulk of the traffic is performed with the Morse ink writers, the greater part of which are worked in connection with the double current key and Siemens' polarized relay. The speed of these instruments depends mainly upon the skill of the operators who work them, being generally about the same as that of the Morse recording apparatus employed upon our own lines. The speed of the Bright's bell apparatus is about the same as that of the Morse sounder, depending, like the latter, upon the skill and experience of the operators. "I timed the operator at Edinburgh," says a correspondent of the *Journal of the Telegraph*, "and found him receiving by the bells at the rate of 33 words per minute." The Hughes type printing instruments are only used to a limited extent in England, and the speed attained is not much in excess of the Morse sounder. The instruments are carried by weights, and the type wheels make about 120 revolutions per minute, or a little more than half the speed of the Phelps combination instrument.

FIG. 1.



Wheatstone's automatic instruments are employed upon 33 message circuits, varying in length from 159 to 515 miles each, and upon six new circuits, varying in length from 166 to 475 miles each, making a total of about 11,000 miles.

The speed of these instruments varies from 38 words per minute upon the London and Cork circuit, to 120 words per minute upon the London and Liverpool circuit. The average speed of the apparatus is about 70 words per minute, or about twice as fast as the speed of a first class sound operator. The time occupied in the preparation of the messages for transmission depends somewhat upon the skill of the operator, but an expert clerk will easily prepare them at the rate of 25 words per minute. The automatic system, as compared with the Morse, requires rather more than double the number of clerks to do a given amount of business, and, therefore, for distances less than 200 miles, it is cheaper to put up additional wires than to make use of it.

The automatic system finds its most appreciative use in forwarding press messages, which are transmitted over several circuits in succession with only one preparation.

The single needle instrument, of which there are over three thousand employed on the English lines, is one of the simplest forms of telegraph apparatus in use, being simply a combination of a vertical galvanometer or galvanoscope, and a current-reversing key.

Fig. 1 represents the exterior of the instrument. In the center of the face is suspended the index or pointer, attached to the magnet, which can deflect only a short distance to the right or left of its zero, on account of the stops. The alphabet is formed by movements of the needle or pointer to the right or left. A turn of the top point of the needle to the left indicates a dot, a turn to the right a dash. Thus A is made by a movement to the left and one to the right; H by four movements to the left.

The interior of the apparatus consists of two helices of fine silk-covered copper wire, in the middle of which is suspended a small magnetic needle, having at the end of its axis a pointer, seen on the outside face of the instrument. There is also a current, changing key, the two knobs of which protrude through the front of the instrument near the base. The key is represented in Fig. 2. L and E are two levers connected respectively with the line and with earth. When they are not depressed, they both press against the upper bar, C, which is connected with the positive pole of the battery. Either lever can be depressed so as to come in contact with the bar, Z, which is connected with the negative pole of the battery. If L is depressed, a negative current flows into the line; and if E is depressed, a positive current flows into

the line. The receiving instrument at the other end of the line is so constructed that the depression of the left hand key causes a deflection of the pointer to the left; a depression of the right hand key, a deflection to the right. The needle, S N, and pointer, a b, are shown in Fig. 3.

FIG. 3.



The alphabet used in England contains precisely the same combinations as the Morse alphabet, but differently expressed.

THE HEBERLEIN BRAKE.

Herr Von Heberlein, Locomotive Superintendent of the Royal Bavarian States Railway, has recently invented a novel railway brake which, it seems, is eliciting considerable attention on the continent. The device, which we find described in the *Engineer*, is not a continuous brake, though it may be fitted to every vehicle in the train. The inventor prefers to divide the train into sections, including one brake car in each, and the operator in this car can apply the brake to his own coach, and to one or more others in connection with it.

The brakes are applied to the wheels by the agency of a friction pulley which engages with a friction wheel on one of the axles of the engine or of the brake car above noted. The revolution of this friction wheel winds up a flat link chain, like that of a watch, and this, pulling on a set of rods under the carriages, applies the blocks to the wheels. The pulley is of iron, but the friction wheel on the axle is built up of wooden segments, with grain radiating, and jammed between two plates set up tight with screws and nuts. The wheels of the brake car are not intended to stop running. The friction wheel instantly revolves, and its friction against the iron pulley supplies the force which applies the brake.

The mode of throwing the apparatus into action is exceedingly simple. A line extends over the roofs of the seats from end to end of the train. By pulling this cord, a detent is thrown out of gear, and the friction pulley, which is hung on a weighted

bell crank lever, is suffered to fall into contact with the friction wheel on the axle, and the brake is applied as soon as the train has run far enough to wind up the slack of the chain. The cord is kept taut, so that in case a car run from the track or become detached, a strain is brought upon the line and the brakes instantly applied. Similarly also the same effect can be produced by any of the employees about the train, as readily as they can now pull the ordinary bell cord.

The *Engineer* says that, on trials with the invention on an English railway, no jar was apparent on the application of the brake, which was fitted to the two cars at each end of a train of five. On the first test all the brakes were applied, both to the engine and train, up an incline of 1 in 123, and round a curve, speed about 35 miles per hour; train stopped in 135 yards, and in 19 seconds. Another case is given on the Royal Hanoverian Railway, with a train weighing 76 tons, with 17 axles, to eight of which the Heberlein apparatus was applied, when the train, traveling 35 miles per hour, was stopped on a down grade of 1 in 64 in 25 seconds.

SOUTH AFRICAN WONDERS—EXPLOSIVE DIAMONDS AND TURTLES WITH TEETH.

Diamonds liable to explode spontaneously, and turtles provided with canine teeth, are two natural marvels indigenous to the fields of Southern Africa. The former are found at the present time, the latter existed ages ago, and are recognized by their fossil remains which have been discovered in the same deposits with the gems. One of these disintegrating diamonds is represented in our first engraving in its natural size. It is a rounded octahedron, imbedded in a conglomeration of fine grained sandstone. Some idea may be gained of the richness of the South African beds from the fact, it is stated, that more than three thousand diamonds have been found during the past eight months. The mines are of two distinct kinds; the first, called "dry," are located in the centers of plains, and consist of layers of rock, in which the precious stones are mingled with garnets, pyrites,

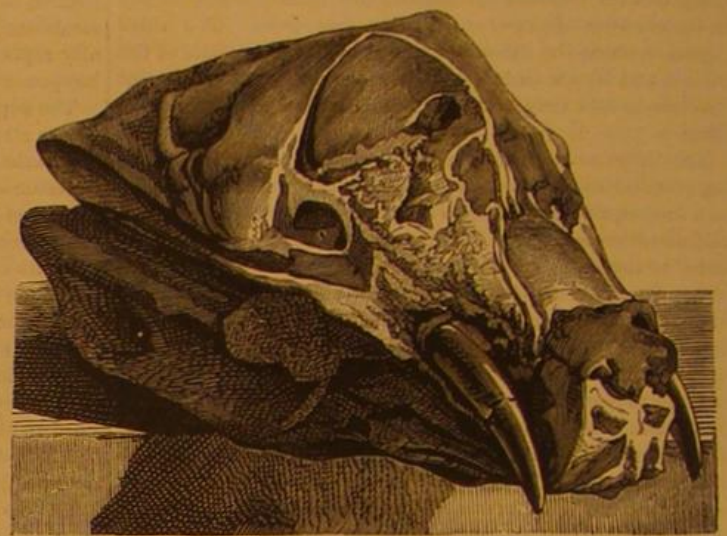


EXPLOSIVE DIAMOND, IN ITS NATIVE SANDSTONE.

the others, termed "river mines," are established on the beds or banks of water courses, and the diamonds in these are mixed with agates, emeralds, and chalcedony. In both, however, the gems are rarely found other than in a fragmentary state, and this is ascribed to the strange peculiarity of the finest and largest stones in suddenly disintegrating or exploding. Ordinarily rupture takes place during the first week after the diamond is brought to light, but cases are known where it has occurred three months subsequently. It is said that covering the stone with tallow will prevent the trouble; but of course, if the grease has to remain permanently upon the diamond to preserve it, its value is destroyed.

Although the geological age of the African diamond fields has not been absolutely fixed, it is generally believed that they date from the triassic epoch. In the strata are found the remains of crocodiles, denosaurs, labyrinthodonts, and other monsters of antiquity, but the most interesting and curious are those referred to in the beginning of this article. The skull, from which our engraving was made, strongly resembles that of the turtle, but it has two long tusks analogous to those of the walrus. Professor Richard Owens, who has profoundly studied this remarkable fossil, believes that the animals, or *dicynodontes* (the name is derived from the Greek, and means literally two dog's teeth), were, when living, oviparous, cold blooded, and yet with pul-

monary respiration; and he also recognises peculiarities which ally them closely to the lizard family. Huxley is of opinion that they were provided with long tails. The peculiar genus to which the reptile, the remains of which our engraving represents, belongs is termed *ptychognathus*, and the species, *depressus*. The bones are not perfectly preserved, and were found in hard sandstone of fine grain and greenish color. In the lower jaw two cavities are noticeable, resembling incisive alveolae which may be really rudimentary teeth. The characteristics of the animal are remarkable from the fact that they seem borrowed from those of creatures most widely separated in Nature. As a whole, the bones indicate a reptile between the lizard and tortoise. That is, the forward portion of the head resembles that of the former; and the edges of the edentulated jaws, covered during life with a bony covering like a beak, relate to the latter. The oblique manner of opening the mouth recalls the same peculiarity in certain fish. Huxley, on the other hand, asserts that the nostrils and various points in the osteology are those of birds. The tusks are more analogous to the teeth of mammals, while the sutures of the skull resemble those of the latter, and are never met with in the case of reptiles.



FOSSIL SKULL OF A TURTLE WITH TEETH.

Sunday Science.

There exists in Switzerland a "Society for the Observance of the Repose of Sunday" (*literatim*), and this body invites the views of the world generally on the subject of resting on the Sabbath, considered from a hygienic point of view. A prize of two hundred dollars is offered to the author of the best essay on the question. The points requiring especial discussion are: (1) The favorable effects of rest on Sunday on people of various ages, and their influence on the family and the nation. (2) Diseases which may be engendered or increased by continuous work in persons who, by the nature of their calling, are deprived of this weekly recreation, as, for instance, railroad employees, journalists, telegraph operators, bakers, etc. (3) Practical results drawn from the observation of cited facts. The essays must be written in French or German, and sent in, before September 30th next, to the President of the above named society, at Geneva, Switzerland.

THE NEW AUSTRIAN ATHENÆUM.—An institution destined to survive the Vienna Exposition, and at the same time to serve as a memorial of that event, is the Austrian Athenæum, an establishment founded in the interest and for the instruction of mechanics and working men, and constructed after the plan of the *Conservatoire des Arts et Métiers*, in Paris. Large numbers of articles left by exhibitors at the Exposition have been transported thither, together with a quantity of models and other instructive apparatus, and a library of 3,412 volumes.

MORE valuable and practical information is furnished to the readers of the *SCIENTIFIC AMERICAN*, through the correspondence columns of this paper, than can be obtained from any other source.

THE SIAMESE TWINS.

The autopsy on the bodies of the Siamese twins has, at last, been consented to by the relatives, and the remains have been transported to Philadelphia. A commission, consisting of Drs. Pancoast, Allen, and Andrews, recently visited the place of residence of the twins, and, after considerable persuasion, succeeded in overcoming the scruples of the two families. The bodies, which had been deposited in cases packed with charcoal, were removed from their temporary sepulcher and carefully examined. Slight change had taken place in their appearance; but as the rapid setting-in of decomposition was feared, the physicians decided to postpone operations until the remains could be taken to Philadelphia, where every facility for a thorough investigation would be at hand. A number of photographic views were accordingly taken, after which a partial embalment was completed, when the bodies were packed into an airtight tin chest and forwarded to their destination. At the time of writing the dissection has not been completed, and public curiosity, now fully aroused regarding the matter, will look with much interest for the forthcoming report. The main question to be decided will be settled as soon as the knife severs the connecting ligature. Opinion now inclines principally to the belief that the strange band contains a large artery and many veins, which made the circulation in both bodies identical. This was the view held by many eminent British surgeons, Sir Benjamin Brodie among the number, and appears to be substantiated by the fact of a compression of the ligature causing the fainting of the weaker brother. On the other side is no less an authority than Nélaton, the great French surgeon, who always maintained that separation could be safely effected, while the family physicians of the twins consider that the circulation in either body was entirely independent from that in the other. The post mortem, in deciding this interesting point, will also necessarily determine whether Eng died from the shock due to the realization of his brother's death, or from a cessation of the flow of his blood.

The illustration which we give herewith conveys an excellent idea of the appearance of these remarkable people. They were of decidedly ugly faces—our picture rather flatters them—and were far from amiable in temperament. Eng was the smaller, and generally stood in the peculiar position represented, bent somewhat backward. The details of their early history are somewhat meager. It is said they belonged to a low order of peasantry, and were born in Siam in 1811. Captain Abel Coffin, of Newburyport, Mass., found them in the city of Meklong, and bought them from their mother. In 1850 Barnum brought them before the world, since which time they have been exhibited throughout this country and Europe. Their subsequent history we have already sketched in a previous notice of their death.

How to Keep a Situation.

An observing correspondent in the *Western Rural* gives the following hints on the above subject:

Be ready to throw in an odd half hour or an hour's time when it will be an accommodation, and don't seem to make a merit of it. Do it heartily. Though not a word be said, your employer will make a note of it. Make yourself indispensable to him, and he will lose many of the opposite kind before he will part with you.

Those young men who watch the clock to see the very second their working hour is up—who leave, no matter what state the work may be in, at precisely the instant—who calculate the extra amount they can slight their work, and yet not get reproved—who are lavish of their employer's goods—will always be the first to receive notice, when times are dull, that their services are no longer required.

The Telephon.

This instrument, popularly known as the "steam jackass," is the invention of a farmer in Illinois. This gentleman was the owner of a mule possessed of unusual ability for producing sweet sounds, it having been ascertained that his voice could be heard over a circle of eight miles diameter. The mule was killed, and the inventor severed the head from the body. The head was then carefully preserved from decay, and the inner organs were covered with a substance that was impervious to steam. We are indebted to the *Brooklyn Eagle* for a description of the first trial of the invention.

"A short piece of rubber hose was attached to the windpipe and connected with a steam boiler. It was a moment of agony to the inventor, as he placed the head in the hands of an assistant and slowly pulled the valve open, a moment of thrilling interest; as the steam was turned on, it passed into the windpipe, expelling the air and producing a sigh followed by a groan, a snort, a chuckle, then a violent coughing and sneezing. As a full head of steam was turned on, the most fearful noise, the most frightful guffaw, the most vociferous bray, that ever assailed mortal ears was produced. The lips were contracted, disclosing a terrible array

of teeth; the features developed a satanic grin, and the jaws rose and fell as the steam crowded the passages; and the ears participated in the general movement, giving to the head an excited and animated appearance. The man who was holding the head gazed upon it a moment with dilated eyes, colorless cheeks, knocking knees and protruding tongue; then, suddenly losing all interest in the performance, he emigrated. As for the inventor, his success ex-

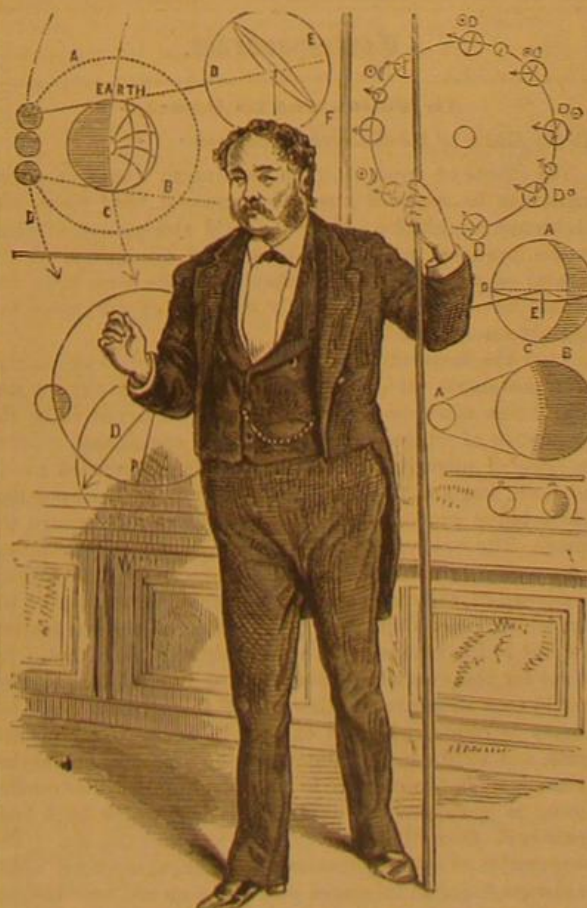


THE SIAMESE TWINS.

ceeded his most sanguine expectations. For an instant he contemplated the head, his countenance working with every manifestation of intense delight; then he, too, started, probably to learn the greatest distance to which that voice would penetrate."

PROFESSOR R. A. PROCTOR.

There are few instances on record of a man attaining so distinguished and, withal, so well earned a reputation, in so



short a period of time, as that of the eminent astronomer who has recently delighted the public of this city with his admirable lectures on the wonders of the heavens. Professor Proctor is now in the thirty-seventh year of his age; and although he gained honors in his collegiate course, and at-

tracted some attention by literary efforts as early as 1863, it was not until 1865 that he definitely adopted the profession in which he is now universally admitted to be one of the ablest masters. To his celebrated controversy with the English Astronomer Royal, regarding the proper method of observing the coming transit of Venus, ending in the virtual defeat of the latter, and the subsequent corroboration of Professor Proctor's views by the first American, Russian, and German astronomers, we have already found occasion to allude; and with his published works, the clearest popular expositions of modern knowledge regarding the constitution of the celestial bodies extant, we presume our readers to be already familiar. His books are a remarkable combination of lucid and vigorous expression with scientific accuracy; and while never superficial, their subjects are treated, even when most abstract and uninviting, in a semi-imaginative manner, which lends to them a charming freshness and interest.

Professor Proctor's most recent work is a collection of essays on topics more of a general than of a purely scientific interest. Lack of space at present at our disposal prevents our here alluding to the "Border Land of Science" in such detail as we could wish, and hence we reserve its review for a more fitting opportunity. We may remark, however, that the author undertakes, in its pages, voyages to the sun and to Saturn, tells about life in Mars, and even ventures into the shadowy realms of ghosts, only, however, to demolish those vagaries of the brain, by the bright light of scientific investigation and logical deductions of cause and effect.

Professor Proctor is of genial and pleasant appearance, and is a fluent and ready speaker. His lectures are excellent even as literary efforts; and although in some instances technically above the ordinary scientific discourse as usually adapted to the comprehension of a general audience, they nevertheless are so agreeably delivered and so brilliantly illustrated, that the interest of his hearers is kept constantly alive from beginning to close. An artist contributes a sketch as he appears upon the platform.

To Destroy Insects.

Hot alum water is a recent suggestion as an insecticide. It will destroy red and black ants, cockroaches, spiders, chintz bugs, and all the crawling pests which infest our houses. Take two pounds of alum

and dissolve it in three or four quarts of boiling water; let it stand on the fire until the alum disappears; then apply it with a brush, while nearly boiling hot, to every joint and crevice in your closets, bedsteads, pantry shelves, and the like. Brush the crevices in the floor of the skirting or mop boards, if you suspect that they harbor vermin. If, in whitewashing a ceiling, plenty of alum is added to the lime, it will also serve to keep insects at a distance. Cockroaches will flee the paint which has been washed in cool alum water. Sugar barrels and boxes can be freed from ants by drawing a wide chalk mark just round the edge of the top of them. The mark must be unbroken or they will creep over it, but a continuous chalk line half an inch in width will set their depredations at naught. Powdered alum or borax will keep the chintz bug at a respectable distance, and travelers should always carry a package of it in their hand bags, to scatter over and under their pillows, in places where they have reason to suspect the presence of such bedfellows.

The Taylor Steam and Hydraulic Cotton Press.

About a year ago, we illustrated an improved form of steam and hydrostatic cotton press, the invention of Mr. John F. Taylor, of the Phoenix Iron Works, Charleston, S. C., and in the accompanying description, page 15, volume XXVIII, the reader will find a full explanation of its working. The power is transmitted to the oil, water, or other liquid in the press from the pistons of two steam cylinders, which act upon the plate alternately, one imparting the initial and the other the finishing pressure. The latter is operated by live steam from the boiler, and the former is actuated by the exhaust. The steam is thus used twice over, on the compound principle, thus effecting no inconsiderable saving of fuel.

One of these machines has recently been erected in the warehouse of Mr. E. C. Pentz, foot of West 11th street, in this city, where it is now in operation re-pressing cotton for shipment. The motion of the apparatus is uniform and entirely free from jar, and its capabilities are stated as extending to the pressing of 100 bales of cotton per hour. The inventor submits testimonials to the effect that 700 bales have been pressed in a working day of ten hours. The power of the machine is 2,006,400 lbs. under 80 lbs. of steam. A continuous and steady pressure, we understand the inventor to assert, is maintained so long as steam is kept up in the boiler. The construction is strong and simple, and there appears to be a notable absence of pumps, valves, and other portions liable to be quickly worn out.

The sand blast is said to work well in cleaning the walls of iron and stone buildings.

Geographical Progress in 1873.

Judge Daly, in an able address before the American Geographical Society in this city, of which he is the President, recently reviewed the progress of explorations and other efforts toward increasing our geographical knowledge, made during the year just ended. The lecture was an exhaustive review of the whole subject and a summing up of the results obtained. The utility of geographical societies as organized means of promoting geographical discovery, as well as the necessity for their existence, is proved from the fact that there is yet one seventeenth part of the globe of which we know nothing except by conjecture.

The region which surrounds the south pole, the antarctic, covers an area of 7,000,000 of square miles. The arctic measures nearly 3,000,000. The unexplored portion of Africa may be put down at least as 1,000,000. The unknown part of Australia is certainly more than two thirds of that amount; and in this connection, attention may be drawn to the great islands of the East Indian Archipelago, stretching from the northeast corner of Asia to New Zealand, occupying the most favored part of the earth, and which have in extent, the magnitude of a continent. One of this great group, Borneo, is considered the second largest island on the globe. A strip along the coast of about 100 miles deep represents what we know of it; the interior and larger portion remains unknown. So also of Papua or New Guinea, which is as large and may even be larger than Borneo. Sumatra is 1,000 miles in length, and Celebes and Luzon are inferior only to Sumatra; and there are in addition numerous islands of considerable size, some as large as Ceylon, and thousands of minute islands, many abounding in spices and mineral ores.

Regarding recent

ARCHAEOLOGICAL DISCOVERIES.

the speaker stated that late excavations made in Rome have revealed that the ancient city, before the Republic, in the time of the kings, was large and strongly fortified, and must have contained an immense population. This is contrary to the impressions of modern historical critics. The foundations of the ancient city have been laid open, which consist of enormous works, many of which were great tanks and wells. The foundations are constructed of oblong blocks of tufa, put together without mortar, the style of building being the same as found in the ruins of Etrurian cities.

Dr. H. Schlieman terminated his excavations upon the supposed site of Troy last summer. He thinks that he has discovered Skaean gate, Priam's palace, and the great wall described by Homer. He writes of his discovery of a great wooden box containing jewels, precious stones, ornaments, and arms, such as battle axes, shields, and an immense goblet of pure gold, with two handles and two mouths, which box, he says, has disappeared. In the island of Delos a whole temple has been laid bare and the ruins of a whole city discovered, and additional excavations, attended with important discoveries, have been made in Pompeii.

A stone has been found on a farm in Parahyba in Brazil containing an inscription, which, upon examination, was found to be in Phœnician characters, which would prove that the Phœnicians had visited America at a very early period.

After fully referring to the various surveying expeditions in Central and South America,

ASIAN EXPLORATIONS

were noted, and it was stated that the Russian campaign which culminated in the capture of Khiva has produced valuable geographical results. The most important information of changes is the addition of the right bank of the Oxus to the Russian dominions, embracing the country north of that river, east of the Sea of Aral. Forty thousand slaves have been liberated in the conquered territory, and slavery has been abolished for ever.

Mr. Jacob Halevy has explored the southern part of the Arabian Peninsula, through the interior of Yemen, a country little known and where traveling is perilous. His journey extended from Hodeghda, on the Red Sea, in a northerly direction, through the Wadi Flabouna, 18° 55' north latitude.

In this part of the country he found many Sabœan inscriptions, and saw the source of the River Kharid, which runs toward the interior of Arabia and disappears, after fertilizing the numerous oases of the Djaouf. He believes this to be the river which is alluded to in a passage of Strabo as having been crossed by a Roman army, Aelius Gallus, before entering the country of the Sabœans. Innumerable ruins in a crumbling condition, he says, cover the soil on the banks of the Kharid and its affluent, the Medheb.

THE ANCIENT JERUSALEM.

Concerning the explorations in Jerusalem, the speaker said:

The details of this work, which occupied nearly three years, are too numerous to enter upon; shafts were sunk below the present city in various places to a considerable depth, and discoveries were made of extensive subterranean passages and galleries, winding aqueducts and canals which were cut in the solid rock, chambers, drains, sewers, wells, and tanks. A stream of running water was found, showing that fountains exist far below the surface, and are still running, a circumstance of interest, as there is now a dearth of water in Jerusalem. Inscriptions in the Phœnician characters in red paint were found upon walls, and many objects of interest were gathered, such as lamps, pottery, weights, seals, gems, and sepulchral chests, some of them very beautiful, containing human remains. An attempt was made to determine the exact position of parts of the Temple and the

site of Solomon's palace; but while the investigations have had the effect of disturbing many of the previous theories as to the precise locality of places, they have not been sufficiently certain to remove doubts, or dispense with further inquiry.

THE PENINSULA OF SINAI

has been surveyed by Professor Palmer and Dr. Drake, and they conclude the locality to be the scene of the events recorded in the history of the Exodus, and its examination has certainly furnished a remarkable corroboration of the truthfulness and accuracy of the Biblical history. The country is extremely wild and rugged, and has one of the most complicated systems of drainage in the world. Formerly it was well wooded, its mountain sides terraced with gardens; its rushing waters regulated and utilized; and this fertility lasted until comparatively modern times. Jebel Musa is considered to be undoubtedly the Mount whence the Law was delivered.

PALESTINE.

The country lying east of the Jordan and of the Dead Sea has been undertaken by the American Palestine Exploration Society. It embraces the part of Palestine which is the least known, and is in territorial extent three times as great as the country surveyed by the English. It abounds in ruins, inscriptions and objects of great interest, and its exploration will undoubtedly throw a great deal of light, not only upon Biblical history but upon the former history of the whole country lying midway between Ancient Assyria and Egypt.

Lieutenant Steever has spent about five months in explorations east of the Jordan. He has surveyed about 600 square miles, and has prepared a very valuable map. The explorations were in Edom and Moab. Various sites have been satisfactorily identified, and the positions of Mounts Nebo and Pisgah determined. The levels of many important spots were taken, a number of ruins in Moab examined, and interesting inscriptions copied.

AFRICAN EXPLORATIONS

are represented to be less fruitful in positive results than those of former years.

MM. Compeigne and Marche have undertaken to penetrate Equatorial Africa in the vicinity of the Gaboon. Their object was to trace the course of the Ogoone and the lakes to which it is supposed to lead, one of which is reported to be very large. The last accounts of Dr. Gandy, the commander of the West African Livingstone Expedition, are that he left San Salvador, the farthest point in the Portuguese dominions, for the country east, which is nearly a blank upon our maps. A German expedition, organized by Dr. Bastian and the Berlin Geographical Society, left last spring for the exploration of Loango.

With a glance at the reports of exploring expeditions in Australasia, Judge Daly concluded his survey with a reference to the telegraphic event of the year, which he thinks has been the completion of a line of telegraph across the entire length of Australia, from south to north, from Adelaide in the south to Port Darwin in the north, a distance of 2,012 miles.

The completion of the telegraph across Australia gives a line, from Adelaide to Gibraltar, of 12,462 miles, of which 9,146 miles are submarine. The practical result is that Australia now receives news three weeks earlier than the latest brought by the mail steamers.

Correspondence.

Air Poison and its Remedy.

To the Editor of the Scientific American:

The effects of fresh air upon the human system are well known to be renewed strength, increased vital force, and heightened complexion; while the fetid atmosphere of close rooms produces pallor, weakness, and diminution of the mental capacity. It is remarkable that the same body, air, should have such diametrically opposite effects under but slightly altered conditions.

After the discovery, in the last century, of the composition of atmospheric air—which is about one fifth oxygen and four fifths nitrogen—it was ignorantly believed to be the absorption of oxygen by breathing, and consequent relative increase of nitrogen, that made the air of crowded rooms noxious; but analysis abolished this idea, and proved that the relative proportions of the two gases are always the same. The oxidation of the carbon supplied by our food causes the gas exhaled from the human frame to be largely composed of carbonic acid; but the chief impurities of the air, which cause decay and putrefaction of organic matter, are the living vibrios, which multiply so rapidly that, were it not for the eternal compensation of natural forces, they would soon suffocate all other life off the earth. Their fell enemy is ozone, which is oxygen in a negatively electric state, and exists in our atmosphere in a proportion varying from one ten-thousandth to one one-hundred-thousandth. Ozone is generated by lightning flashes, which have been truly said, from time immemorial, to clear the air. The evaporation of saline solutions also disengages ozone, which is always found in increased proportion on and near the sea. Being more dense, and one and a half times more heavy, than oxygen, it descends to the earth, from which the vibrios ascend. It has also a strong phosphoric smell, and has the important property of combining with all bodies, except gold, platinum, and water. This property is its great weapon in the destruction of the vibrios.

The open air is the space in which ozone continually rules,

while the vibrios have the supremacy in close and fetid places where ozone is very seldom or never recognized. Every breath we take in such places begins to poison and to weaken our system, while every breath in the open air neutralizes poisonous agents and renews strength. D.

The Aboriginal Americans.

To the Editor of the Scientific American:

There is, I think, abundant evidence that the osseous structure of the mound-building aboriginal peoples differed, to some extent, from that of all the present inhabitants of the globe, after making due allowance for individual peculiarities.

In my researches in this country, which was at one period densely populated by the mound builders, I have never seen anything resembling the short, strong bone running from the sixth cervical vertebra to the scapula, mentioned by Mr. R. K. Slosson, on page 244 of your volume XXVIII., and am inclined to look upon such a bone (if found) as a *luxus naturalis*; but I have found several bones that I am unable to classify or pronounce upon, among which are the submaxillaries, of which I wrote you some time since.

I have a genuine mound builder's skull, which, although somewhat decayed, is a marvel to all who behold it and contrast it with what we know of modern man. There are marks on the skull caused by the copper ornaments with which this once noted character (for such he undoubtedly was) was buried. The man who stood under that skull was probably a stranger to disease, and knew no such thing as fear. A rifle ball would hardly fracture or enter his head, if it were to strike it in any way but perpendicularly. There is a peculiar formation where the muscles of the neck were attached, such as none of us ever saw before. This skull is an object of deep interest, and most especially would I call the attention of all phrenologists to a specimen so rare. The copper crown, with which his head was discolored, was so far decomposed that I was unable to save it.

Yellowbird, O.

S. L. N. FOOTE, M.D.

Glue as a Healing Remedy.

To the Editor of the Scientific American:

For the last twelve or fourteen years I have been employed in a shop where there are over three hundred men at work; and, as is the case in all shops of this kind, hardly a day passes but one or more of us cut or bruise our limbs. At first there were but few that found their way to my department to have their wounds bound up; but after a while, it became generally known that a rag glued on a flesh wound was not only a speedy curative, but a formidable protection against further injury. I was soon obliged to keep a supply of rags on hand, to be ready for any emergency. I will here cite one among many of the cases cured with glue.

A man was running a boring machine, with an inch and a quarter auger attached; by some means, the sleeve of his shirt caught in the auger, bringing his wrist in contact with the bit, tearing the flesh among the muscles in a frightful manner. He was conducted to my department (the pattern shop), and I washed the wound in warm water, and glued around it a cloth, which, when dry, shrunk into a rounded shape, holding the wound tight and firm. Once or twice a week, for three or four weeks, I dressed the wound afresh, and it was well. The man never lost an hour's time in consequence. The truth of this statement hundreds can testify to. I use, of course, the best quality of glue.

Racine, Wis.

J. A. FIELD.

The Hartford Steam Boiler Inspection and Insurance Company.

This company's report for 1873 has recently been received. It is an unusually interesting and important paper, and the brief summary that we give below does but scant justice to its merits.

Inspections in 1873: Internal, 8,511; external, 23,312—total, 31,823.

Defects discovered: Furnaces out of shape, 599; cases of fracture, 1,003; burned plates, 682; blistered plates, 1,737; cases of deposit of sediment, 2,263; cases of incrustation and scale, 2,180; external corrosion, 818; internal corrosion, 333; internal grooving, 206; defective water gages, 561; defective blow-out apparatus, 253; defective or overloaded safety valves, 321; defective pressure gages, 1,470; boilers without gages, 682; cases of deficiency of water, 113; cases of loose and broken braces and stays, and insufficient bracing, 463—total, 13,866.

Boilers condemned in 1873, 178.

Boiler explosions in the United States in 1873, 88; number of persons killed, 139; number of persons wounded, 164.

Cases of distortion and fracture of furnace sheets occur from low water, deposits of sediment, and a cold water feed. It is economy to heat the feed water, because it both saves fuel and prevents wear and tear. Sheets are liable to be fractured, if boilers are blown down when heated. Blisters in plates occur from the use of iron which is not homogeneous. Blisters should be cut off; and if the thickness of the plates is much reduced, patches should be put on. The deposit of sediment gives the most trouble to steam users. When the feed water contains carbonate of lime, it will be deposited in a hard mass, if the boiler is blown down when hot; but it can be washed out, if the boiler is first allowed to cool. Grease in the boilers seems to combine with the carbonate of lime, and sink down upon the plates, keeping the water from them and causing overheating and burning. Feed water heaters, with separating plates or chambers, seem to work well when the water holds solid substances in solution. The deposits of sulphate of lime are the most

troublesome. Potatoes and slippery elm seem to prevent and remove scale in many cases. Substances containing tannic acid also seem serviceable with some kinds of water. There should be frequent blowing off when these solvents are used. Crude petroleum seems to prevent scale when the water is principally impregnated with sulphate of lime, but is not recommended where the carbonate of lime is the principal foreign ingredient.

External corrosion is frequently caused by the exposure of boilers to the weather, and by leakage and dripping. It is a bad practice to put ashes on top of the boiler, wood ashes being the most liable to produce corrosion. Coatings of felt or calcined plaster can be used with benefit. Ashes are frequently allowed to accumulate in the ash pits of boilers, and, becoming wet, produce corrosion.

Internal corrosion is caused by scale, or by acid in the water. If the latter occasions the trouble, the surest remedy will be to abandon the water and get a supply from another source. The dyes discharged from factories into streams frequently render the water unfit for use in boilers. This difficulty can sometimes be remedied by neutralizing the acid by the use of soda or soda ash. It should be remarked, however, that all the solvents and neutralizers mentioned above should be used with great caution, as their indiscriminate application is frequently productive of more harm than good.

Internal grooving or channeling probably arises from unequal expansion and contraction, in connection with the use of impure feed water. Glass gages are sometimes stopped up by a mixture of grease with the impurities of the water. The lever safety valve is most commonly used, and, under the care of a competent and reliable man, is all that is needed. It should, if possible, be so arranged that it cannot be tampered with. It should be raised every day, in order to prevent corrosion and sticking to the seat. Pressure gages should be tested every few months. The height of the water in a boiler should always be ascertained before starting the fire. It is not unusual to look after the fire first and the water afterward; and in many cases, boilers have been nearly ruined from this cause.

Many boilers are braced imperfectly, or not at all. Boilers are frequently left without examination for months, and the bracing becomes defective. Steam users take too many chances, under the advice of boiler makers who are ignorant or careless.

The above will be sufficient to show that there is no need of mysterious theories to account for boiler explosions. Boilers, with the best of care, will wear out, and the process is much hastened if they are improperly set and badly managed.

The Company employs about 30 inspectors, who inspect the boilers under their care quarterly and semi-annually. Defects, when discovered, are pointed out; and unless they are repaired, the Company's liability ceases.

SCIENTIFIC AND PRACTICAL INFORMATION.

ADULTERATIONS IN YELLOW AND RED CHROMES.

The yellow and red chromates of lead, employed as pigments, frequently contain sulphate of lead. This substance is insoluble in strong nitric acid, and in this way it can be detected; but a neater and more convenient method, proposed by Dr. Julius Löwe, consists in the use of hyposulphite of soda. The finely pulverized pigment is placed in a moderately concentrated, cold solution of pure hyposulphite of soda, when the sulphate of lead readily dissolves, leaving the chromate unacted upon. After filtering, the filtrate may be tested for lead by adding a solution of the neutral chromate of potash, when the yellow chromate of lead will be precipitated. If it is desired to ascertain the amount of the sulphate of lead present, it may be precipitated by sulphuretted hydrogen gas, or by sulphide of ammonium, as sulphide of lead, which is then purified and converted into sulphate of lead by the use of fuming nitric acid, and weighed. This method is preferable to the one depending on the insolubility of sulphate of lead in nitric acid, as proposed by E. Davillier recently, since there might be other insoluble adulterations present, as, for example, barytes.

THE DETECTION OF BLOOD SPOTS.

M. Sonnenschein states that tungstate of soda, strongly acidulated with acetic or phosphoric acid, throws down albuminoid matters from very dilute solutions. These precipitates, insoluble in a large excess of water, dissolve in alkalies, especially if hot. If defibrinated blood is treated with this salt, a red brown precipitate is formed, which becomes clotty on boiling. All the coloring matter is precipitated. To detect blood spots by this means on clothing, the suspected portion is cut off; and after having been treated with distilled water, the filtered solution is precipitated with the above reagent. The precipitate, washed and treated with ammonia, takes a reddish grey color. If phosphoric acid be present, it must be carefully washed away before treating the precipitate with ammonia.

THE TELEGRAPH IN CHINA.

The Great Northern Telegraphic Company has recently established a line between Woosung and Shanghai. Twenty words are sent for a dollar. This is the first successful attempt to introduce the telegraph through the main portion of the empire, as previous efforts have been met with violent opposition from the people, who cut the wires and destroyed the poles.

NITRITE OF AMMONIA.

M. Berthelot has recently succeeded in producing this body for the first time in a crystalline state. Nitrite of baryta is placed in sulphate of ammonia. The precipitated sul-

phate of baryta is collected on a filter, leaving the nitrite of ammonia in solution in the liquid. The crystallization of the latter cannot be obtained by heat, as the same causes a rapid decomposition of the substance; hence the liquid is placed under the receiver of an air pump, with very hygroscopic materials. In spite of these precautions, however, and although the operation is conducted at the freezing temperature, about two thirds of the product become decomposed. The balance, however, is pure nitrite of ammonia, crystallized in white needles. The body is remarkable for its explosive properties, detonating violently at 165.2° Fah., or by reason of a shock, with a force nearly equal to that of nitro-glycerin.

A CIRCULAR COMPASS NEEDLE.

M. E. Duchemer has addressed a note to the French Academy, in which he claims that a circular compass needle possesses the following advantages over the usual form:

1. A magnetic power, for a given diameter, double that of a needle whose length is equal to this diameter.
2. The existence of two neutral points instead of one, which has the effect of maintaining the position of the two poles constant; the magnetism seems to be so energetically preserved that even the strongest sparks of a Holtz machine do not cause any displacement of the poles of the magnet.
3. A more satisfactory means of suspending the magnet when it is well mounted and balanced by a plate of agate; it seems then to move as if placed in a liquid.
4. An increase in sensibility of the magnet proportional to its diameter.
5. The possibility of neutralizing the magnetism of the vessel by means of a second magnetic circle, changing the position by an amount calculated beforehand, and thus permitting the compensation of the compass before the sailing of the vessel. This idea was suggested by Captain D. Venie.—*Comptes Rendus*.

NEW EXPERIMENTS IN CONVECTION.

The phenomenon of convection of heat in a liquid, consisting in that the superior portion of the mass is always at a more elevated temperature than the lower part, can be clearly illustrated by the following novel experiments:

Two glass tanks are placed before a white surface; one is filled with cold and the other with boiling water. A solution of starch is freshly prepared in a large test tube, and, by the addition of an aqueous solution of iodine, colored a deep blue. The liquid is then warmed until this color just disappears, care of course being taken not to add an excess of iodine, which would prevent this action; and the tube is then plunged into the cold water. The blue color, brought back by the cooling, will appear first in the lower portion of the tube, and will gradually extend upward, thus proving that it is the lower portion of a warmed liquid which first becomes sufficiently cooled to cause a return of the tinge.

In the other tank, containing boiling water, a similar test tube, containing a blue liquid obtained by the addition in excess of caustic potash to a solution of sulphate of copper and tartaric acid, to which a little grape sugar is added, is placed. The formation of yellow oxide of copper begins at the surface of the liquid and descends gradually to the lower portions, showing that it is the upper part which first attains the temperature necessary to cause the re-action which precipitates the oxide of copper.

The Fireproof Building Company.

On January 12, a fire test was made of the Fireproof Building Company's concrete, at their works, corner of Corlears and Cherry streets in this city. Below we give the details, which will doubtless be interesting to our readers: The company had constructed a small house, and a model of a mansard roof. The latter was open at the top, and was made with wooden rafters, covered on both sides with the concrete blocks, the inner blocks being 1½ inches in thickness, and the outer ones, 2½ inches. The inner blocks were hollow, and the outer solid. A part of the outer covering was slated, and a small space was covered with plastic slate roofing, which consists of ground slate mixed with a residuum of coal tar until it acquires the consistency of common mortar, and is then applied with a trowel to a double layer of felting, the slate mixture having a thickness of about ½ of an inch. This was arranged so that the edges were not exposed, being covered by the common slate. A fire was made both within and around this model, and was allowed to burn for 35 minutes. During its continuance, loud explosions occurred, caused by the hard finish breaking off from the inside of the blocks, the material not having been thoroughly dried. When the fire was extinguished, it was found that the ordinary slate had crumbled to a serious extent, while the plastic slate was uninjured. The concrete blocks were apparently unchanged.

The next test was made with the house. This was a small building about 8 feet square, and the same height. It was built near the factory chimney, with a flue running into the chimney. The walls were 7½ inches thick, and an inside wall, also 7½ inches in thickness, was built on one side, a hole being made in the outer wall on that side, so that a thermometer could be inserted. The walls were made of solid blocks. The roof of the building was composed of wooden rafters, covered with solid blocks 4 inches thick, and having blocks, 2 inches in thickness, suspended from the bottoms of the rafters. The floor was constructed in a similar manner. A large fire was made in the house with logs soaked in oil, and was allowed to burn for 50 minutes. After the fire had been burning for 20 minutes, the inner wall had hardly become heated through. The space between the two walls was filled with steam after the fire got well under way. During this test a large block of concrete with three holes in it had a piece of wood put into one, some paper into the

other, and a handful of shavings into the third. The holes were then closed with cement, and the block was thrown into the fire, a bucket of oil being also thrown in immediately afterwards. After the fire was extinguished, a workman, reaching into the building, chipped away pieces of the floor and ceiling blocks. The beams were thus exposed, and they were found to be damp and scarcely warm to the touch. The large block was broken open and its contents were found to be in a similar condition. After this test, the visitors were shown a floor, built of these blocks, and weights were put upon it to prove its strength.

The blocks with which the foregoing experiments were made are composed of cement, consisting chiefly of the hydraulic lime of Teil, which is said to combine great strength with lightness. The blocks used for partitions have been found capable of resisting a crushing force of 800 pounds per square inch, and the weight of these blocks, 4 inches in thickness, is 11 pounds per superficial foot.

We should have stated that the fire was quickly extinguished by water at the conclusion of the tests, and that the blocks showed no signs of cracking, under this severe proof.

Those who have carefully perused the foregoing statements will see that these tests are not conclusive as to the fireproof qualities of the material. As a general rule, buildings do not take fire immediately after completion, and before the cement is dry. It would be interesting to see an experiment with this concrete after it had been thoroughly dried.

THE RIBBON POST.

The Ribbon Telegraph Post Company, of Manchester, England, have recently introduced a light and graceful form of iron pole or pillar, constructed as represented in the annexed engraving, extracted from *Iron*. The ribbons are made around a mandrel, which is provided on its exterior with spiral intersecting grooves. The latter form a receptacle for the ribbons, which are wound on by machinery, without twist or strain, and in such a manner that the gradual decrease of the pole is compensated for. The first series is put on from right to left, beginning at the bottom; the next, in the reverse direction, commencing at the top. The latter ribbons, of course, overlap, and are, at this stage of the operation, temporarily secured to those beneath them by bolts fitted in holes previously punched in both, so as to coincide exactly at the points of intersection.

The core of the mandrel is then removed, causing it to collapse, when the pole is withdrawn and placed upon a cylindrical bar, ready for the insertion of the angle irons. These, previously punched, are secured by rivets to the intersections of the ribbons, the temporary fastenings being taken out. The cap, the nature of which depends necessarily upon the uses to which the pole is to be devoted, is then put on; and the base, consisting of various forms, strengthened with extra iron and inserted, for some little distance, with the ribbon and secured to a plate which affords a strong support, is added.

The strength of poles thus constructed is said to be very great. Two, without angle irons, measuring 10 feet by 8 inches, supported a weight of 10 tons without sinkage, deflection, or collapse. The total weight of a telegraph post 31 feet long is about 434 pounds.

On rocky ground, these posts can be fastened directly to the surface of the rock; no lightning conductor or earth wire is required, since the poles are themselves conductors; no ladders are needed; they offer small resistance to the wind, and are ornamental and durable. It is suggested that they may be advantageously used as substitutes for the heavy iron pillars or clumsy wooden supports frequently employed in the construction of conservatories, porches, etc.

THE OHM.—The term "ohm" is derived from the name of the celebrated electrician who first ascertained the laws of electrical resistance, and is a measure of resistance of which it is the unit, in the same way as we use the inch or yard in the measure of length. The "ohm," as a unit of resistance, was adopted by a committee of the British Association, many years ago, and is now the acknowledged standard of resistance throughout the world. The ohm represents the resistance of about 210 feet of copper, wire No. 16, or galvanized wire No. 8, unexposed to disturbing causes and in a temperature of 60° Fah.

To pass our time in the study of the sciences has, in all ages, been reckoned one of the most dignified and happy of human occupations.—*Brougham*.



IMPROVED COTTON WORM DESTROYER.

The inventor of the device represented in our engraving proposes to exterminate cotton worms by ejecting a poisonous liquid over the plants on which they exist. To this end he has devised a novel apparatus, mounted on wheels, so as to be drawn by horses around the field, which is provided with mechanism by which the fluid is distributed in the form of a fine spray.

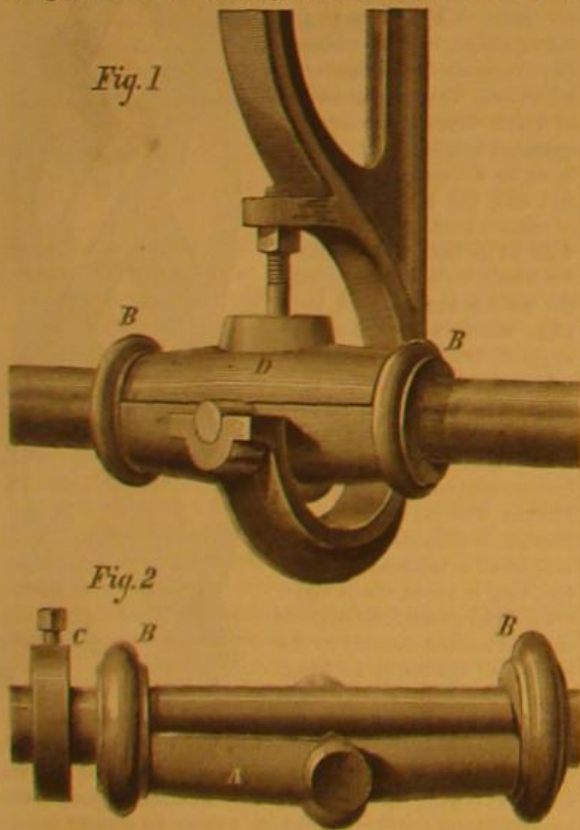
There is a large tank or reservoir, A, into which the poison is placed, and from which it is lifted by the double action force pump, B, into the two branches of a pipe, C, on top of the tank. The lever of the pumps is actuated, as will readily be understood from the engraving, by a pitman pivoted eccentrically on one of the wheels of the apparatus. From the pipe, C, the liquid passes through a suitable valve, by which its flow is readily governed, and into a horizontal tube, D, which runs transversely across the rear of the tank. To this tube are connected several shorter pipes, E, a section of one of which is represented in Fig. 2. In the interior of these attachments, which are of cast metal, are cut grooves, and their lower ends are closed by plugs of india rubber, which are secured by a rod and set screw. By means of the latter the stoppers can be tightened or loosened in the opening at will.

It will be seen that the liquid, being continually carried up by the force pumps, will, in passing through the lower end of the tubes, E, escape by way of the grooves, and assume the form of fine spray, which will penetrate and evenly distribute itself over the foliage of the plant. The wheels upon which the apparatus is mounted are smaller than those ordinarily used for wagons, and are attached to the tank by means of vertical bars. The machine is thus enabled to pass over the rows of plants without injuring the same; while, at the same time, the dimensions of the wheels are such as to give the required number of strokes to the pump lever necessary to the production of a constant and full volume of spray from the pipes, without auxiliary gearing. The action of the device is necessarily automatic, and hence but a single hand is needed to regulate the spray openings, admit or cut off the liquid, and guide the horse or horses attached to the machine.

Patented December 16, 1873. For further particulars address the inventor, Hon. J. W. Johnson, Columbus, Texas.

IMPROVED BEARING FOR SHAFTING.

In examining the annexed engraving, the reader will notice that the box through which the shaft passes (instead of being made in the ordinary manner, that is, divided longi-

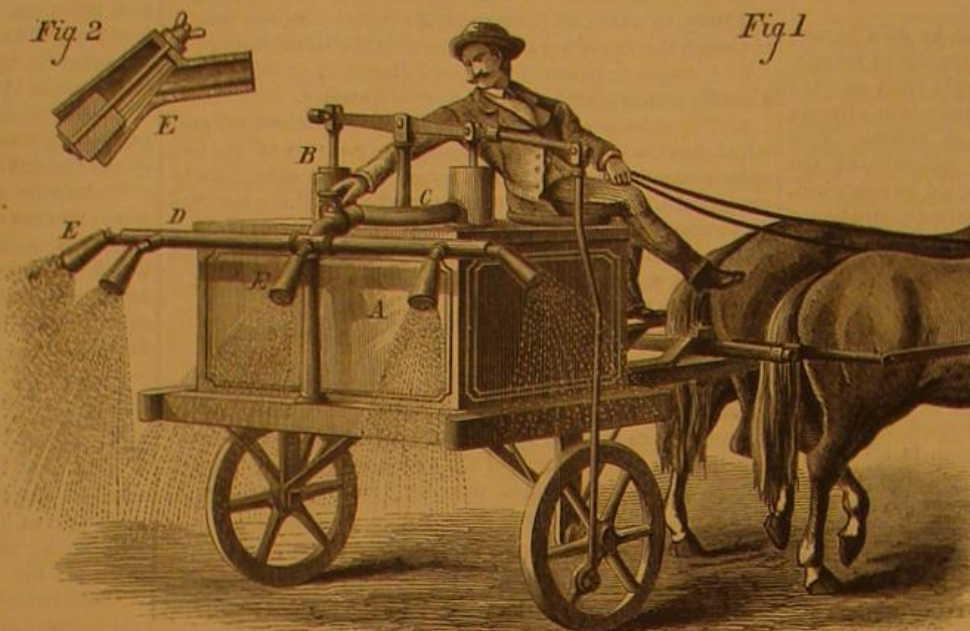


tudinally, and the halves united by bolts) is constructed of two portions of unequal size. The idea of the inventor is to produce a bearing, the ends of which, in taking against the usual collars or rings, secured to the shaft to prevent end motion of the box, shall not cause the unequal wear of the collars and the consequent disagreeable noise.

The lower portion of the box, A, Fig. 2, is cast hollow to fit the shaft, and in a single piece; while at its extremities rings, B, are provided to abut against the collar, C, on the shaft. These rings present a smooth surface to the collars, and hence exercise but very little wearing effect upon the same. In putting up a line of shafting, the box, A, has to be slipped over the end, the shaft passing through the rings which, of course, support the box when bearings are being fitted, and also during repairs, etc. The upper part of the

box, D, fits, as shown in Fig. 1, in the opening between the rings, B, and, if both portions are made with flanges, the bearing is readily attached together by bolts in the usual way.

In our engravings, however, these flanges are omitted, and the mode of securing the box in the hanger is clearly shown in Fig. 1. Lugs are cast upon the box, A, which fit in suitable sockets in the hanger; and an indentation with raised sides is formed upon the cover, D, into which a screw, passing through a projection on the support, is, by a nut, firmly turned. It will be noticed that the apparatus, while thus held tightly in place, can, by loosening the screw, the work



JOHNSON'S COTTON WORM DESTROYER.

of a minute, be quickly opened for any purpose. In practice, the apertures in all boxes of the same size are designed to be of similar dimensions, so that all the covers may be cast alike, and hence all fit any one box. The inventor states that the difficulty often met with in losing line by taking off the ordinary boxes and then replacing them accidentally end for end, as may easily be done, is here necessarily avoided, as the lower portion of the bearing is always on the shaft, unless removed over the extremity. The interior of the box is lined with the usual Babbitt or other suitable metal.

Patented December 16, 1873. For further particulars, address Messrs. Pierre J. Hardy & Co., 156 West 19th street, New York city.

Manganate of Baryta as a Green Pigment.

The manganate of baryta, possessing a handsome green color, has attracted the attention of color manufacturers; and it has been proposed to employ it as a pigment. Two methods of preparing it have been published: One consists in igniting together the nitrate of baryta and manganese oxide or dioxide; the other consists in fusing a mixture of pyrolusite or black oxide of manganese, caustic baryta, and chlorate of potash. By either process a green mass is obtained, but the second method seems to yield a more beautiful and homogeneous product. In experimenting with other and more direct methods for preparing a baryta green of great purity and beauty, Fleischer has made several observations of its properties not generally known, which will, we think, prove of interest to our readers.

If a green solution of manganate of potash be precipitated while boiling, by chloride of barium, a heavy, granular, but not crystalline, precipitate of manganate of barium is obtained. This precipitate has a violet color, approaching blue, can be washed by decantation at first, and afterwards may be collected on a filter. On drying the precipitate, its color grows lighter with the increase of temperature; and on being heated to a dark red heat, it looks almost perfectly white, with only a shade of grayish blue. If then it be heated still higher with free access of air, or in an oxidizing flame, it gradually turns green; by carrying the process farther, the color becomes a beautiful greenish blue, and finally at a very high heat a dirty grayish brown mass is formed from the reduction of the manganic acid to binoxide of manganese.

On adding chloride of barium to a solution of the permanganate of potash, and boiling, a precipitate is slowly formed, of a peach blossom color, while the liquid retains a deep violet color. By decanting and bringing the mass, diluted with water, on a filter, the precipitate is not decomposed and can be dried at 100° C. without changing color. When the dry permanganate of barium is gradually heated, its color also grows paler, but does not, like the manganate of baryta, acquire a green color at a still higher temperature; for after the color has once vanished, an increase of temperature soon converts it into the grayish brown mixture of the binoxide of manganese and baryta, or carbonate of baryta. Hence it is impossible to prepare the green manganate of baryta from the permanganate.

In regard to the color itself, experiments have shown that the most beautiful green is that formed by igniting the manganate as described above. The green prepared by Rosenstiehl's process,—fusing together caustic baryta, chlorate of potash, and binoxide of manganese—is less beautiful than

the above; while that attained from nitrate of baryta and binoxide of manganese is far inferior to either of the others. Perhaps, however, this color could be improved by preparing it in a reverberatory furnace with a strong oxidizing flame.

The blue green baryta pigment has different shades according to its preparation, some being almost pure blue with only a shade of green, and resembling the light blue quill feathers of many parrots. The greener the color, the more it gains in intensity, but it loses in fineness, although still surpassing the green manganate of baryta.

The production of the blue or bluish green baryta color is due entirely to the alkaline property of the mass. Whether each definite color is due to a definite composition is doubtful, since the temperature, which must not exceed that of a bright red heat, exerts a great influence on the color. This much is however certain, that both manganic acid as well as the permanganate of baryta, when mixed with about 20 per cent of hydrate of baryta and ignited at a red heat, will always produce this blue green color. It is evident that the blue green color is dependent entirely on its basic character; for on placing this powder in weak acids, it first turns green and is then gradually decomposed. The baryta pigment is quite permanent, and may be subjected to the action of strong sulphuric acid for hours, at the ordinary temperature, before the color will be destroyed. Boiling potash solution has no perceptible effect on it. The permanence, especially of the blue shade, is increased by adding a little baryta, which increases its alkalinity. It is also worthy of remark that the pigment prepared from the nitrate of baryta is much less permanent, because the nitrous acid present will after a time exert a reducing action.

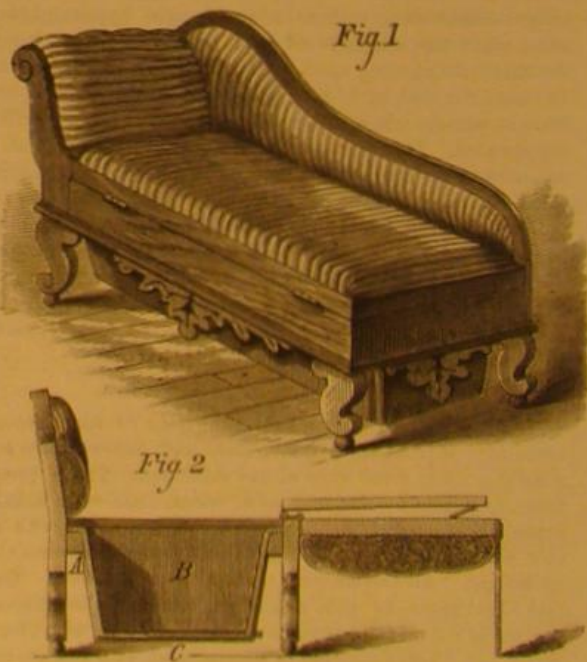
The baryta pigments seem especially adapted to fresco painting, because they appear very bright and lively on stone, and especially on lime, where many other pigments lose their beauty or are entirely destroyed.

The Bridge over the Alleghany, at Warrenton, Pa.

We are indebted to a correspondent, Mr. A. Hertz, for the following particulars regarding the structure above named, which is one of the handsomest of the many iron bridges crossing the rivers of the United States. The length of span, from center to center of the towers, is 470 feet. The latter extend 44 feet above the abutments, the masonry of which is 24 feet above the water. The floor beams are 33½ feet long, giving a roadway of 19 feet and a sidewalk of 5 feet on each side. The two main cables are composed of 7 two inch steel wire ropes each, manufactured by J. A. Roebling's Sons, of Trenton, N. J. The cost of the work was \$45,000.

COMBINED LOUNGE AND BATH TUB.

This is an ingenious combination of two indispensable ar-



ticles of household utility, which will be found a convenience to persons occupying apartments in which economy of space is of importance. The invention, which was patented by Mr. Conrad Wendel, of New York city, consists in arranging, under the seat of a lounge, sofa, or bench, suitable supports, A A, for a bath tub, B, Fig. 2. The seat is hinged to the frame so as to form a cover for the tub, and to be readily thrown forward when it is desired to use the latter, in the position shown in the sectional view. The tub is provided with suitable flanges to rest on the cleats, A.

The seat is shown closed in Fig. 1, and serves to conceal the tub, and also as a cover for the same, to prevent the entrance of dust, etc. The tub is also supported by straps, C, which embrace its body at suitable distances apart, and which are secured to the frame.

THE ARTIFICIAL MANUFACTURE OF BUTTER.

The preparation of butter from substances other than cream, and by means other than the time-honored churn, is a subject which seems to be attracting considerable attention. With the view of presenting the fullest possible information on this interesting subject, we have obtained descriptions of various plans, for butter making and refining, patented in the United States, from which we are enabled to compile a comprehensive statement of the progress of invention in this direction. The extent of the topic necessitates its subdivision, and hence, in its consideration, we propose to treat it under the following heads: Manufacture of butter and shortening for culinary use from fats; manufacture of butter from whey; modes of purifying and improving butter; and, finally, butter-coloring compounds.

THE MANUFACTURE OF BUTTER, ETC., FROM FAT.

Taking the various processes in their chronological order, the earliest on record is the patent of H. W. Bradley, of Binghamton, N. Y., and is dated January 3, 1871. It consists in a mixture of refined vegetable or fixed oil, hog's lard or stearin, and tallow, heated and agitated with water by means of a current of steam. After a suitable length of time, the oil is drawn off and allowed to cool. This produces a purified grease, which may answer for some culinary purposes, but is hardly, we should imagine, palatable for table use. The same inventor, in a specification dated October 3, 1871, describes a mode of removing the offensive taste and smell from cotton seed oil, by adding one ounce of chlorate of potash and niter to each gallon. After heating and agitation, the oil is drawn off and treated with a current of pure oxygen, the effect of which is to deodorize and oxygenate it, rendering it, according to the patentee, sweet and palatable for cooking purposes.

The modest claims above noted are somewhat overshadowed by the numerous advantages which Dr. de la Perouse, of Paris, considers are obtained by his method of preparing fatty matters, patented November 21, 1871. He proposes to render fats, however rancid, neutral and pure—to produce a low priced cooking butter, which will always remain sweet—to give the prepared material improved digestible qualities—to preserve meat by enveloping it in unoxidizable fat—to make superior candle tallow, and, lastly, to mix liquid fat with flour of leguminous plants (peas, beans, etc.), or with chopped meat, to form a nutritive food. This last seems to be simply pemmican, an article of diet well known to the inhabitants of the northern part of this continent. The operation consists in placing a tun at a time of raw fat (beef, pork, or mutton) with distilled water, in which is dissolved a quantity of the sesquicarbonates or bicarbonates of oxide of potassium or aluminum. A solution of chloride of sodium or potassium is then added, and the whole boiled, first actively and then moderately, for several hours, when all the fat becomes separated from its cellular tissue. After a repose of two or three hours, the melted fat is passed into refrigerators, and thence into casks for the market.

Mr. Alfred Paraf's patent, which is next in date, April 8, 1873, is that under which the oleomargarin butter is made. This process has already been fully described on page 246, Vol. XXIX. of the SCIENTIFIC AMERICAN, but a brief review of its salient points will not be here out of place. The fresh fat, finely chopped, is mingled with its own weight of water at 120° Fah., at which temperature it is maintained for hours. The whole is then allowed to cool, when the mixture of congealed oleomargarin, stearin, and membrane is separated from the water and worked with common salt between cylinders, after which it is placed in bags and squeezed in a hydraulic press. This operation is performed in rooms at a temperature of 60° Fah., which is the melting point of oleomargarin, so that, by this means and by the mechanical contrivances, the latter is separated. It is finally reworked with salt, and churned into butter in the ordinary manner, with a proportion of buttermilk.

Mr. Joseph R. Brown, in a patent dated December 23, 1873, proposes to purify tallow, remove its smell, and render it hard and solid at all seasons of the year, by placing the substance in one fourth its weight of water, to which two per cent of strong sulphuric acid is added. This is heated to 200°, and the melted tallow, after an hour or so, is drawn into another tank in which there is a solution of alum. The temperature of 200° is again imparted, when air is forced into the mass for half an hour. Cooling then follows, and the water is drawn off. The tallow is lastly brought to 230°, and more air driven in, when, after settling, it is made up into suitable packages. Bleaching is effected by mixing chloride of sodium vapor with the air that is forced in.

A process which seems different from any yet described, and which is claimed to consist of artificially performing the natural functions of the lacteal system of the cow, when it absorbs its fat in order to transform the same into butter, was patented December 13, 1873, by M. Hippolyte Mège, of Paris, France. The first operation is to neutralize the ferments; and to this end the fat, as soon as the animal is killed, if possible, is immersed in a solution of sea salt and sulphite of soda. Crushing under millstones follows, and then artificial digestion, at a temperature of 103° Fah. This is accomplished by a compound of half the stomach of a pig and biphosphate of lime. When the fat is perfectly liquid, showing no lumps, more sea salt is added, and it is drawn off into water, at 86° Fah., contained in wooden tubs. Here most of the stearin is deposited in the form of teats in the middle of the liquid, which then goes to a hydro-extractor, or centrifugal machine, which effects the complete separation of oleomargarin and stearin. The former, says the inventor, is an excellent butter for kitchen use, but he improves it as follows: Cream, bicarbonate of soda, and the

udders of a cow, chopped, are macerated and passed through a fine sieve. This mixture, with coloring matter, is added to the margarin, which becomes thick, tastes like cream, and, when cold, is passed through large cylinders, which give it a homogeneous mass, and complete the production. When the butter is to be kept for long periods, water is substituted for cream in macerating the udder. The stearin is used for candles or may be saponified.

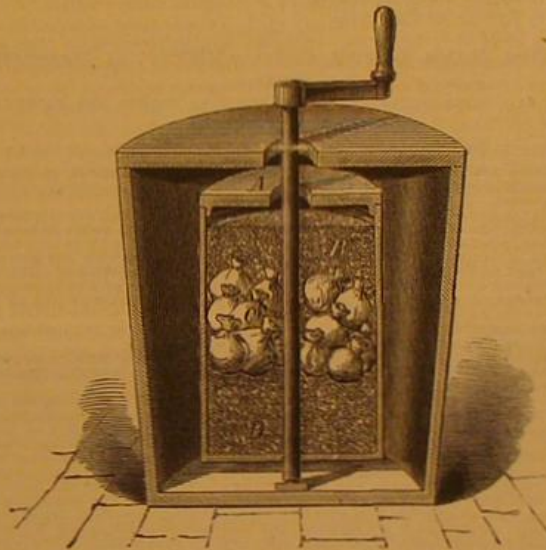
BUTTER FROM WHEY

is made by three processes. The first is that of Homer C. Markham, of West Turin, N. Y., and dated December 11, 1866. After cheese making, the whey is drawn off into a kettle, and to it is added dairy salt and a kind of acid made of old and sour whey. This is heated to about the boiling point, when the cream rises, is skimmed off, and, after cooling, is churned in the ordinary manner. The amount of whey given off by 450 pounds of milk will, it is stated with suitable proportions of the ingredients above mentioned, give three pounds of good butter.

Mr. James Suggett, of Cortlandville, N. Y., in a specification dated December 18, 1866, describes the second process, the first operation of which is to pass the whey into a cooling chamber which is surrounded with cold water. A solution of saltpeter, borax, and saleratus is added, and the whole left in the cooler for twenty-two hours, at the end of which time the cream, having risen to the surface, may be removed and made into butter.

Mr. Ira Page, of Adams, N. Y., patented June 23, 1868, the third process, in which the whey is allowed to stand 24 hours; and to the cream, which is then skimmed off, saltpeter is added. The butter obtained by churning is worked with salt and sugar.

There is another plan for butter making which, though not properly coming within the above sub-heading, may nevertheless be found worthy of notice and, doubtless, of trial. It is the invention of Mr. Adolphe Mot, of Washington, D. C., patented July 19, 1870; and we add a small engraving, which shows its construction. There are two



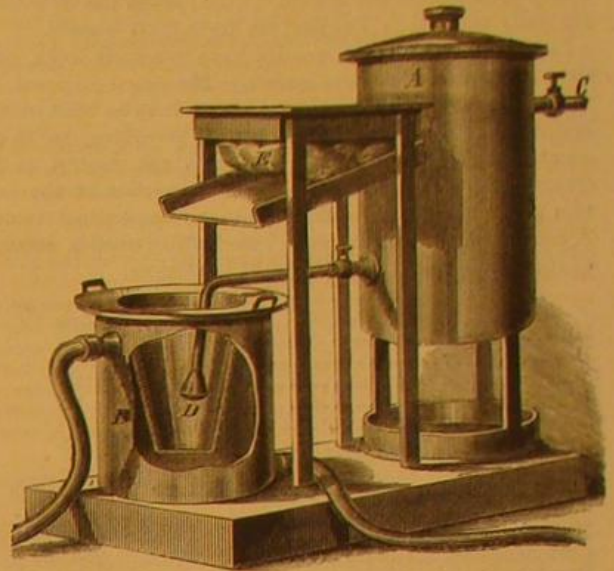
tubes, the inner one, A, of which may be revolved by suitable means within the outer. Within the tub, A, the sides of which are perforated, are placed, first, a quantity of pumicestone, baked clay, or similar porous substance, B, the cream, C, tied up in small bags, and, finally, more pumice. The effect of the latter is, after a few hours, to separate the buttermilk from the cream, leaving pure butter in the bags. Tub A is then revolved, and the liquid is projected through the perforations into the outer vessel, and, lastly, water is added for washing purposes, which is got rid of in a similar manner.

We now pass to the

REFINING AND PURIFYING OF BUTTER.

Mr. D. H. Gregory, of Detroit, Mich., patented (September 10, 1867) a process which consists in adding to one pint of milk, fresh from the cow, the yolks of two eggs and a pound of poor butter. This is churned, salted, and worked in the usual way, producing, it is stated, two pounds of fresh wholesome butter. Mr. Joseph Sigler, of Anderson, Ind., in a patent dated November 5, 1867, proposes a somewhat similar operation, churning together 1 gallon of sweet milk, 1 ounce of loaf sugar, 20 grains of nitrate of potash, 1 ounce of liquid rennet, and 10 grains of annatto, with 8 pounds of butter. The weight of the resulting compound is not given. Louis S. Robbins, of New York city, suggests, in his patent of July 28, 1868, that butter, after churning, will be less likely to turn rancid if heated to a semi-liquid condition, and then washed, first with warm and afterwards with cold water, so as to remove the buttermilk and other impurities. Butter already rancid, according to the patent of Mr. Calvin Peck, of Marshal, Ill., dated November 20, 1869, may be restored and purified by adding two ounces of pulverized alum to every five pounds of butter, the latter being melted. The butter, while still liquid, is passed through a fine sieve into clear cold water, from which it is removed and worked with dairy salt, saltpeter, and sugar. We add an engraving of the apparatus recently devised by Mr. George Kirchhöffer, of Chicago, Ill., and patented June 10, 1873. A quantity of butter in a melted condition, is put in a reservoir, A, its temperature being kept between 100° and 120° Fah. B is the congealer, which is filled with milk or buttermilk, and through the hollow sides of which a current of cold water is maintained so that the temperature of the milk is retained between 55° and 65° Fah. Pressure is next applied to the

surface of the melted butter in the reservoir, through the pipe, C, and, a valve being opened, forces the butter down through the tube, D, and out of the perforated nozzle at its end into the cold milk. The congealed particles, after being skimmed, are thrown into a filter, E, through which the milk escapes and runs down the inclined trough, back into the congealer. The butter is subsequently worked in the ordinary way.



Different from any of the above plans, and apparently much simpler, is the process patented by Mr. Josiah W. Prentiss, of Pultney, N. Y., October 4, 1859. It consists simply in removing the hoops from the firkin, A, containing the spoiled butter, placing it in a bag, B, and burying the whole in charcoal, C, contained in a barrel or other receptacle.



cle. The illustration shows the arrangement, and necessitates no further explanation. Two

COMPOUNDS FOR COLORING BUTTER

have been made the subjects of patents. One, devised by Mr. D. W. Dake, of Brooklyn, N. Y., consists in adding annatto to pure oil obtained by melting the butter. The annatto is mixed mechanically with the liquid, and produces a compound of a reddish golden color, 75 pounds of oil to 5 pounds of annatto being the proportions. One or two pounds of the coloring matter suffice for 100 pounds of butter. Messrs. Bogard, Cramer & Lewis, of Laporte City, Iowa, patented September 16, 1873, another coloring compound composed of annatto, 5 ounces; curcuma, pulverized, 6, ounces; saffron, 1 ounce; lard oil, 1 pint, and butter, 5 pounds. It is said that the amount of coloring thus obtained is sufficient for 5,000 pounds of butter.

The Suez Canal.

It has been proposed that the European Powers should buy the Suez Canal, and throw it open for the benefit of the whole world of commerce. The present dues levied by the company, it is stated, are absolutely prohibitive against the greater portion of the imports and exports on both sides of the canal; and a recent increase which has been made, of some 43 per cent on the original charges, on the basis of tonnage, operates to shut out small vessels and heavy goods. Each country, it is suggested, should contribute a certain quota of the purchase money, to be estimated by a determination of the amount of benefit which each individual commerce would receive by the enfranchisement; and by this means, the entire estimated amount of \$70,000,000 (at par, and without interest), it is said, could be collected. Vessels in such a case would be required to pay only such dues as would aggregate sufficient for the simple maintenance of the work, and not be heavily taxed as at present for the accretion of large dividends. It is believed that the commerce of the world would thus be immensely benefited.

Light Draft Iron Steamers.

A paper by Mr. Theodore Allen, on "Iron Hulls for Western Steamers," has lately been published in the "Transactions of the American Society of Civil Engineers." Mr. Allen is about to remove to the west, to test by practice the correctness of his theories. We give a brief summary of the paper:

In England, steamers are constructed almost exclusively

James McMillin, Ripley, O.—This invention contemplates the use of a wedge as a remedy for the tendency which so generally exists to wear the heel of a shoe or boot on one side. If the tendency is to wear out the sub-jacent edge of heel on the inner side, the thicker part of wedge is caused to abut against the corresponding side of the upper, thus throwing the strain toward the center, and not only preventing the edge wear on heel, but tending gradually to correct a slovenly habit of twisting the ankle when the weight is pressing thereon in standing or walking. If the wear should be usually on the other side of the heel, the wedge piece is reversed in position, and is in like manner productive of the same result.

Improved Apparatus for Unloading Corn from Wagons.

Thomas Barron, Black Oak, Mo.—The parts of the bottom of the wagon box are attached to cross bars, so that the said bottom may operate as a single piece. One edge of the bottom is connected with the lower edge of one of the side boards of the box by hinges. To the bottom, near its other edge, are pivoted buttons, which may be turned into catches, attached to the side of the box to support the bottom in place. Upon the outer ends of the buttons are formed toes, to enter the forks of levers, which are pivoted to the side board of the box, and are connected so that they may all move together. One of the levers projects upward, so that it may be operated by the driver. Eye straps on the forward and rear parts of the side boards receive hooks attached to cross bars, to the centers of which are attached the ends of the ropes by which they are suspended. The ropes pass over guide pulleys pivoted to the beam attached to the frame of a corn house. The ropes are connected with a drum pivoted to supports attached to a sill of the frame. A drum is provided with a ratchet wheel and pawl to hold the wagon box suspended in any position to which it may be raised, and is operated to wind up the ropes by horses or other well known means. The upper ends of arms are pivoted to parts of the frame in such positions that a board may be swung beneath the locked edge of the bottom to form an inclined plane to guide the corn into the crib or bin as the locked edge of the bottom is detached and lowered.

Improved Fly Trap.

N. Barker McCreary and Henry L. Crist, Phelps city, Mo.—This invention is an improvement in the class of insect traps formed of an inner and outer wire gauze cage. The outer cage rests on the cross bars of a bait pan which is of sufficient depth, width to extend around the base of the cage, and admits easily the flies to the bait at the bottom thereof, from which they pass through cones into the upper chamber, where they are killed by hot water, heat, or other suitable means. A small door is hinged at one side, near the top part of the cage, and serves for the purpose of removing the flies without detaching the inner cage.

Improved Sash Pulley.

Moses Nelson, Eaton, Ohio.—The case of metal and made in two parts. It is inserted in a hole bored in the end of the stile, and incloses an enlarged wheel of such relative diameter as to allow the sash cord to project free from each side of the stile.

Improved Potato Digger.

Richard B. Evans, Connellsville, Pa.—A scraper removes the portion of the earth which covers the potatoes, leaving a corrugated roller suspended from the beam to act with good effect upon the smooth surface thus formed. A double or V shaped plow, following immediately after, is thus enabled to elevate the earth in which the potatoes lie embedded without injury to them, and with comparatively small expenditure of force. The roller also acts as a collector wheel, in respect both to the scraper and the plow, governing the depth to which they penetrate the soil.

Improved Combination Lock.

Arthur E. Pickle, Nevada, Mo.—This invention consists of a rotating plate, having a projecting pin at one end, which engages the locking bolt, so as to withdraw the same in part by means of the inner pin of a rotating dial plate acting upon a projecting band spring, attached to the rotating plate. The withdrawal of the lock bolt is completed by the action of a second pin of the dial plate on the bolt, which is recessed and provided with inclined front and rear projections for the same. The pins of the dial plate may be changed to any combination of letters by being placed into any two holes of the concentric series of perforations provided therein.

Improved Winged Plow.

Isaac A. Benedict, West Springfield, Pa.—This invention has for its object to improve the winged plow for which letters patent were granted to the same inventor December 13, 1870. To opposite sides of the standard are pivoted arms, to which braces, fastened to the rear side of the standard, are secured by bolts, which pass through short slots in said arms, so that the rear ends of the latter may be raised and lowered, as required. Wings are also secured to the arms, and may be expanded and contracted. The inward pressure upon the wings is sustained by a cross bar, the ends of which pass through longitudinal slots in the arms, and are bent into hook form. The brace bar is further secured in place by keys which rest in notches formed in the arms to prevent the ends of the brace from slipping when adjusted. Wedge wheels are interposed between the arms and the standard, so that, by turning them, the pitch and spread of the wings may be adjusted to suit wide or narrow rows, and turned down flat for shallow culture, or set up for billowing corn or potatoes.

Improved Die for Forming Hammer Eyes.

Henry Harrison Warren, Bridgewater, Canada.—The object of this invention is to furnish an improved means for forming the eyes of nail and other hammers, of the shape and style of the "adze-eye;" and it consists in constructing the dies with recesses or forming surfaces which will give the eye of the hammer blank the preliminary form necessary to the proper action of a punch or plunger employed to finish the eye.

Improved Apparatus for Painting Broom Handles.

John Reif, Kossuth, Wis.—This invention is an improvement in apparatus for painting or ornamenting broom handles by means of bands or stripes, and consists in a series of strings or cords so arranged upon a frame that paint may be applied to them, and thus transferred to the broom handles when the same are subsequently rolled over them.

Improved Feed Wheel for Saw Mill.

John Kerr, Milltown, Canada.—The object of this invention is to produce a feed mechanism for saw mills, which will be absolutely regular, and equalize the movements of the saw carriage to such an extent that each cut or stroke of the saw will be equal to every other cut or stroke. The invention consists in the application of a friction shoe to the V shaped rim of the feed wheel, and in its connection with the operating mechanism in manner that will, when the shoe is drawn in one direction, cause the wheel to be turned, while the wheel will not be turned when the shoe is moved in the other direction.

Improved Clamp.

Jacob F. Schneider, Brooklyn, N. Y.—This is a strong and adjustable clamp connection for the several parts of wooden boxes or other objects where the parts are made detachable for the purpose of transportation and readjustment. It consists of two plates with bent edges, which are slightly inclined toward each other, and applied to the pieces to be connected. A plate with downward bent edges, with similarly inclined sides, is driven over the side plates, holding them rigidly together, and forming a strong connection of the parts.

Improved Floor Clamp.

Robert C. Davidson, Evanston, Wyoming Ter.—There is a plate for protecting the edge of the flooring, and a pawl for holding the clamp after clamping up the flooring. The connecting screw has a nut for adjusting the bar according to the thickness of the joist to which the clamp is to be fastened. A key is fixed in said screw to cause the nut and bar to shift together. Said key shifts along the screw with the nut and bar in a groove in the screw. A set of pointed stud screws is provided in the bars, near the connecting screw, for screwing into the joist to hold the clamp when it may be necessary to release a lower set of screws to shift them forward to get a new hold. In case the flooring is not clamped up sufficiently by the first operation. The bars are placed in the joist close to the edge, and fastened by the screws. The upper end of the clamp is then pressed forward, so as to press the flooring together by the plate.

Improved Machine for Sprinkling Cotton Plants.

William T. Robinson, Huntville, Texas.—A two wheeled truck, of proper height and width, is arranged to run along above one row, and provided with a tongue to hitch on the animals, so as to go on opposite sides of the row. There is a liquid holding tank on the front part of the frame, which has a sprinkling tube, of suitable size for sprinkling the liquid upon three rows of cotton. Behind the truck is a horizontal shaft, extending each way beyond the wheels, for reaching over the outside rows, and carrying revolving sleeves for sprinkling on powdered substances. By suitable arrangement of the mechanism, the plants are first dampened with water and then overspread with poisonous powder, the former causing the latter to adhere to the plant.

Improved Bung Bush Insertion.

Lomax Littlejohn, New York city.—The object of this invention is to improve the bung bush insertion for which letters patent No. 138,568 were granted to the same inventor May 6, 1873, to make it impossible to burst the bush, however much power may be applied. By suitable construction, when a sleeve has been inserted in the bush, and a shank turned, an elliptical journal will expand the sleeve, causing it to grasp the bush firmly, and screw it into the bung hole in the stave. In case the stave is hard, and considerable power is required to force the bush into place, the powerful expansion of the sleeve will sometimes burst or split the bush. To remedy this, a tongue is attached to the elliptical journal, which enters a slot in the sleeve, which strikes against the side of a shoulder of said slot, and thus turns the bush, the said tongue and slot being so arranged that the sleeve will be expanded sufficiently before the tongue strikes the shoulder of the slot.

Improved Apparatus for Manufacturing Illuminating Gas.

John G. Müller and William Müller, Dayton, O.—The gas retort, of cast iron, is placed longitudinally in a furnace, which is constructed of fire brick, in the usual manner. Coal oil is fed to the retort from a tank as the formation of the gas progresses. The retort connects, by a conical neck and pipe, with a hydraulic valve. The gas, which is formed after the retort is at red heat, passes up through the bottom of the valve. The mouth of the entrance pipe has a conical cap, which is open at the bottom and placed in water, through which the gas is forced and cleaned from the tar vapors. The top part of the valve is made airtight by being placed with its lower end in tar or other fluid, on the outer casing of the valve, as usual in gas factories. The gas passes then from the valve to the purifiers, which are filled with coke, and thence, by a hydraulic valve, to the gasometer.

Improved Music Leaf Turner.

William H. King, Petersburg, Ind., assignor to himself and Jerome Borer, of same place.—The object of this invention is to provide an improved music leaf turner for sheet and book music, by which the leaves are readily turned as required during the playing of the instrument, and firmly retained in position on the rack or stand, whether they are placed singly or in book form thereon. The invention consists of a frame which is attached by its base piece to the rack of a music stand or piano. Upright connecting bars are pivoted to the base piece and top piece, by means of which the latter is adjusted parallel to the base piece and the supporting bottom bar of the rack. The top piece is slotted for the arms, which are pivoted to a common center pin, and applied by flat end wings to the sheets to be turned by a sliding plate, which catches by staples and slots into the forked ends of the arms. The sliding plate is drawn from side to side by cords and pulleys connected to a knob on the base piece.

Improved Wheel for Vehicles.

Frederick H. Brinkkötter, Quincy, Ill.—Flanges rise out of the surface of the hub cylinder at a considerably greater distance from each other than the breadth of the spokes, and incline toward each other for the greater portion of the distance to the periphery. Near the outer edges they make a short turn directly toward the spokes, and for the rest of the distance they are parallel to each other, and have a flange on the inside, and form a dovetail shaped annular chamber, in which are collars of wood, divided in two parts, for putting them in. They are coated with white lead, to prevent them from shrinking, and the spokes are driven in so as to wedge tightly all the way to the bottom. The inside of the hub and also the exterior of the box are provided with short spiral ribs, near each end, to lock the box against end motion, by turning it after it is inserted in the hub, so that the ribs bear against each other; and near the outer end of the box is an annular ring, against which is a leather washer, to pack the joint tight by a flange of a nut. The wheel is placed down, with the inside of the hub up, the box centered at that end, and the space finally filled with melted sulphur.

Improved Earth Closet.

John L. Young, New York city.—A hinge is attached to the cover and to the casing, by means of which the service pan and shutters are operated, and which consists of a bar which is attached to the edge of the cover, having a branch thereon. Connected with this is mechanism so arranged that, when the cover is raised, the service pan is carried forward beneath the seat, taking with it a layer of earth equal in thickness to the width of the discharge mouth. The excrement falls upon this layer of earth. When the cover of the seat is closed, the pan is drawn back, and the contents of the pan are deposited in the tub beneath. The thickness of the layer of earth on the pan may be of any width. The shutters are two pieces of metal, with their ends turned at right angles and pivoted to jambs, so that they will fall and close together by their own gravity. They are opened, when the cover is raised, by means of the turned up edges of the service pans, which strike cranks, which raise the ball as the pan is carried forward. The hinge is of such peculiar construction and so applied that the shutters are neither opened nor closed until the cover is thrown almost back against the front of the hopper.

Improved Plane Guide.

Walter S. Shippe, Minerva, O.—This invention relates to an improvement in plane guides, by which the plane is steadied, in squaring or beveling, to any desired angle without the use of a try square or bevel; and consists of a yoke, which is firmly applied to the plane, and provided, at one end, with a pivoted guide strip, which is adjusted, by clamping screws, under any required angle to the plane.

Improved Sugar Manufacture.

Herman M. Aschenbrenner, Havana, Cuba, assignor to himself and Theophilus Masac, same place.—The juice passes from the grinding mill into a conveying tank with two sets of filters, which operate alternately. The conveying tank discharges into the flannel filter, and the juice falls into a tank which has three outlets corresponding with three open kettles. In these kettles, in successive order, the cane juice is precipitated, by means of lime and magnesia, and the sediment is drawn off. Thus purified, the juice passes through the siphons into the last filter, and then, by the suction pump, is forced into the sulphur box. This box, of wood, has inside a paddle wheel, worked by the steam engine of the mill, and is fed with sulphurous fumes from the adjoining sulphur furnace. The juice leaves the box in a perfectly bleached condition, passing upon a metallic box of sheet metal, heated inside by steam, and serving to raise the temperature of the juice to not over 90° centigrade, by a condensation of 32° to 35° Baumé. There it goes into a communicating canal, upon the inclined plane, also heated by steam and provided with an outlet, and finally is acted upon by a blast from a steam fan placed at the lower end of this inclined plane. The juice becomes now so thick that it has to be scraped with the slowly revolving scraper, which is constructed like an endless apron, provided with suitable scraping blades, and actuated by power transmitted from the engine. There is another smaller and more inclined plane, similar to the former one, and also fanned by another fan, from which plane the sugar, already crystallized, is scraped off, by hand or otherwise, into the final receiver. A complete description and illustration of this invention will be found on page 367, vol. XXIX., of the SCIENTIFIC AMERICAN.

Improved Package for Caustic Alkalies.

Henry B. Hall, New York city.—This invention relates to the caustic alkali package, consisting of a spun or stamped metal cup, with a hermetic cover of resin and wax or the like material, formed by pouring a gummy substance, in a melted state, over the alkali, with which the cup is filled; and it consists of a metal disk or cover of tin or other suitable substance put in before the gummy sealing material is put on, and made to spring into a small groove in the inside of the cup near the top. The object is mainly to utilize gummy sealing matters or compounds for closing metal packages containing broken caustic soda. The sealing substance cannot well be used without said metal cover, in consequence of its settling down in the spaces between the pieces, and cementing them together, causing considerable waste, besides interfering with the use of the soda.

Improved Pen Wiper.

Hugh S. Ball, Spartanburg, S. C.—This invention consists of two sponges held in suitable metal cups affixed to the ends of bent lever arms. The latter are so connected with a suitable standard and with each other that when the pen is lightly pressed upon the lower sponge, sufficient force is exerted to bring the upper sponge down upon it, so that both sides of the pen are thereby cleanly wiped.

Improved Farm Gate.

David A. Neidig, Paris, O.—This invention is an improved gate for self-closing and self-latching, and answering the purposes of a small farm gate for the passage of persons on foot and horseback as well as those of a large farm gate. The gate works easily and conveniently, is cheap and durable, and lifts clear above the snow. When the gate is closed, a supporting rail extends through its full length, and rests with a semicircular notch on the pulley of the main post. When pushed open to the side, the gate slides on the supporting and inclined rails, and, being self-closing and self-latching, into its former position. When it is desired to keep the gate open for ordinary purposes during the day, it is pushed back till it rests on a long notch on the inclined rail, which raises also the forward end of the supporting rail, and locks it into the top of the main post, bringing the gate to a level. In this position the gate cannot be swung around, and in order to do so, so as to make room for a load of hay or other bulky substance, it is necessary to push the gate into a second or shorter notch, which causes the forward end of the supporting rail to drop into a semicircular recess, from which position it can easily be lifted and, the gate being properly balanced, swung around.

Improved Can for Transporting Oil, etc.

James E. Pimley, Newark, N. J.—The ends of the cover extend down and overlap the sides of the body, and are fastened by screws put in so that they can be taken out readily, to remove the cover altogether while the contents are being drawn from time to time for use. A tapered nozzle is constructed without a head at the top, so as to secure a tapered cap, which is provided with an annular groove, to fill with plaster of Paris or other cement in a plastic state when the cap is put on for sealing it up tight. The cement is broken loose by a few taps with a small hammer or other instrument when it is to be taken off. There is a funnel around the vent-hole, to hold the cement for sealing the vent for transportation.

Improved Wire Stretcher.

Isaac H. Congdon and Jacob E. House, Omaha, Neb.—This invention consists in the mechanical application of an iron frame and rollers for the purpose of adjusting or giving a uniform and constant tightness to the iron wire used in the construction of wire fences. The rollers are of hollow cylindrical shape, secured in suitable frames on either side of a post, and are provided with flanges in which are holes for the insertion of lock pins, which prevent the rollers from turning back after the wire has been tightened. The wire is attached by its end to one roller, and is adjusted thereon by a crank handle, which is carried by the attendant from post to post, so that very extensive fences can be easily set as desired.

Improved Fountain Pen.

Henry N. Hamilton, White Plains, N. Y.—The handle of the pen is made hollow, and is tapered at its lower end. In the inner surface of the upper end of the handle is a hollow screw plug, with a closed lower end, and with a hole through its side. Secured to the screw plug is a rod which extends down to the tapering part of said handle, and has a valve to fit into the lower part of the cavity, so as to prevent the outflow of the ink, unless the rod and valve are slightly raised. A nut, which is screwed into the hollow screw plug, is perforated from its lower end, from the upper end of which a perforation leads out through the side of said plug. By turning the plug up a little, the valve is raised from its seat to allow the ink to flow out. The nut is then unscrewed sufficiently to bring its side perforation above the plug, so that the air may pass in to cause an outflow of the ink.

Improved Sugar Cane Cultivator.

Henry Von Phul, Jr., and James Mallon, Holly Wood, near Baton Rouge, La.—The mold board is hinged to a standard and the land side. The land side produces, with the mold board, the shape of a slanting V. The position of the mold board and land side is regulated by a curved lever which is pivoted to a supporting bar of the land side, and connected by a pivoted bar to a projecting lug of the mold board. For expanding the fluke to its largest width, the handle end of lever is locked by a pin, through a hole near its handle, into a hole of a projecting bar of the land side. By suitable means the width of the fluke may be contracted as desired.

Improved Velocipede.

George Avery, Ottawa, Ill.—The rear axle is provided with a crank for each pedal bar, which are so arranged that the bars are made to act alternately on the axles, the weight of the driver being first thrown upon one bar and then upon the other. The power is applied when the cranks are in a horizontal position, when the weight will have the greatest effect. The arms of the steering lever are attached to the forward axle. The frame rests upon the axle at the rear, and upon the bolster in front, the forward axle being bent to allow the bars to play. The bars are jointed to the forward end of the frame, and foot pieces are on each of the bars, one each side of each joint. The driver stands upon these bars, with his feet on the foot pieces, and propels the machine by throwing his weight first upon one bar and then upon the other alternately.

Improved Ore Washer or Buddle and Ore Separator.

John Collier, Idaho Springs, Col. Terr.—The first invention is a revolving buddle. The finely crushed ore, consisting, for instance, of quartz, copper pyrites, iron pyrites, and galena, is conveyed by water through a suitable spout into the distributing box, from which it passes through small holes, and spreads itself uniformly upon the surface of the table, the heavier minerals settling mostly near the center, and the lighter near the periphery but still in a mixed condition, as the separation caused by the running water only is very imperfect. As the table revolves the minerals are subjected to the combined action of the clear water from the distributing box, and the stirring of the brooms, which causes the quartz and other light earthy matter to pass to the periphery of the disk, and then to fall into a suitable receptacle; while, owing to the jarring action of the pounders and the greater density of the other minerals, the latter still remain on the buddle. The copper pyrites, and then the iron pyrites, being subjected to the action of the other brooms and larger quantities of clean water, are each passed to the circumference, and deposited in separate receptacles. The galena still remaining on the table may be removed by other brooms or scrapers, or be washed off by strong jets of water. The same inventor has also patented an improved ore separator which consists of two or more grading sieves in the upper portion of a tank of water having appropriate discharge passages for different grades of material escaping. These are actuated in the water by suitable mechanism, and also have a washing attachment so arranged that currents of water are caused to flow upward against the descending currents of ore. The "slime" water is thus separated from the coarser particles, and caused to flow, with the fine particles of ore, into another tank, in which is a siphon pipe adapted to collect that which is sufficiently heavy to settle to the bottom of the water in said tank and convey it to a proper receptacle.

Improved Station Indicator.

John W. Newlin and Jacob S. Simmerman, Millville, N. J.—This invention is an improved station indicator for railroad cars, so constructed that the indicators throughout the train may all be adjusted at the same time. The front of a rectangular box has a transparent portion in its middle part, to allow the names of the stations to be seen. The names of the stations are printed upon strips of wood. The upper parts of the strips have hook shaped slots. Vertical pieces are attached to the top of the box, and to their lower inclined edges are attached metallic straps, in such a way as to form inclined slots. Other pieces with upper edges inclined to the rear are attached to the bottom of the box, and their forward ends extend close up to the door. The lower edges of the strips incline downward. A shaft which works in bearings attached to the box, carries three arms. The first arm projects downward into such a position as to strike the clapper of a bell. The second arm, when moved forward, strikes against the end of the lowest name strip, and pushes it longitudinally until it drops upon the inclined edge of the lower vertical pieces, down which it slides to the rear part of the box. The third arm passes out through a slot in the end of the box, and has a pulley pivoted to its end, to receive a cord which is kept in place upon the pulley by a spring which allows the cord to be slipped off and on conveniently. The cord extends through all the cars of the train. When the cord is pulled the effect is to raise all the arms, which strike the bells, and push the lowest strips from their places and expose the next strips. When the end of the route is reached, the strips will all be upon the lower vertical pieces, and arranged in proper order for the return trip, so that all that will be necessary to rearrange the indicators will be to raise the strips, and hang them upon the straps of the upper pieces.

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A. E. C. can repair his meerschaum pipe by following the directions on p. 90, vol. 30.—J. F. and others will find explicit information on the subject of sumac in any good work on botany.—G. C. B. can repair rubber boots by the process described on p. 155, vol. 26.—C. S. & Co. will find directions for bronzing malleable iron castings on p. 233, vol. 29.—C. B. and others can obtain the lenses for the cheap telescope described on p. 7, vol. 30, from any optician.—A. S. will find directions for repairing rubber overshoes on p. 155, vol. 26.—J. H. should address the engineers of the Hoosac tunnel for the information he seeks.—J. W. A. will find a description of nickel plating on pp. 91, vol. 29, and 187, vol. 23.

C. H. F. says: 1. In a self-feeding stove, the pipe runs 8 feet horizontally from the stove, and then some 12 feet perpendicular into the garret, where it runs 20 feet horizontally and enters the chimney. A substance is constantly dripping from this 20 feet of pipe in the garret, and it eats its way through the pipe in a short time. There is no possibility of any water getting into the pipe from the chimney. I send you a few crystals which formed on the perpendicular part of the pipe in the garret where this substance runs down on it. What causes this substance, and what are the crystals composed of? A. Probably some corrosive substance is distilled from the coal, and condenses in the pipe. The specimens sent seem to be sesquioxide of iron. 2. How can the tone of a church steel bell that is cracked be restored? Could it be done in the steeple? The bell is so hard that steel tools will not cut it. A. We scarcely think it can be done. 3. Is there a substance, and if so how is it made, that will take the temper out of steel or soften it, so that it can be drilled without heating? A. We do not know of any. 4. Which will stand the most pressure, a copper or an iron boiler, both of the same size and thickness? A. An iron one.

J. E. W. asks: 1. Why can a gimlet pointed screw be driven more easily with a long screw driver than with a short one? A. On account of the greater leverage that can be obtained by inclining the long screw driver. 2. Can the same screw be driven more easily with a pressure on the screw more than enough to keep the screw driver in place? A. We think not.

F. D. asks: 1. How can I get a good spring temper on steel wire? A. Temper in oil. 2. How can I case harden it? A. With prussiate of potash. 3. If I case harden it, will it make it break more easily? A. We think it will.

F. F. R. asks: 1. Will a common horseshoe magnet, if bent straight, have the same qualities as a compass needle, as to polarity? A. Yes. 2. Would a compass needle lose its power if it were confined so that it could not turn on its pin, a weight being put on the cap of the needle so that it cannot move? If I turn the compass so that the north end of the needle would point south and let it remain for six months, what would be the result? A. Probably it would lose a little of its attractive force. 3. Is there any motor run by a magnet? A. Yes.

C. A. W. says: 1. It seems to me that, in the present state of steam engineering, there ought to be rules for the construction of slide valves that would be generally recognized by builders as giving the best result for average speeds. The diversity of practice seems to be as great as the number of builders, and the theories equal the mechanics in number. I know builders who give so large a compression in some cases as to force the valve from its seat, while others release almost as early as the cut-off, and have practically no compression. I should suppose that the most economical point of cut-off, release, and compression would have been determined approximately, by actual experiment by this time. Is there no work treating on these questions? Auchincloss assumes these points to be determined, and then gives rules for constructing valves accordingly. A. We think the subject is treated in several manuals of the steam engine and locomotives. 2. Are straps prepared from starch, cotton, wood fiber, etc., by the use of sulphuric acid or other re-agents deleterious? And is there any simple test for detecting deleterious qualities? A. We think not, in general. Probably the simplest test would be with litmus paper.

R. H. says: In a shop heated with exhaust steam, conveyed through pipes made of galvanized iron, the heat does not seem to radiate, no matter how much steam is turned on. Why is this? A. Probably the trouble is caused by insufficient radiating surface or too little steam.

W. asks: In estimating the heating surface of a vertical boiler, should the surface of those parts of the tubes be measured which project above the surface of the water, through the steam chest? Is not the heating surface as great in a boiler where the tubes only extend to the surface of the water as in a boiler of same dimensions where the tubes extend to the top of boiler? A. The heating surface is greater where the tubes extend the whole distance.

T. J. McM. asks: How can I divide a given straight line into two parts, so that the square on one of the parts may be double of the square on the other? A. You can solve the question, to any degree of approximation desired, by the following formula: Let l = length of the line. Lesser part = $l \times \sqrt{2} - 1$. Greater part = $2l - 1 \times \sqrt{2}$.

T. C. W. asks: 1. Can you give me a recipe for making blackberry wine? A. Cook the berries slightly; let them stand until the next day. Then strain them, add 1 quart of water and 3 pounds of brown sugar to each gallon of the juice. Place the mixture in a cask, cork tightly, and let it stand until the following March, when it can be bottled. 2. Is it a healthy drink or not? A. We think so. 3. Would it not be practical to ring the bells in the different churches by telegraph, providing each church had its own battery, and could not one man ring all the bells in one church? A. Yes. 4. Can I get the different drawings and specifications of all the patent ice elevators? How can I find out how many have been patented? A. Yes. You can only find out the number

by a search. 5. Can I have my hydrant so arranged as to force the water out of my cistern into water pipes through the house, without letting any water out of the hydrant into the cistern? A. You can probably do it by putting up a water engine, to be driven by the water from the hydrant. 6. Can you give me a good recipe for hair oil that will not injure the hair? A. Probably castor oil is as good as anything. We cannot answer your other question, as the data are insufficient.

J. T. H. asks: Should the propeller be of a greater or less pitch at the center than at the perimeter, to avoid drag? A. There is a great difference of opinion among engineers on this point. Makers of propellers with varying pitch assert that their screws, when in motion, do not shake the vessels so much as equally efficient screws with constant pitch.

J. W. D. E. asks: 1. How many different kinds of fire engines are there in use? A. Hand engines, steam engines, chemical engines. 2. How much fall is usual on canals? A. They are generally level. 3. What is the common width? A. The widths vary greatly in different localities. 4. Is it essential that canals should be walled up? If so, would brick be cheaper than any other material? A. Generally canals require to be walled up, but we do not think that brick is the most suitable material. 5. When will the committee decide between the competitors for the reward offered by the State of New York? A. The time during which competition was allowed has expired.

N. L. T. asks: 1. How can I compute the pressure exerted outward by a ball weighing 1 lb., revolving in a circle the radius of which is 1 foot, at 1 revolution per second? Is there any fixed rule for determining the centrifugal force of a body? A. The centrifugal force of a body = $(\text{Weight in pounds}) \times (\text{velocity in feet per second})^2 \div \text{radius} \times 32.2$

2. Do you know of any book published on the compass and the variations to which the magnetic needle is liable, treating the subject in such a way as to enable a person to acquire the skill and knowledge requisite for an expert surveyor? A. Gillespie's "Treatise on Land Surveying" has considerable information on the subject of the compass.

W. J. B. asks: What is the most reliable work on superheated steam, and where may it be obtained? What is the greatest number of degrees of heat that can be obtained from superheated steam? A. We do not know of any work that will answer your purpose. Steam can be superheated to any degree that the apparatus will stand. It would probably be well for you to consult an experienced engineer about the matter, as in this way you will avoid costly experiments.

T. L. C. asks: 1. What is the greatest perpendicular height to which the waves on the ocean rise, measuring from bottom of the trough? A. From 30 to 40 feet, we think. 2. What is the distance between them from top to top or center to center? A. About the same as the height. 3. How far below bottom of trough is the water agitated by the strongest wind and largest waves? A. Probably about 2,000 feet.

M. J. S. says: I have a hollow rectangular vessel, two feet long and four inches square, made of sheet steel, one sixteenth of an inch thick. Can I pour in molten cast iron to make a solid piece, and secure a perfect weld with the steel without deteriorating the quality of the steel? Which is the best method to perform the operation? A. We do not think you can do it.

W. L. asks: Is any injury to be apprehended in firing a boiler with the dust from mixed fabrics whence the wool has been extracted, from greasy rags with oil of vitriol? A. We scarcely think that any injury will result from the use of this material.

G. W. V. G. asks: 1. Will a thermometer indicate the same temperature hanging in the wind that it would if sheltered from the wind, everything else being equal? A. Probably the indication would be lower in the wind. 2. Is the temperature when air is put in motion by a fan or bellows changed? If so, what is the cause? A. We think not, materially.

G. A. E. asks: 1. In the electrical plate machine described on page 402, vol. 28, if the disks are of glass, is it absolutely necessary to the proper working of the machine that the lower disk should be of glass and the upper of iron? Or is it only necessary that the lower one should be twice the thickness of the upper? A. Probably the relative thickness is not a matter of great importance. 2. How or where can I get ebonite? A. Ebonite is made by heating India rubber with half its weight of sulphur. You can doubtless obtain it from a rubber factory.

L. W. M. says: We conduct escape steam through our building with tin pipe, for heating purposes. The pipe is not painted inside. Is there any way that we could coat the inside of the pipe without taking it down? We think we could economize part of the escape steam if we could apply some good radiator. A. We scarcely think you can accomplish this.

E. P. C. asks: In Bourne's mode of setting the eccentrics, what is meant by "the center of the eccentrics"? A. It has the same relative position as the center of any circular figure. 2. When a train of cars is going around a bend in the road, do the inside or the outside wheels slip on the track? A. The outer wheels will slip the most, if both have the same diameter.

A. B. D. asks: 1. What will remove black worms from the face? A. Friction with a rough towel has been highly recommended by some of our correspondents. 2. Are the so-called black worms living insects, or merely a secretion? A. We think they are secretions of matter. 3. Are hot air furnaces bad for the health? If so, what is a better and not too expensive way of heating a house. A. This is a matter about which there is a great diversity of opinion. For our own part, we think that hot air furnaces, in which water is constantly evaporated, may be used in well ventilated houses without injury to health.

A. C. E. says: 1. I have a small library of about 400 volumes which I wish to arrange and catalogue. What is a good method for so doing? A. It is a good plan to arrange the catalogue alphabetically, according to the names of the authors of the works. Example: "LLOYD, HUMPHRY. Elementary treatise on the wave theory of light. 2d edition, 1 volume, 8vo. London, 1878. 2. E." The figure 2 refers to the book case, and the letter E to the shelf on which the book may be found. 3. In sharpening a knife or a similar tool, when the grindstone is turning towards you, should you hold the sharp edge of the knife toward you or from you? A. The latter way.

E. E. B. asks: What course of study is necessary for a civil engineer? What books are necessary, and where can they be procured? A. Send to some publisher of scientific works, for his catalogue, in which you will find the different subjects classified. You will see the advertisements of such publishers in the SCIENTIFIC AMERICAN.

A. S. asks: How can I stop the leak in an aquarium? One of the glasses is cracked. A. Probably you can stop the leak by the use of marine glue.

T. E. asks: How can I ascertain the amount of any given element in any given mineral, for instance the lead in galena, or the zinc in blende? A. It can be ascertained approximately by a careful blowpipe analysis.

R. C. G. asks: How can I tin pieces of iron wire? I have tried dipping them in melted tin, but cannot prevent their sticking together, and they are very rough and unevenly coated. A. Probably you will have to arrange the pieces so that they can be dipped separately, and wiped off as soon as removed from the tin bath.

C. D. says: We have a private telegraph. My station would not work; upon seeking for the cause the copper insulated wire (running from the street wire into my cellar) was found corroded at the two ends of the cellar window where it touched the brick wall. Will you inform me of the cause of this corrosion at these two points? A. Gases that corroded the wire might have been given off from some place in the vicinity.

J. M. D. asks: What will be the advantage of inserting a 3/4 inch pipe into each end of a cylinder thereby making direct communication from one end to the other? The object of this is to provide for the drainage of the cylinder. A. As we understand the question, the effect will be to increase the back pressure on the piston.

H. F. M. asks: 1. How many feet to the mile are there in a grade of three degrees? A. About 275 feet to a mile, measured on the incline. 2. How can I ascertain the amount of water that a roadside gutter will carry? A. Knowing the construction, you can determine by experiment the velocity, and consequently the amount of water discharged in a given time. 3. How much fall should be given to an open spout, made of two planks nailed together, in a distance of 500 feet so as to carry 30 gallons of water per minute? A. You can use the formula given on p. 48, vol. 23, multiplying the coefficients there given by 0.571. In this way you can find the inclination necessary for a wooden pipe. Then make your trough so that the wet surface is the same as the surface of the pipe. 4. Is there any way to repair the screw on a common auger when it is slightly damaged or worn? A. It can often be done with a file. 5. Is there a way to clean kerosene barrels, so as to make them fit for packing meat in? A. We think they can be cleaned by steaming. 6. What is the best way to wash fannel? A. This is a disputed point. Perhaps the ladies, who know all about such matters, will send us their views.

G. R. E. says: 1. In your article on the initial velocity of projectiles on p. 400, vol. 23, you say that the circuit of the battery of the Boston instrument can be closed or broken at will by means of a disjuncter. What is that disjuncter composed of, and what is its position? 2. In the description of the Schultz chronoscope, you mention the interrupter, and say it closes and opens the circuit about 500 times per second; can you explain it? A. In these instruments an electro-magnet is employed and the attraction is destroyed by interrupting the connection of the conducting wire with the battery. 3. What will cut off or stop the current of a common horse shoe magnet? A. We do not know of anything that you can use to cut off the attractive force of a permanent magnet.

C. R. asks: In the compound engine, in which the steam does duty twice, what is the ratio between the first and second cylinder? A. From 2.5 to 3. 2. What gain is claimed for this sort of engine? A. Greater facility for a high grade of expansion, and less cooling and reheating of the cylinder during alternate strokes. 3. Is there not a back pressure on the piston of the small cylinder on the return stroke? A. Yes. 4. Is there any way of avoiding this back pressure, and, if it could be obviated, would not the gain be large over the ordinary engine where the steam is used only once? A. Reducing this back pressure reduces the working pressure in the second cylinder.

G. E. W. asks: Is not the curvature of the earth for the first mile nearer six and a half than eight inches? Reckoning diameter eight thousand, and circumference twenty-five thousand, miles, the fall from pole to equator is four thousand miles, of course. Then, as the square of 6,250 miles is to the square of 1 mile, so 4,000 miles are but a small fraction more than 6 1/2 inches. A. The polar diameter of the earth is 41,797,536 feet, or 7899.153 miles; the mean diameter at the equator is 41,847,662 feet, or 7905.694 miles. It is sufficiently accurate in calculating the curvature of the earth, to regard it as a sphere with a diameter of 41,778,000 feet = 13,926,000 yards = 7912.5 miles. The curvature for any distance, all dimensions being taken in feet, is found by dividing the square of the distance by 41,778,000—or the curvature, in feet, for any distance expressed in miles, is equal to two thirds of the square of this distance. For a distance of 1,800 feet, or one mile, the curvature will be $\frac{(1800)^2}{41,778,000} = (1)^2 \times \frac{2}{3} = 0.667$ feet as given in the table. 2. 41,778,000

Has a telescope a lifting power, so to speak, as well as a power for enlarging; and, if so, are the two powers equal? A. In general, a correction for refraction (which makes the object appear higher than it really is) and thus reduces the curvature) should be applied. This varies with different states of the atmosphere, but its average value may be assumed as one sixth of the curvature, so that the corrected curvature is five sixths of that given by calculation. Hence it appears that the curvature, at a distance of one mile, corrected for refraction, is, on an average, $\frac{(2280)^2}{41,778,000} \times \frac{5}{6} = (1)^2 \times \frac{5}{6} = 0.833$ feet. 3. From what bases have the earth's circumference and diameter, as these are now measured, been estimated? A. By the measurement of the lengths of a degree of latitude and longitude at different parts of the earth's surface.

R. J. B. R. asks: At what age does a person usually stop growing? A. Some one has recently published the following data in regard to the growth of men and women: Average weight of boys at birth, 6 1/2 lbs.; average weight of girls at birth, 6 1/4 lbs.; average weight of males at 20, 145 lbs.; average weight of females at 20, 120 lbs. Men acquire greatest weight, on an average, at 35, weighing 153 lbs.; women, at 50, weighing 128 lbs. Weight of an average man or woman when full growth is attained is about 20 times that at birth.

J. G. asks: Why will a hollow cast iron cylinder sweat on the inside when a flame of illuminating gas is turned into it for heating purposes? Is it because the moisture is contained in the pores of the iron and liberated by heat, or is the gas condensed into water upon coming in contact with the cold surface of the iron? A. The steam formed by the combustion of the gas condenses on striking the cold cylinder.

J. H. asks: What is the best method of painting upon glass, so that the coloring will resist the weather? A. First draw the subject on paper, and fasten it, face downward, by pasting it at the ends, to the glass. Turn the glass over, and paint with a camel's hair pencil, the pigments being mixed with varnish. Let the outlines dry before filling in and shading. The painting may be varnished over.

J. B. N. asks: How can I transfer pictures from paper to glass? A. Coat the glass with a varnish of balsam of fir in turpentine, then press the engraving on smoothly and evenly, being careful to remove all air bubbles. Let it stand for 24 hours, then dampen the back sufficiently to allow the paper to be rubbed off by the forefinger, rubbing it till a mere film is left on the glass, then varnish again.

H. H. asks: How are organ pipes constructed, and are they tuned in the shop or after the organ is set up? Do they ever get out of tune? If so, how are they made right again? A. Organ pipes are made of wood or metal. The wooden pipes are generally nearly square in cross section, varying in size of section according to the length. Metal pipes are of different kinds of pewter, the best being the sort known as spotted metal. Pipes can be tuned before being put in the organ or afterwards. Shortening a tube raises the tone, lengthening it lowers it.

R. H. S. says: By what means can a barometer that has lost a portion of the mercury from the cistern be made to register correctly? A. It would probably be difficult to adjust it without using another barometer, unless the cistern is adjustable.

H. S. asks: 1. How does a chemist earn a living? A. Chemists make analyses, prepare reports of processes, etc. Some of them are professors in educational institutions. 2. Does he ever get rich? A. Good chemists often realize large profits from their profession. 3. What are the best books for a boy to study who wants to learn chemistry, supposing he knows nothing about it? A. "Towne's Elementary Chemistry," price \$2.75, will be a good book for you to have, and you will find in it information in regard to your other questions.

J. S. asks: 1. When in a rotary engine there are two or more pistons to but one abutment and steam port, after the second piston has passed the abutment and is receiving steam, does the steam between the first and second piston cause back pressure by expanding and pressing the two pistons apart? A. In general it does. 2. Are the compound brass fishing reels cast or stamped out of sheet brass? A. We believe the cheaper styles are stamped.

W. W. M. asks: How can I cover wire for insulating it? A. A disk having a large hole in the center, and carrying two spools on which the silk is wound, is made to revolve as the wire is drawn through the hole, the ends of the silk being first tied to the wire. By varying the relative speeds of the disk and wire, the silk may be wound on as closely as may be desired.

J. P. L. asks: How can I prepare bronze powder, to be used in a semi-liquid state upon wood? I want it to dry quickly. A. The best way is to coat the wood with glue or drying oil, and dust the bronze powder over it through muslin. But the bronze powder may be mixed with drying oil, and applied with a brush.

D. B. asks: 1. How can I make small portions of yellow and green bronze, and golden ink? A. For golden ink, see p. 102, vol. 30. Yellow ink can be made with a decoction of saffron. Green ink can be made by mixing indigo carmine with picric acid. 2. Do you know of a simple prescription to take tan off the face and hands? A. Cover the skin with cold cream. 3. Which is the better, to study civil engineering theoretically, or to study it by being the assistant of an engineer? A. The latter way. 4. Name some authors who have written on the "True and Beautiful." A. Ruskin, Taine, Goethe, Matthew Arnold, and the majority of the poets. 5. What is the salary of a United States coast surveyor? A. From one hundred to one hundred and twenty-five dollars a month, we believe. 6. What are the predictions of the coming spring? Will it be early? A. Probably it will be late, but this is a mere guess. 7. Whose work on civil engineering do you regard as the best? A. Professor Rankine's.

H. J. B. asks: Is there any kind of oil that will form an explosive gas by forcing air through it? A. Probably naphtha or some other of the hydrocarbons will answer your purpose.

W. asks: Why is it that, in hewing green wood, a spark of fire is often seen down in the wood next to the ax, where there could be no grit? A. The spark is probably due to the friction between the ax and wood.

R. G. asks: Why is it that a large boiler cannot carry as much steam per square inch as a small one? A. The strength of a cylinder, other things being equal, is inversely as the diameter.

E. J. F. asks: 1. Will the magnet be less powerful in attraction under water than otherwise? A. We think not. 2. What is the best method of causing a magnet to retain its full power of attraction? A. Keep weights suspended from the armature. 3. Which is best, magnetite or iron merely magnetized, or is there no difference in the power? A. The latter is best.

T. S. V. says: I am using a 10x20 engine, running at 80 revolutions, with steam at 60 lbs., with a 3 inch exhaust pipe, and I would like to exhaust into the bottom of a tank containing six feet water. How much back pressure will it make on the engine? A. About two and three quarter pounds per square inch.

J. A. B. asks: Would a steam boiler explode with the same noise and throw pieces of the boiler as far if it exploded under hydraulic pressure at 150 pounds to the square inch as it would under the same pressure of steam? A. The explosion would generally be the most violent in the case of steam.

N. L. T. asks: 1. Why can a kettle of boiling water be held on the hand without inconvenience as long as it boils, but as soon as it stops the heat becomes intolerable? A. If such is the fact, it is probably because water in boiling requires so much heat that it is abstracted from surrounding objects. 2. Can heat be transmitted through a vacuum? A. We think so. 3. Why are rifle balls made conical at one end, and flat and sometimes concave at the other? Would they not be more effective if made tapering to both ends, as in that case no vacuum is formed after the ball, the air flowing in behind it instantaneously? A. They are made concave at one end, in order that they may spread, and fill the grooves of the rifle barrel.

O. K. asks: 1. Is the White House at Washington a wood, brick, or stone building? A. It is built of freestone. 2. Has it ever been rebuilt? A. We think not. Why is it called the White House? A. Because it is a white house.

W. B. N. says: A friend claims that, in setting logs for sawing, the eccentric blocks, making two motions for one inch, will not throw the log as hard as setting the log by one motion with the double rack and pinion. There is no back lash in either case, and the log is to be moved the same distance in the same time. I claim that, if there is any difference, it would be in favor of my plan with the double rack and pinion. He is sure that he is right, and will not let anyone decide. I ask for your opinion. A. It is difficult to determine which is correct without a practical test with the two devices.—J. E. E., of Pa.

W. M. J. asks: What is the best kind of saw to saw plow beams, wagon felines, and wagon hounds? How many plow beams are a day's work for one man, cut from plank of the proper thickness for common two horse plows? Is cutting the lumber or logs into plank the proper way to get out plow beams, or would it be better to saw the timber or logs to the shape of beam, and then slit up to the thickness of beams? A. The logs are the first sawn into plank to the proper thickness for the beams, and then to a pattern marked with the required shapes. A strongly built jig or band sawing machine is used for sawing the curves or the curved way of the beam. The first cost of a band sawing machine would probably be more than for a jig saw, but it would saw more rapidly. So much depends upon conditions that it is impossible to give an approximate estimate of a fair day's work.—J. E. E., of Pa.

W. J. says: 1. I have a theory that a balloon could be guided at will by attaching to it a conical shaped apparatus, made of light material and hollow, the open and large end to be fastened to one side of the balloon, the other end converging to a point. The theory is based on the principle that the balloon with the above attachment offers less sail-like surface to the wind, and consequently would be enabled to sail against currents of air. What is your opinion? A. We do not think that this arrangement will enable you to do what you propose. 2. Would not perpetual motion be possible if it were not for the law of gravitation? A. Possibly it would. 3. What is your opinion of the following proposition: If perpetual motion is ever invented, will it work by magnetism or attraction of magnetic force? A. No. 4. Has there been anything invented to condense all the steam from a steam engine and return it to the boiler. If so, what is the percentage of waste? A. Yes. There is no waste, if the apparatus is tight. 5. Does the patentee of an invention possess any certificate to show that his invention is patented? A. No. 6. Is there any instrument that will detect the presence of a metal in the earth. A. No.

W. S. C. asks: 1. If the same pressure is brought to bear on every part of the interior of a steam engine and boiler, why are they made of different strengths? For example, the boiler is $\frac{1}{4}$ inch thick, the live steam pipe is $\frac{1}{2}$ inch, and the steam chest and cylinder sometimes one inch and more. A. The strength of a cylinder, other things being equal, increases as its diameter is decreased, consequently small cylinders do not require to be made as thick as large ones. 2. How is it that a steam boiler can pump water into itself? It seems to me that there would be a back pressure on the pump piston head. A. The steam piston is larger than the water piston, so that the pressure per square inch on the water piston is greater than the boiler pressure. 3. If it takes 10 ordinary horses to run a machine at the required speed, what sized engine would do the same work? A. An average horse performs about an engine horse power, when working in a gin or mill, so that an engine of five horse power would generally do the work of 10 horses. 4. Why can a horse pull more when he is hitched directly to the load than he can 100 yards from it by a rope, deducting the weight of rope? A. We are by no means certain that this is a fact.

C. H. W. asks: How is curd soap made? A. By using tallow for the grease and soda for the alkali.

A. B. says: 1. In February last, while plowing a piece of land, I found, at a depth varying from 3 to 6 inches, a large number of honeycomb insect nests. These nests were of various sizes, but, for the most part, varied from 2 $\frac{1}{2}$ to 3 inches in width, about 4 inches in length, and about 1 $\frac{1}{2}$ inches thick. These nests are somewhat oval, inclining to flat on the top and bottom, and have quite a number of honeycomb cells, varying generally from six to twenty-four, which contain the cocoons of the insect. These nests are made of clay, somewhat like the dirt doblers. Can you inform me what bug or insect could have made such a nest, what its habits are, etc.? A. The insect which you describe appears to be a kind of wasp, of which there are two descriptions, the social and the solitary. The solitary wasp sometimes builds its nest in the ground, while the nests of the social insect are sufficiently familiar to us hanging from trees and fences. Consult an encyclopedia, article "wasp." 2. What is the best method of mixing white lead or zinc for painting wood? A. White lead and zinc are mixed with boiled linseed oil to a proper consistency for paint. 3. In vol. 23, No. 26, you published a new specific for rheumatism. It will be valuable to many if you republish it. A. Propylamin is the specific referred to. Wertheim prepares it by the decomposition of narcotine and codeine by alkalies. Dose, 5 drops in a tablespoonful of peppermint water every 2 hours.

C. S. A. asks: If a magnet were made in the shape of a ring, of the ordinary thickness, would not each molecule have polarity in the same directions as the whole magnet? A. In a bar magnet the magnetic power is most intense at the two extremities or poles, the middle portion showing hardly any or no magnetism. A circular disk or ring could be magnetized in the same way, the position of the poles depending upon the manner in which it was magnetized.

G. M. G. asks: Why is it that metronomes, for beating time in music, are not made in this country? A. Make one for yourself by taking a cheap clock movement, and substituting for the pendulum a wire with a sliding weight. Mark the wire with a file at the different points of graduation.

R. J. asks: 1. How can I make phosphate of calcium? A. By phosphate of calcium, we suppose, you mean calcium phosphate or phosphate of lime. The former term and analogous ones we consider both confusing and uncalled for in chemical nomenclature, although some chemists affect them. Phosphate of lime occurs naturally in the mineral apatite, and consists to a considerable extent in bones. In chemistry there are various phosphates of lime, depending upon the amount of base present. To form a basic phosphate, add a solution of basic phosphate of soda to a solution of chloride of calcium. 2. Can you tell me how to dissolve old rubber boots, etc., on a large scale? A. Bisulphide of carbon is a good solvent for India rubber. 3. Which is proper in speaking, to say "I can't" or "I cannot"? A. The vowel a in "can't," abbreviation of "cannot," is sometimes pronounced with the a short and flat, and sometimes with the a broad and long, but never, properly, with any sound of o, as in "cant."

R. F. Jr. asks: 1. Will you please give a practical method for testing the explosive nature of the several brands of burning oil? A. Oil that will not take fire when a lighted match is held to it may be considered tolerably safe. 2. In a recent number you gave a recipe for a paint dryer, which named gum lac as one of the ingredients. Is there any other name for that article more familiar to the trade? A. We think the name gum lac is applied to all the varieties in the market, namely, stick lac, the crude product, seed lac, in a granulated form, and shellac, which has undergone a purification.

J. V. D. says: After getting up steam on a Monday morning, I went to start my engine when, after about five or six turns, there was a loud report inside of the boiler, which jarred the whole mill. In about two seconds there was another and louder one, and then the boilers went on all right. On the next Monday morning they acted similarly. In the first case, the steam fell from 70 to 30 lbs., and in the second from 40 to 30. What was the cause? A. It may be that the pipes connecting the boilers with the steam drum had been choked with ice or something else, which would account for the accident.

E. S. H. asks: How can I make a safety fuse, to burn at least 5 minutes? A. Soak a plaited cord in a solution of saltpeter.

S. asks: 1. How may I prove meerschaum to show that it is not imitation? A. This is the work of an expert. 2. How may it be made white, after it has become colored? A. We think it can be done by heating.

H. S. asks: If I fill a cask with steam from water at a heat so that the pressure will raise a safety valve weighted to one pound to the square inch, and then allow the steam to condense, what proportion of vacuum will there be in the cask? What proportion of the cask would fill with water by suction caused by the condensation of the steam, if the cask is connected by a suitable pipe with a water in a well at the depth of 24 feet, the pipe being full of water? A. If the steam is condensed, there will be practically a perfect vacuum, and the cask will become filled with water from the well.

W. F. M. B. and N. C. R. ask: Is the law, passed some time between 1856 and 1859, requiring all persons in charge of steam boilers and engines to be examined by commissioners appointed for that purpose, still in force? A. The United States law applies only to engineers of steam vessels. There are local laws in most of the States. It is very questionable in the light of the working of the present United States law whether government regulations affecting all persons in charge of steam boilers would be desirable.

T. H. E. asks: In soldering two pieces of iron together (a pair of gun barrels, for instance), after they have been thoroughly cleaned, tinned, and fastened together with binding wire, and warmed so that a thin sheet of solder applied to the joint will melt, is there anything besides resin that will make the solder flow as it ought, to make a good job? Resin is disagreeable to the workman, besides leaving a dirty, black color on the iron, which is difficult to remove. A. To 2 ounces of muriatic acid, add small pieces of zinc until bubbles cease to rise. Then put in half a teaspoonful of sal ammoniac and 2 ounces of water.

H. E. F. asks: Is vulcanized rubber the same thing as gutta percha? A. No.

G. M. A. asks: Is there a garden gate which opens and closes automatically? A. Such a gate is described on p. 406, vol. 23. 2. Is there any method to cement mica to copper, tin, glass, or another piece of mica? A. The cement described in our answer to R. L. on p. 90, vol. 30, will answer the purpose.

W. L. asks: Is there any chemical that can be applied on glass, tin, or paper, which will be visible only through colored or stained glass? A. We are not aware of the existence of any such substance.

M. H. A. asks: If I take equal parts of block tin and quicksilver and unite them together by heat, could this be used for a polish for cleaning knives, forks, etc.? I propose to use muriatic acid and then apply the tin and quicksilver; would it adhere so that they could be used? Would there be any danger in using such articles? A. Your process might answer for tinning, and you can easily try the experiment, but amalgamated articles would be objectionable for culinary purposes.

M. B. asks: How can I make molds to cast silver, so that the silver will flow well and cast smoothly in casting small articles? A. You can make molds for silver similar to those which are used for fine cast iron castings. For a smooth facing, fine soapstone or plum-bago may be used.

A. A. S. asks: Has hydrogen ever been decomposed? A. We have seen no authentic statement to the effect that it has.

A. S. says: An engineer of some experience has been building engines with concave pistons and corresponding convexity of the cylinder heads, taking steam in the center of the pistons by an arrangement of ports cored out of the heads, claiming that he gains a greater effective pressure on the piston by that shape. He states that, on a 4 inch cylinder, he gains 2 square inches. I claim that, no matter what the shape of piston or head, the size of cylinders being equal, the pressure will be the same as in the common engine. A. We think you are right.

W. S. W. asks: How are Japanese scintillettes made? A. Japanese scintillettes consist of pencils of rolled paper, one extremity of which, to the extent of about half the length of the pencil, is filled with a composition which burns with a red flame. It is ignited by holding the fine extremity in the hand, while the other end containing the mixture is held for a moment in a flame. The composition may be made to suit the fancy, the chief ingredients being probably sulphur, meal powder, or chloride of potash, etc.

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

S. E. W.—Your boiler sediment consists of some saline material. So far as we can judge without a chemical analysis, it is common salt. The water used is apt not only to form scale, but to corrode the iron. The remedy is to distill, and to use the water from the condensed steam as far as practicable.

G. W. P. Jr.—The stones you send are garnets. When very perfect and of a pure color, they are sometimes reckoned among precious stones. Fine specimens are found in Ceylon and Brazil. We do not consider your specimens of any particular value. The garnet is a double silicate of alumina and lime, colored with manganese and iron.

L. T. H. asks: How can I make imitation ivory billiard balls without pressure?—E. E. S. asks: How

is moss prepared for finishing wax flowers? Can it be bleached and made to resemble white wax, to be put in white bouquets? How can small monopetalous corollas be made of wax, so that they will have the delicate fragile appearance of natural flowers? With what should the colors be mixed, so that they can be put on the wax as evenly as on paper? How can the bloom and flock be made to adhere to the wax?

COMMUNICATIONS RECEIVED.

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

On the Spider's Web. By J. H. B.
On the Hot Springs of Nevada. By G. A. F.
On the Centralization of Matter. By A. D.
On Ventilation. By A. R. M.
On the Relative Attraction of the Earth and Sun. By A. R. Jr. and by E. W.

Also enquiries from the following:

A. W.—G. A.—S. R.—G. B.—A. P.—J. W. T.—R. J. W.—W. H.—E. C. B.—E. N.—A. Th.—D. A. S.

Correspondents in different parts of the country ask: Who makes match spitting machines? Who makes balanced slide valves for use on locomotives? Who sells a hash machine? Who makes woolen machinery, such as pickers, breaker cards, and finisher cards? Who manufactures balloons? Who makes a machine which prints by touching keys, similar to a piano? Where are machines for making friction matches sold? Who makes movable calks for horseshoes? Who makes broom handle machinery? Who makes ditching machines? Where can machines for pressing coal dust into blocks be obtained? 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.]

Index of Inventions

FOR WHICH

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January 20, 1874,

AND EACH BEARING THAT DATE.

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Elevator, hydrostatic, H. Flad.....	146,613
Elevator, water, N. H. Lindley.....	146,604
Engine, rotary, J. B. Adt.....	146,630

3,070.—J. A. Green, Hamilton, Ontario. Improvement in railway switches, called "Green's Self Adjustable Railway Switch." Jan. 3, 1874.

3,071.—Wm. Hamilton, Neversink, Sullivan county, N. Y. U. S. Improvements on machines for making shoes, called "Hamilton's Ox Shoe Machine." Jan. 3, 1874.

3,072.—D. J. Casement, Patneville, Lake county, Ohio. U. S. Improvement on seal locks, called "Casement's Seal Lock." Jan. 3, 1874.

3,073.—J. Wilson, Kingston, Ontario. Improvements on paddle wheels, called "Wilson's Paddle Wheel." Jan. 3, 1874.

3,074.—A. Amos, Potsdam Junction, St. Lawrence county, N. Y., U. S. Improvements on horse hay rakes, called "Amos' Improved Horse Hay Rake." Jan. 3, 1874.

3,075.—C. McPhail, Big Harbor, Inverness county, Nova Scotia. Improvements on armor for ships of war, called "McPhail's Armor for War Ships." Jan. 3, 1874.

3,076.—C. H. Chapman, Shirley, Mass., U. S. Improvements on machinery for weaving tape, called "Chapman's Tape Weaving Loom." Jan. 3, 1874.

3,077.—Wm. McAllister, St. Lawrence, Mass., U. S. Improvements for protecting buildings from fire, called "The McAllister Fire Protector." Jan. 3, 1874.

3,078.—L. Woolridge, Dean's Corner, Lake county, Ind., U. S. Improvements on land rollers, called "Woolridge's Improved Land Roller." Jan. 3, 1874.

3,079.—W. C. Davol, Jr., Fall River, Bristol county, Mass., U. S. Improvements in hose leak stoppers, called "Davol's Fire Hose Leak Stopper." Jan. 3, 1874.

3,080.—I. Helton, Carter's Depot, Carter county, Tenn., U. S. Improvements in a medical compound, called "Fever Specific," the title or name whereof is "Fever Specific Compound." Jan. 3, 1874.

3,081.—H. H. Hudgin, Howard, Kent county, Ontario. Improvements in the formation and construction of gate posts, called "Hudgin's Gate Post." Jan. 3, 1874.

3,082.—M. Boch, Brooklyn, Kings county, N. Y., U. S. Improvements on fasteners for shoes, etc., called "Boch's Improved Shoe Fastener." Jan. 3, 1874.

3,083.—J. Rogers, Brooklyn, Kings county, N. Y., U. S. Improvements on apparatus for manufacturing lamp black, called "Rogers' Improved Lamp Black Furnace." Jan. 3, 1874.

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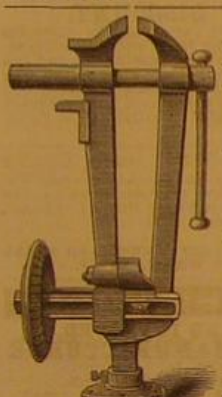
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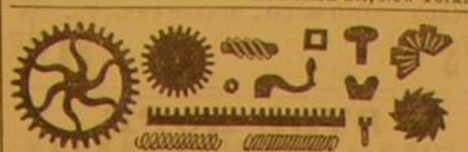
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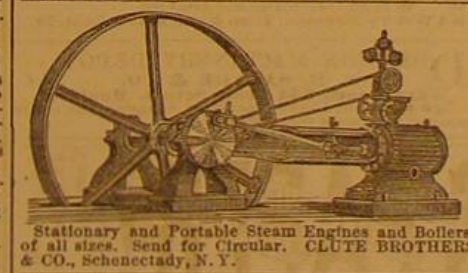
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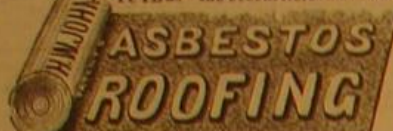
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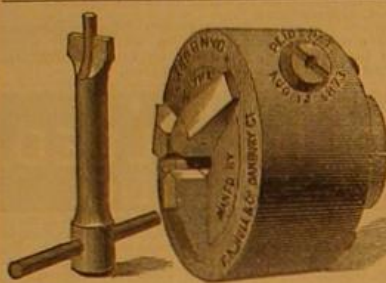


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