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## THE PROPOSED NIAGARA BRIDGE AT LEWISTON, N. Y.

In a recent issue we printed a letter from a correspondent, C. A. H., in which the possibility of erecting a permanent bridge across the Niagara River, at Lewiston, N. Y., was suggested, and the opinions of engineers on the subject asked. Our correspondent pointed out briefly the high importance of such a work, and offered, in event of its completion within twenty years, a subscription of $500, and also a further and similar amount to go toward the creation of a trust fund of $100,000 for the engineer whose skill may be used to the desired end.

With reference to the above, we have lately received a communication from Messrs. Clarke, Reeves & Co., the well known bridge builders, of the Phœnixville (Pa.) Bridge Works, inclosing a plan of a practicable bridge, from which the annexed engraving has been prepared.

THE PROPOSED NIAGARA BRIDGE AT LEWISTON N. Y.

Lewiston, we may here remark, is situated some seven miles below Niagara Falls; and at this point the river emerges from the narrow gorge, which varies from 200 to 400 feet in width, after making a last gradual descent of some 250 feet. Messrs. Clarke, Reeves & Co. state, with reference to their proposed bridge, that the span is 600 feet. The structure is designed for a double track railway, 120 feet above the level of the river, and for a carriage way, beneath this road a distance of 75 feet. The estimated cost is $800,000. The difficulty, therefore, of erecting a single span, over swift rapids and where the water is practically unfathomable, the manufacturers claim to have overcome, and they offer to contract for construction as soon as a company is ready to supply the funds. Instead of occupying twenty years in building, Messrs. Clarke, Reeves & Co., with their present facilities, believe that the work could be accomplished in as many months. With reference to our correspondent's proposed trust fund, they add: "There is so much oldfashioned liberality (rare in these latter days) in C. A. H.'s proposition to create a trust fund, that we take the trouble of writing this letter to show him that the construction of a bridge across the Niagara river, at Lewiston, is a much simpler and less costly undertaking than he supposes."

The wide reputation of the above firm, and their uniform success in accomplishing the various difficult engineering feats which they have hitherto accomplished, are, to our minds, sufficient guarantee of the reliability of their opinions in the present. Since the work, therefore, is possible, it remains to produce the men who will supply the means and the enterprise for its prosecution. The amount required is so small that many of our great capitalists could bear it alone; so that certainly, to a few of that class, if they can be found with the progressive views which evidently characterize both C. A. H. and Clarke, Reeves & Co., the undertaking would be no difficult one.

### Solders and Soldering.

The operation of soldering appears, as it is in fact, a very simple one; but simple as it may be, it is only the practised hand who can turn out a really creditable piece of work, even in the ordinary tinman's line. The amount of practice necessary depends in a great measure on the natural ability of the tyro; but a little patience and a fair amount of perseverance on the part of amateur mechanics will, as a rule, enable them to solder up ordinary work in a manner as serviceable, if not so neat, as that done by the professional. It may be of assistance if we give a brief account of the process and of the solders used for joining the different metals. Soldering is of two kinds—that in which a more or less fusible alloy is placed between the two portions to be joined, and that in which the metal itself is made to unite, a process known as autogenous soldering, and in some cases termed "burning." The principle of soldering consists essentially in creating a temporary or rather incipient fusion of the parts to be joined, by the direct application of heat, or by means of a fusible alloy which will, when in the state of fusion, unite with the metal or metals to be fastened together. In the latter case, it is obvious that the metal or the alloy forming the solder must be more fusible than the metals to be soldered, and, moreover, must have a chemical affinity for them. But although there must be an appreciable difference in the temperatures of the points of fusion, as a general rule the smaller the difference—or, in other words, the nearer the fusion point of the solder approaches that of the metal to be joined—the more perfect the joint; for, as just mentioned, the nearer the parts can be brought to a state of fusion, the neater and stronger will be the union, the solder having then formed a true alloy with the metal to be soldered. It is also essential, for this formation of a true alloy, that the parts should be perfectly clean and free from oxide, and that they should remain so during the whole operation. To insure this state of things, several substances are employed, chief among which may be mentioned sal ammoniac, chloride of zinc, rosin and tallow. The effect of all these fluxes, as they are termed, is the same: they merely preserve the metals from being oxidised, a process which goes on very rapidly when metals are melted, and are not protected from contact with the air. The chloride of zinc, which is hydrochloric acid (muriatic, spirits of salts) "killed" with zinc, that is to say, acid which has been supplied with all the zinc it can dissolve, melts over the surface of the work, removing any trace of oxide that may have formed since cleaning, and also acting as a covering from the air. Sal ammoniac, containing hydrochloric acid, acts in a similar manner, and rosin and tallow have the effect of temporary varnishes, preventing the surfaces from oxidising. The methods of effecting fusion are almost as numerous as the solders themselves; the principal are the copper bit, tinned at the part applied to the solder, the heated iron which does not require tinning, and the blowpipe flame. For certain operations in the way of soldering, commonly called brazing the heat of a fire or of a muffle is required, while for others the articles are dipped in melted solder, or melted solder is poured on the joint, and, in some cases, the heat is applied by a stream of heated air.

Of all the solders, those formed of differing proportions of lead and tin are by far the most numerous, and probably the most useful, if we take into consideration the variety of their applications. For different purposes, they are mixed in widely varying proportions; but the ordinary solder of the shops and commerce is known as either hard or soft solder, tinman's solder, plumber's solder, coarse, common, and fine, being all names for an article which is possibly never twice alike. The sealed plumber's solder (of the Plumber's Company of England) contains two parts of lead to one of tin and melts at 440° Fah., or about the melting point of tin; but a solder made of equal parts of the metals is sometimes used, though rarely, as it is of course considerably dearer. Soft solder consists of two parts of tin to one of lead, and melts at 350° Fah. or thereabout. It is said to be the ordinary solder used for joining tin plates, and, with the addition of one part of bismuth, forms ordinary pewterer's solder. As a matter of fact, however, the solder found in commerce generally is known as coarse, common, and fine; and the respective proportions of the metals are supposed to be—for coarse, two parts of lead to one of tin; for common, equal parts; and, for fine, two parts of tin to one of lead. These proportions can generally be detected in the manufactured article, for coarse solder exhibits on its surface small circular spots, caused by a partial separation of the metals on cooling; but these are wanting when the tin exceeds the lead, as in fine solder. The great bulk of the solder made in this country comes from manufactories where it is made a specialty; but many of the larger firms who use it make their own, probably from having been disappointed in the quality of the goods bought of others. In the ordinary solder of

commerce, it is very rare that the tin exceeds the lead, and No. 1, or hard solder, of the shops, will, as a rule, be found to vary between one and a half to two of lead, and one of tin. The common stuff—that which plumbers use for making wipe joints in lead pipes—contains from two and a half to three parts of lead and one of tin. Such a mixture as this melts at less than 500°, that is, considerably below the melting point of lead, and has the property of remaining semi-fluid for some little time, so that, with a thick pad anointed with grease, the plumber is able to mold it to any desired shape. To render the solder hard without increasing the proportion of tin, some makers add a little antimony or copper, which has the effect of raising the fusing point without affecting the other qualities of the alloy. Although we have spoken of hard and soft solder in regard to alloys of lead and tin, it is better to retain the names now employed in commerce, coarse, common, and fine; and when we wish to make solder, to confine ourselves to the proportions mentioned as nearly as possible, for accuracy is not material. The mechanic by "hard solder" understands an alloy for uniting metals that are difficult to melt—a compound of copper and zinc, sometimes with a little tin—a brass, in fact; hence the term brazing has been substituted for soldering.—*English Mechanic.*


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(Illustrated articles are marked with an asterisk.)



## BOGUS STATE LAWS CONCERNING PATENT RIGHTS.

We have heretofore, on several occasions, called attention to the unconstitutionality of various State laws, by which local legislatures have attempted to regulate or prevent the sale of patent rights within their borders. In some of the States, laws have been passed by which patentees or their agents who offer patent rights for sale, without complying with certain State regulations, are made liable to fine and imprisonment.

We need hardly say that all such State laws are without binding force, and are in direct conflict with the laws of the United States; and any State judge or officer who should, under pretence of a State law, arrest or interfere with a patentee or his agent in the sale of a patent right, would be liable for damages and punishment in the Courts of the United States.

This question was adjudicated by the United States Court in the case of John Robinson, agent for the Goodyear Rubber Dental Plates patent, who, on offering to sell a right under the patent, was arrested and imprisoned under a State law of Indiana. The law in question made it unlawful to sell a patent right in that State unless the patentee or seller first deposited a copy of the patent with the county clerk, and made affidavit that the copy was genuine, had not been revoked, and that he was authorized to sell, etc. A certified copy of the affidavit was also given to the patentee or seller, and he was further required to exhibit the same to any person who might demand to see it.

The United States Court held that this kind of legislation is unauthorized, that property in inventions exists by virtue of the laws of Congress, and that no State has a right to interfere with its enjoyment, or annex conditions to the grant. If the patentee complies with the laws of Congress on the subject, he has a right to go into the open market anywhere within the United States and sell his property. If this were not so, a State might nullify the laws of Congress and destroy the powers conferred by the constitution.

We believe there are some Western States that have not yet repealed their obnoxious patent laws; and for the convenience of district attorneys, lawyers, and patentees, we will state that the decision of the United States Circuit Court, above alluded to, may be found printed in full on page 137, Vol. XXV of the SCIENTIFIC AMERICAN, date of August 26, 1871.

## METALINE AT THE AMERICAN INSTITUTE.

Metaline is an alloy which, when applied to machinery, is alleged to obviate the necessity of oil or other lubricants. But while we are told that it runs on everything from watchmakers' tools to big steam engines, one of its most recent applications has proved far from beneficial—in fact, instead of making the constituent parts move nicely, it has set them to grinding, cutting, jarring, heating, and disaggregating in a manner really sad to contemplate. We allude to that rather cumbrous machine known as the American Institute, the whole inner mechanism of which metaline has apparently disorganized. At the late Fair, it failed to slide smoothly through the hands of the judges, managers, and directors, and it drove the Board of the last mentioned so (morally) out of true that Professor Chandler, because the Institute gave a silver medal to metaline instead of a gold one, deliberately cut both the Board and the Institute. He resigned—he waxed warm in the journals—daily ones—he said that parts of the Board were welding themselves into a conspiracy. The alleged conspirators then published a long effusion, denying the soft impeachment.

To make matters still worse, metaline turns up again as the disorganizing element of the rotary engine tests. It did not clog the engines, but it apparently did the Fair official who supervised them. We hear of a protest to the results of the trials because the Superintendent of the Machinery, who made the calculations and had something—we know not what—to do in the way of supervision, was at the time engaged in negotiating with the successful competitor for a sale to the latter of metaline stock, and has since maintained business relations with him. Certainly no person acquainted with the gentleman will venture the assertion that he could be biased, even in prospect of a possible fat commission; but those who have denounced the tests to us, for reasons best known to themselves, as unfair, claim that such dealings on the part of an Institute official are sufficient, on their face, to invalidate the results of so very close a competition.

The award of silver instead of gold to metaline, and other equally important misdemeanors, form leading arguments against the present management by the opponents of the bill now before the New York Legislature, which the existing officers of the Institute want to have passed. This bill provides for a president and twelve trustees as substitutes for the unwieldy Boards of Managers and Directors now *in esse*. Both the metaline people and the Institute people include names which will be equally powerful in commanding the confidence of the public. The opponents of the bill assert that the measure has never been submitted to the Board of Direction or to the members generally, and that the present management attempted to rush it through the Legislature and have an election before a tithe of the members found out about it. A ring, it is alleged, would thus get themselves elected, and would be able to keep themselves in power indefinitely by exercising a right which the bill gives them to fill places among the trustees vacated by resignation, etc. This matter, however, appears to be a purely internecine war, and one which we have no doubt can be brought to a just conclusion by the exercise of good sense and moderation on both sides.

## ACCURATE ALIGNMENTS.

We have a slip from a Philadelphia paper, giving some particulars of the tunnel through the Musconetcong Mountain, on the line of the Easton and Amboy Railroad. The length of the tunnel is about 5,000 feet, through a mountain some 450 feet above grade. In making a tunnel, as our readers doubtless know, we have given a hill in which a hole is to be bored, the position of the ends of the hole, and the grade at which it is to be run; and as two headings are run at once, one from each end, it is very desirable that they should be on the same line, and should conform to grade, so that they will meet in the middle of the hill. The length, direction, and grade of the headings must then be calculated from outside measurements; and it becomes an interesting matter, after the work is completed, to see how closely the lines, as actually run, conform to the requirements. In the case of the Musconetcong Tunnel, the statements are made that the length, as ascertained by chaining over the mountain, only differed from the actual length, measured after the headings were completed, by six and four tenths inches, that the center lines of the two headings were only out of line about one three-hundredth of an inch where the headings met, and that the grades of the two headings, where they met, coincided to within one eight-hundredth of an inch.

The measurements were made with ordinary instruments; and if the results are reported correctly, the work reflects great credit upon the engineers having it in charge.

In this connection, we may mention a statement, in a Virginia paper, that an engineer, in the employ of the Belcher Mining Company, in *joining* two drifts by a short tunnel, 128½ feet in length, could not detect any error in the alignment, after the two headings were connected.

The Hoosac tunnel, it may be remembered, is 25,031 feet long, and there is an ascending grade of twenty-six and four tenths feet to the mile, from each end to the central shaft. On testing the work, after the completion of the tunnel, it was found that the error in alignment was nine sixteenths of an inch, and the difference of level, between the two headings, at the central shaft, one inch and a half.

While upon the subject of "great bores," some reference to the Mont Cenis Tunnel may not be out of place. This is about 40,000 feet in length; the level in the Italian side is about 435 feet above that of the French side, and the level at the summit, where the two headings meet, is about ten feet above the level at the Italian end of the tunnel; so that the two headings run to meet each other on very different ascending grades. On testing the work, after the two headings were joined, it was found that the heading from the French end was about twenty-four inches too high, and the error of alignment was about eighteen inches.

## FLYING MACHINES.

We have recently perused a very interesting paper by Dr. Barnard, of Columbia College, in which the writer, in his charming style, discourses of "Aerial Navigation," giving both his own views and the results of the researches of M. Bruignac, a French mathematician. As many of our readers are devising plans for sailing in the air, we think it well to give a brief *resumé* of Dr. Barnard's article.

As birds fly with wings, it occurred to man to employ the same device—but only to meet with failure. The reason of this is obvious. A bird has sufficient strength to fly, and a man has not. Hence the conclusion that, if a man wishes to fly, he must use some artficial motor to drive the necessary mechanism. In regard to this mechanism, it appears that a revolving wheel, such as a propeller, is better than a pair of wings, since the latter have an intermittent motion, and it is more difficult to construct them of the requisite strength and still have them light. At this stage of the inquiry, it becomes necessary to determine, by experiment, the effect of a revolving wheel in propelling a machine through the air. If the wind strikes against a plane surface, it creates a certain amount of pressure, depending upon its velocity; and inversely, if a surface is made to revolve at a high velocity, it encounters a resistance according to the velocity. M. Bruignac's experiments upon the pressure of the wind give the following results:

| VELOCITY OF THE WIND. | | PRESSURE. | |
|---|---|---|---|
| In feet per second. | In miles per hour. | In pounds per sqr. foot. | In pounds per sqr inch. |
| 33 | 22·495 | 2·75 | 0·0191 |
| 49 | 33·406 | 6·17 | 0·0428 |
| 65 | 44·319 | 11·00 | 0·0764 |
| 98 | 66·815 | 24·50 | 0·1701 |
| 147 | 100·243 | 55·50 | 0·3854 |

Instead of making the aerial vessel with a flat end, it can have a conical form, by which the pressure of the air, or the resistance that it must overcome, can be reduced to about ½ of the amount required in the case of a flat surface of the same cross section. It is to be expected that the machine cannot always sail in a calm; and on the supposition that it is to carry only one man, and is to advance at the rate of 20 miles an hour against a wind of the same velocity, it must have a motor capable of exerting about 5 horse power. The method of moving the aerial vessel, however, does not present so many difficulties as the means to be provided for keeping it in the air, and enabling it to rise or descend, at the pleasure of the navigator. It can be kept up by having a balloon attached to it, in which case, as the moving surface is largely increased, it must have a more powerful motor; or either vertical propellers, or an immovable plane, can be employed. A kite is sustained in the air by the pressure of the wind against it, provided the direction of the wind is oblique to its surface; and it is easy to see that, if the kite were moved through calm air at the same velocity as the wind has, it would be sustained in exactly the same manner, and a fixed plane surface on the aerial ship, in an inclined position, will sustain the vessel when it is put in motion This fixed surface seems to be the simplest mechanism that can be devised for the flying machine, in connection with two propeller wheels, turning in opposite directions, so as to keep the machine in an upright position. The best angle of inclination of the fixed plane, that is, the angle in which the least amount of surface is required, is 54° 10′ with a horizontal line; but the power required for motion in this case is very great. By reducing the angle between the fixed surface and a horizontal line, the power required for propulsion is diminished; but it is necessary to give the machine a much higher velocity, in order that it may be sustained in the air; or if the original velocity is retained, the area of the fixed surface must be largely increased, which will of course add to the weight. It must be remembered, also, that the machine will not be sustained unless it is in motion, so that it cannot rise from the ground, but must be launched from an elevation.

M. Bruignac finds, from a number of calculations, that, by attaching balloons to flying machines, they can be propelled by the aid of less power than in the case where a sustaining plane surface is used. The best form of balloon is that of a

horizontal cylinder with conical ends, the slant hight of the cones being equal to the diameters of their bases. The resistance to motion of a plane surface has been given in the preceding table; and it is found by experiment that, if three bodies having the same cross section are moved through the air at the same velocity, having the forms respectively of a circular plane, a sphere, a cone with slant hight equal to diameter of bases, the resistances to motion in the two latter cases will be (calling the resistance of the plane R) for the sphere $\frac{R}{2}$, and for the cone $\frac{R}{3}$.

The most favorable form of aerial machine, according to M. Bruignac, is a combination of a balloon with a sustaining plane. By his calculations, it appears that the most advantageous design, for a speed of 20 miles an hour in a calm, must not weigh, with engines, navigators, fuel, stores, etc., more than 2,200 pounds, and must have the following dimensions: There must be a balloon, filled with hydrogen, 22 feet in diameter and 94 feet long, together with a sustaining plane 94 feet long and 16 feet wide; and an engine capable of exerting from 6 to 7 horse power. This is equivalent to saying that the problem is impossible with our present means of construction, and would seem to settle the matter conclusively, unless it can be shown that a more favorable plan than the best one discussed by M. Bruignac can be designed. It is pretty evident that, if a machine is not practicable even in theory, there is little hope of its actual success.

Dr. Barnard concludes his paper with an exceedingly practical suggestion, which we commend to all our readers who are endeavoring to work out this problem. If it is possible to lift a given weight into the air, and make it move in any desired direction, it is certainly easier to do the same with a part of that weight. Let the inventor, then, attach his lifting apparatus to some vehicle on land, as, for instance, a railroad train, and, by sustaining some of the weight, make it move more easily; let him remove the locomotive, and put in its place his aerial propeller. If this works well, there is some hope of actually getting into the air; but should it fail, it would seem advisable for him to abandon his experiments.

## THE "SCIENCE" OF SPIRITUALISM.

Resuming the subject from page 80: Gordon's materialization was a startling novelty and too good a trick to be lost. Its successful revival, however, necessitated a patience of waiting till the little drawback of the exposure should blow over, and a shifting of the scene of action to a safe distance from the unfriendly climate of New York. The conditions were complied with; there was a waiting of a year, and the performance was repeated in the city of London under the mediumship of Miss Florence Cook. But Gordon's invention was expanded and improved, for Miss Cook substituted living persons for the masks; she constructed the celebrated and original Katie King, whose genuineness as a veritable spirit was certified to by witnesses whose testimony on matters of this world would be unimpeachable. The precise *modus operandi* was not found out. Katie appeared only a few times and London knew her no more. The medium explained that she had over-exerted herself, and thus had impaired her power of materializing, which, we take it, implies that a wholesome caution or forewarning had come upon her. The original Katie has probably made her last appearance in public.

But a duplicate or imitation Katie made her *debut* in Philadelphia in May, 1874, and was a greater success there than the original. The proprietors were practised mediums, Mr. and Mrs. Nelson Holmes. They had just returned from London; and it is pretty certain that they were acquainted with Florence Cook, and that they brought her secret with them. The theory that the London and Philadelphia tricks are substantially the same is tenable till something more plausible is proposed.

The new Katie was welcomed with enthusiasm by the leading spiritualists, and her desertion of England for America stimulated their patriotism; to them she was the final and overwhelming demonstration of practical spiritualism. The weak in faith were strengthened, and new converts were added to the fold in droves. For months, the Katie King mystery was the most prominent sensation for newspapers and magazines. But great success made the Holmeses too bold in continuing the show; and they came to a grief in November last, which early in January became wholly inconsolable. The trick was found out and fairly exposed; but the Holmeses and the devotees persisted, denied, and sophisticated, and thus kept Katie King alive as a spirit for more than a month.

The credit of the exposure is almost wholly due to the *Philadelphia Inquirer*. The facts of evidence against the Holmeses, as they were developed, were published in the *Inquirer*. But the evidence so appearing in disconnected fragments, although convincing to most sensible people, was misunderstood, perverted, and sophisticated by the spiritual partisans. A methodical statement which should end all doubt and controversy was therefore prepared and published, in an article occupying about fifteen columns of the *Inquirer* of January 9 and 18, 1875. The statement is in the form of an autobiography of the lady who personated Katie King; it was verified by her affidavit sworn to in the presence of several prominent citizens of Philadelphia. It was further confirmed by the lady having in her possession the robes and ornaments worn at the show, and the presents which she had received from her admirers in the character of Katie; she was fully identified by respectable people who had seen her at the show. Also Dr. Henry T. Childs, Hon. Robert Dale Owen, and others, who had been zealous and admiring patrons of Katie King, are witnesses to the truth of many of the essential facts. The *Inquirer* promises that the autobiography will be published in book form; we commend the book in advance as an antidote to the spiritual delusion, which will be effective as well as pleasant to take.

The lady objects to the use of her real name in connection with the spiritual fraud, and we will continue to call her Katie King. She was born in Massachusetts, January 1, 1851, was married at 15, and has a child eight years old. Her husband died two years ago, leaving her penniless, and her child and an aged mother depending on her exertions for their support. Last spring she set up the enterprise of keeping boarders in Philadelphia; the Holmeses boarded with her and got their living by the practice of spiritualism. But Katie fell among Philistines, and her enterprise lasted only a few weeks. In her extremity she entered the service of the Holmeses and was by degrees taught to tolerate and to practice deception, and at last to exhibit herself as a spirit.

The grand secret of the Holmeses was the device for getting Katie on and off the stage of exhibition without being discovered by the spectators. The device was a dummy board in a partition which constituted the rear of the cabinet, the partition separating the exhibition room from a private apartment or other hiding place; the dummy board was a board neatly cut in half, the lower half serving as a door for Katie's exclusive use. At one house in Philadelphia, the cabinet was erected against a doorway leading to a bed room, the back of the cabinet being the partition with its cut board substituted for the door. At another, the cabinet was erected against a window, the embrasure of which, by means of the partition, was made into a secure but narrow hiding place for Katie. The partition with its dummy board was an essential part of the stock in business, and was carried by the mediums in the various journeyings.

The exhibition had two acts or parts: first, a dark *séance* wherein a guitar was thumped, bells rung, and things stirred up promiscuously, being the ordinary and silliest of spiritual performances; next came what the mediums designated as the light *séance*, wherein darkness was made visible by a single and shaded kerosene lamp, placed as far as possible from the cabinet. For the light *séance*, Holmes locked himself in the cabinet, and Mrs. Holmes kept guard, seated at the door of the cabinet. The performance begins by the display of masks at the window of the cabinet, *à la* Gordon Katie King says these false faces were generally recognized by persons in the audience as the veritable spirits of their deceased friends. At last Katie herself appears at the window or in the doorway of the cabinet, and talks and walks precisely like a human being.

Katie's first appearance was on the evening of May 12; we quote her account of it:

"I entered it the first time, after the dark *séance* was over, from the bed room. Mr. Holmes was in the cabinet. After one or two false faces had been exhibited, I gently drew aside the curtain hanging over one of the apertures, showing the audience my face, and in a very low whisper, scarcely audible, said: 'Good evening, friends,' then drew back my head and drew down the curtain. The sensation in the audience was great.

Although somewhat excited, I was amused to hear the different remarks: 'Did you hear it speak?' 'I wonder who it is?' 'How beautiful it was.' 'I do wish it would appear again.' The lady medium, who was on the outside of the cabinet, among the audience, appeared very much pleased indeed at the reception I had received, and remarked that "she thought something unusual would occur, for the spirits had been drawing from her so hard all evening, to enable them to materialize, that she had scarce any vitality left." After the excitement had subsided a little and various requests had been made that I should appear again, I pulled the curtain to one side, showed my face at the aperture, and three or four voices at the same time said: 'Who are you?—Please tell us your name.' I answered in a low whisper, as before: 'I am Katie King, you stupid.'

These cant phrases, 'you stupid,' 'I shan't,' be sure I am,' etc., were used by Florence Cook (so I was informed by Mr. and Mrs. Holmes,) when personating Katie King, and it was very important that I should use them, so that the people would think I was the same Katie who had appeared in London. The sensation among the audience was greater than at first, and often was the question asked: 'Can this possibly be the Katie King who appeared through the mediumship of Florence Cook in London?' After a few moments I again showed my face and said: 'Of course it is, you stupid.' The sensation was even greater than before. I again withdrew. The lady medium remarked that 'spirits could not remain materialized but a few moments at a time; they had to retire into the cabinet to gather strength.' On my appearance again at the aperture, Dr. Childs asked me 'when I had been in London.' I replied: 'I attended a *séance* there to-day, you stupid,' and again retired.

Mr. H. suggested that I had said enough for the first time, and I left the cabinet, passed through the bed room, upstairs to my own room on the third floor."

Katie by degrees became accustomed to her part, and overcame much of the timidity of her first appearance; she found that the credulity of the average man was her safe protection; she at last permitted the faithful, especially Dr. Child and Mr. Owen, to touch her and to converse with her. She received many tokens of regard in the form of bouquets, letters, jewelry, and other things appropriate for a young lady, and in return she gave letters, locks of hair from her wig, and pretended pieces of her dress; to supply the great demand for the latter, she carried in her pocket a roll of muslin from which she cut the pieces as they were called for. Those who were so fortunate as to possess these bits of muslin were generally willing to certify that they saw them cut from the dress, and that they saw the holes in the dress close up before their eyes; the dress had a reproducing power like that of the widow's cruise. As the show advanced in interest and popularity, the admission fee was raised from $1 to $5.

The risk of discovery of the fraud was always a subject of anxiety with the mediums and Katie; with the mediums it was only a question of business, but Katie's conscience was constantly in trouble. Various precautions against detection, besides those mentioned above, were resorted to. Care was taken that the inner circle, the visitors seated nearest the cabinet, should be composed of devotees. They knew that suspicion would be likely to be centered on the bogus partition, and they forearmed themselves. One morning they put a sound board in the place of the dummy and had a committee of ten, including several experts, to make a thorough examination. This committee took down the cabinet, including the partition, piece by piece, and then conscientiously reported that the structure was of a substantial character and that there was nothing deceptive about it, and especially that the partition concealed no fraud and could not be used for Katie's entrances and exits. The report was printed and was made into a very effective advertising circular. Katie's autobiography, as may be inferred perhaps from our brief account of it, furnishes very rich amusement as well as instruction; it is a kind of truth stranger and more readable than a first class fiction; we regret that our limited space does not allow us to say much more about it.

But there is one extraordinary fact that has been developed in this matter, which justice to a leading spiritualist requires us to publish. Dr. Henry T. Child, more than any other spiritualist, with perhaps the exception of the Hon. Robert Dale Owen, has given the most unqualified, enthusiastic, and public endorsement of the Holmes' pretensions. On the discovery of the fraud, and this is what is extraordinary, he publicly and unreservedly makes reparation for his error, a course of conduct which is a novelty among spiritualists.

On January 8, 1875, Katie King, accompanied by Dr. Child and other friends, presented herself before the Hon. William B. Hanna, Judge of the Orphans' Court, Philadelphia, and signed and made affidavit to the truth of her written confessions as prepared for the *Inquirer*. Dr. Child then took the pen and wrote upon the document, below the affidavit of Katie and the certificate of Judge Hanna, the following:

I hereby certify that I witnessed the signing of the above paper, the confession of Katie King, and that it was signed, declared, and affirmed to be true by the person who appeared at the *séances* of Mr. and Mrs. Nelson Holmes, No. 50 North 9th street and No. 825 North 10th street, as the materialized spirit of Katie King.

Henry T. Child, M. D., No 634 Race street.

## NOT THE BEST WAY TO SELL A PATENT.

As soon as an invention is patented, the fact is published throughout the length and breadth of the land; and then the patentee begins to receive circulars and letters from agents of all kinds, suggesting to the inventor that they possess unequaled facilities for selling his patent. In some cases these persons state that they have a customer willing to pay several hundred dollars for the patent, and warning the patentee not to negotiate with others till he hears from them again; this conveys the impression that they have a *bona fide* offer, and, more even than this, that a greater sum may be realized from the *anxious* purchaser. But before the letter closes, it states that a power of attorney and a fee of from $5 to $25 must be sent by early mail to pay for this preliminary negotiation, and that the balance of their commission will be taken out of the purchase money. By this mode, a number of persons in different parts of the country live on the credulity of patentees, without rendering them the least equivalent for their money. They get from the inventor a power of attorney, and a small fee, and that is the last he hears from his agent. Tired of waiting for the mail to bring him the money he so confidently expects, he, after a while, writes to know how the sale is progressing. He receives no reply—he waits—then writes again; still no answer. Then he writes to us; and states what he has done, incloses the correspondence, and wishes us to investigate the matter, and tell him if he has been swindled; he asks if we know the parties, if they are reliable, etc. Sometimes a circular is inclosed, in which our names are used as references, etc.

Now we do not pronounce all dealers in patents to be swindlers; but when such parties refer to us, it is without our authority, and they should be looked upon with suspicion. We advise every patentee to be on his guard against granting a power of attorney to sell his patent to any one whom he does not know, and under no circumstances to pay in advance any sum of money, however small, under the idea that this preliminary payment is necessary to the negotiation of the sale. When patentees receive letters or circulars exacting such conditions, they will be wise in paying no attention to them; but if they do reply, we would suggest that they tell their correspondent that it will be time for them to deduct the small fee required in advance when the sale is consummated.

TREES ON BOUNDARY LINES.—The New York Court of Appeals not long since decided that a man has no right to the fruit growing upon branches of a tree overhanging his land where the trunk of the tree stands wholly upon the land of his neighbor. But the law regards the overhanging branches as a nuisance, and they may be removed as such; or the owner of the land shaded may remove them if he is careful not to commit any wanton or unnecessary destruction in so doing. Where the trunk of a tree stands on the line, the owners of the adjoining land have a joint ownership in the tree and fruit, and neither one has the right to remove it without the consent of the other

### Curiosities of Ocular Spectra.

Spectra are not only the concomitant sequences of color sensations, says W. Cave Thomas in *Art*, but of the sensations of black and white. A black spot will be succeeded by a white spectrum,a white spot by a black spectrum. Ocular spectra appear to change their places with relation to our bodies with every movement of the eyes, and, for an evident reason, are still seen in whatever direction we turn the retina.

The natural sequence of the ocular spectra after a momentary glance at any object would appear to be this: The original sensation persists as a spectrum for 0·32 to 0·35 of a second, as may be illustrated by the whirling of a light or other object. Then, if the original impression be not renewed, the reaction sets in; this first spectrum is doubtless followed by feebler librations or oscillations, which, although too delicate to be perceived by the open and excited eye, may, sometimes with closed eyes, be followed for a greater length of time.

If we view for a long time a black square on a white ground, and then divert our eyes slightly to the right or left of the square object, or rather look more directly at its margin, a portion of the spectrum which it has produced will appear free as a bright margin on a white ground; the remainder of the spectrum will overlap the true image and appear as a gray space, while a portion of the true image will be free and intensely black. We have then a free portion of the spectrum very bright, a middle portion, where the true image and the spectrum are coincident, gray, as if the two conditions of black and white were there balancing each other, and a free portion of the true image intensely black. The usual explanation of the phenomenon is this: The sensation of white in the part of the retina which was previously the seat of the black image is more intense, because that part of the seat of the retina was unexcited, hence the bright margin. The part of the image where the true image and spectrum are coincident remains unchanged, while the portion of the true image which is left free appears darker than before, because it now falls upon a part of the retina which had previously received rays from the white ground, and has consequently lost part of its excitability. This, however, is far from being the exact truth, the entire explanation; for if the eyes be closed to all external influence, a white spectrum will appear in the place of the black spot, showing that a reaction in the retina has set in, producing the sensation of light, and that it is this libration which is the cause of the two coincident portions of image and spectrum appearing gray, and those beyond darker and lighter.

### Backing Up of Sewer Gases.

To prevent the backing up of sewer gases through the ordinary pipe traps into the apartments of dwellings, a remedy heretofore mentioned in our columns is to lead a gas escape pipe from the drain pipe to the kitchen chimney. The fire here generally kept burning produces an upward current favorable to the carrying off of the gases in question. A correspondent tells us of a case, within his own knowledge, where this method proved insufficient, as the pressure of sewer gas was so great that it found its way through the stove pipe holes in the chimney. It is of course necessary in all cases that the chimney shall be tight; and in those cases where the sewer gas pressure is very strong, the escape pipe should be extended to the roof of the building independent of the chimney. Some architects provide a small gas escape pipe leading from the top of the bend of the sewer pipe trap, to the water leader of the roof.

### New Style of Photo Portraits.

The pictures are made upon the white ferrotype plate, which is now being manufactured largely, and which combines with great beauty the most simple manipulations, and all the advantages of the porcelain picture, without any of its defects.

The plate being of a very pure white and properly prepared, all that is necessary is to pour on the collodio-chloride, dry it by a gentle heat, expose it to vapor of ammonia for a short time, and then print very slightly deeper than it is desired to be when finished. It is washed, toned, and fixed in a similar manner to the ordinary mode followed in making porcelain pictures. The result is a picture of exceeding delicacy and durability.

### IRRIGATION IN COLORADO.

The system of irrigation now quite extensively adopted in Colorado has worked a great change in the character of the soil, and transformed the once almost barren country into a magnificent wheat-growing region. From the large rivers and streams, such as the Arkansas, the Platte, and the Bear rivers, long canals are dug, branching into smaller ditches, through which the fertilizing waters are conducted in every direction to the fields. Our engraving, for which we are indebted to *Harpers' Weekly*, shows two farmers opening a sluice of a main canal to let the water into a side ditch. These ditches form a regular network, as shown in the diagram.

IRRIGATION IN COLORADO—LETTING WATER INTO A SLUICE WAY.


The supply of water can be regulated at will. Towns are supplied with water on the same plan. At the head of each street is a sluice box for a lateral ditch running the whole length of the street, from which branch smaller ditches used for garden irrigation.

### An Evening at the Royal Microscopical Society.

At a recent meeting of the Royal Microscopical Society, held at King's College, an unusually interesting series of exhibits was shown, illustrating the progress of optical and mechanical ingenuity in the development of the instrument, which is rapidly becoming an indispensable article of furniture in homes where intellectual culture is promoted, all over the world. One of the exhibits was a large microscope by R and J. Beck, in solid silver, fitted with every conceivable piece of apparatus, all in silver. This luxurious work of art, intended for an American microscopist, and costing $2,500, was of course the lion of the hour, and is perhaps the most costly microscope ever made. After mention of this, there is of course no further space to allude in detail to the numerous humble brass microscopes in the room. Fortunately it is the observer who utilizes it, rather than the instrument itself, who can claim the credit of a beautiful display, and to whom our advance in knowledge is due. So here the attention was riveted by many objects of unusual interest, upon each of which a long theme might be discoursed. Conspicuous among these was the exhibition of insect dissections by Mr. Loy. They were perfect marvels. Several showed the complete muscular system in certain large lepidopterous larvæ. Various slides illustrated salivary glands and other wonders of insect anatomy. All the specimens were stained in various colors, mounted in fluid, in large cells, on slides 4 inches by 2. Mr. Guimarens had a very interesting series of preparations by Bourgogne, of Paris, illustrating the vine parasite in all its stages (*phyllozera vastator*). Near him Mr. Fitch was exhibiting a mounted slide containing a harvest spider (*phalangium*), upon the back of which, and attacking the eyes, was a red parasitic mite, probably a young *trombidium*. Dr. Gray had a very curious slide on view. It was a piece of skin from the neck of a domestic fowl from Ceylon, which was completely hidden from sight by a dense mass of fleas. The size of the specimen, only a small fragment of the original, was about one third of an inch square, and on it might be counted nearly one hundred fleas. Each of them had buried her lancets (I say *her*, because only one or two males were among the crowd of fleas) deep in the skin. A remarkable series of models and specimens illustrated in a beautiful manner the structure of the cochlea of the ear in various animals. Mr. H. Lee exhibited, with Moginie's portable binocular, the larval form of the crayfish, from the Brighton Aquarium, a creature so unlike its parent that, till lately, it was considered a distinct species, and was known as the glass crab. It was a beautiful specimen. Among the vegetable preparations attracting notice was a charming slide of a fungus on wood, shown by Mr. Reeves, and named by him as a *stemonitis*. Curious deposits from solutions of silica were shown by Mr. Slack.

### Sagacity of the Partridge.

Instances of the sagacity of the partridge, woodcock, and other birds have often been related. But the most singular illustration of the deception practiced by the first of those wily species to protect their young is given by Mr. Henshaw, of the Government Survey west of the one hundredth meridian. While riding through pine woods, a brood of partridges, containing the mother and eight or ten young of about a week old, was come upon so suddenly that the feet of the foremost mule almost trod on them. The young rose, flew a few yards, and, dropping down, were in an instant hid in the underbrush. The mother meanwhile began some very peculiar tactics. Rising up, she fell back again to the ground as if perfectly helpless, and imitated the actions of a wounded bird so successfully that for a moment it was thought she had really been trodden upon. Several of the men, completely deceived, attempted to catch her, but she fluttered away, keeping just out of reach of their hands until they had been enticed ten or twelve yards off, when she rose and was off like a bullet. Her tactics had successfully covered the retreat of her young.

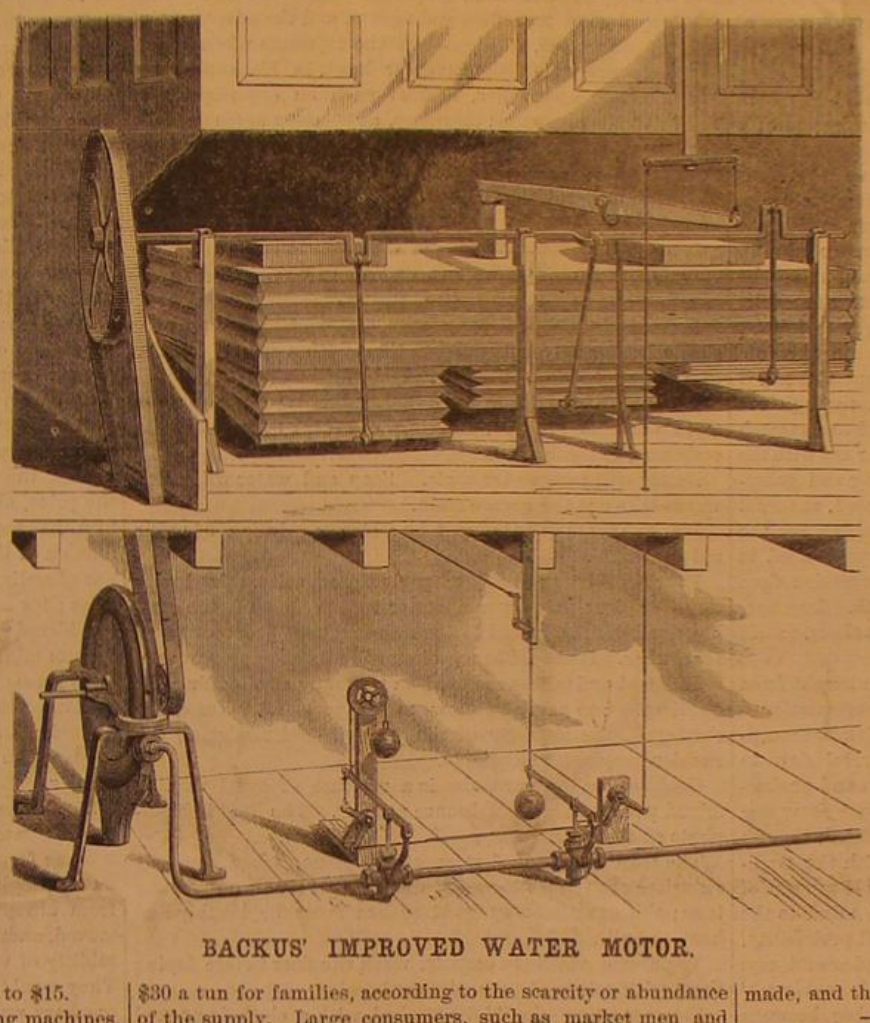
COMPOSITION OF WOOL GREASE.—According to Schulze and Urich, the bulk of the natural wool grease of sheep consists of compound ethers. A part of alcohols and fatty acids are in a free condition

OF all metals known, silver is the best electrical conductor

## IMPROVED WATER MOTOR.

Another contribution to the various devices, which have lately appeared for supplying a cheap and readily available power for general usage, will be found in the novel water motor represented in the annexed illustration. Its object is to drive organ bellows, coffee mills, and sewing machines, and to perform a variety of light work ordinarily done by hand. In brief, its special adaptation is to operations requiring less than a single horse power, although the apparatus may be built to perform much heavier work.

This device consists of a light but firmly constructed iron wheel, provided on its outer rim with buckets, and the whole enclosed in a watertight iron casing. Through the casing an ordinary water pipe is so inserted that a stream of water from the pipe, flowing downward, strikes the buckets at a right angle with the radius of the wheel. The aperture at the end of the pipe is comparatively small, and on this account the water is forced through and against the buckets with a percussion-like effect, thus imparting a rapid and steady motion to the wheel.



BACKUS' IMPROVED WATER MOTOR.

In the illustration, the motor is shown attached to an organ bellows, the belt running from a small pulley on the motor to a large wheel on a crank shaft, to which the pitman from each feeder is attached. These feeders are shown at various stages, working alternately. In the supply pipe are two valves, one under the control of the organist, to admit or shut off the water, while the other is a regulator and works automatically. To start the motor, the performer has only to pull up the lever which opens the throttle valve. When the main bellows are full, the upper side, in rising, strikes a lever which is connected with the regulating valve by wire cords and bell cranks as shown, closing said valve and shutting off the water.

The inventor informs us that this arrangement is extremely sensitive, a mere touch on the keys of the instrument being followed instantly by a few revolutions of the motor, for a period just sufficient to replace the air expended. From testimonials submitted to us, it appears that the employment of the invention upon organs has been successful, and that the amount of water used has been about one third the quantity necessitated by other devices. It is stated that there is no jerking or thumping, but an even, smooth, noiseless, steady motion; while the apparatus is, besides, claimed to be simple, durable, and cheap, and to run for years without repairs. It is now in use on several organs of forty stops, doing the work with a pressure of water of twenty pounds per square inch, costing per annum, as we understand the inventor to assert, from $12 to $15.

The invention is also adapted for driving sewing machines, and, we are informed, can be applied to a single machine for domestic use so as to run at a cost of from $2.50 to $3 per annum. By regulating the water supply through a foot treadle, any speed may be attained from one stitch per second to 1,000 per minute, as desired. The apparatus can be attached to the ordinary water pipes, and it is claimed that a stream no larger than the head of a pin is sufficient to drive a sewing machine. Generally, the device can be used where the pressure is from twelve pounds upwards.

Among other practical applications of the motor may be mentioned its use for printing presses, turning lathes, jewelers' lathes, opticians' and lapidaries' wheels, grinding coffee and spices, cutting sausage, hoisting for stores and private residences, and, in fact, all light machinery requiring one horse power or less.

We understand that this motor is being used in Brooklyn and vicinity with much success, and at very cheap cost. Water sufficient for the purposes of a large organ can ordinarily be obtained for from $12 to $15 per year, or for a sewing machine for about $3.50 for the same period.

The invention was by Mr. Oscar J. Backus, of Oakland, Cal. For further particulars address the manufacturers, Backus Bros., & Co., Wright street and Avenue A, Newark, N. J.

### Progress in Spain.

A very practical sign of real progress and improvement in Spain is seen in the increased demand which is springing up there for scientific information. *La Gaceta Industrial* of Madrid, formerly an insignificant publication, now comes to us enlarged to sixteen quarto pages, and is published twice a month, illustrated with engravings. It has reached its eleventh year. It is a handsome periodical and is ably edited. In the number before us the editor, Mr. Alcover, has a very excellent article upon the Centennial Exposition to be held next year at Philadelphia. He urges the authorities to provide liberally for a Spanish representation on that occasion, which, he says, is to commemorate the glorious anniversary of American liberty. It is to be a demonstration, he thinks, of the achievements of true liberty and independence, that can only be realized by labor, which is the secret of the prosperity of nations, and which has given to the North Americans such an astonishing preponderance.

### Fourteen Thousand Miles of Ice.

The Hudson river ice crop for 1875 has now been harvested, and is one of the largest and finest ever gathered. The blocks average 14 inches in thickness, and the total quantity secured is about 2,000,000 of tuns, or seventy millions of cubic feet. If this mass of ice were arranged in a single line or beam, 12 inches square, it would have a total length of about fourteen thousand miles, and would reach more than half way around the world. To transport the entire quantity above named simultaneously, in ice carts, each carrying two tuns, drawn by two horses, driven by one man, would require an army of a million men, two millions of horses, and a million vehicles.

This enormous supply of ice will be chiefly consumed in the city of New York. It is brought down the Hudson river from the great ice houses, which are located at the water's edge, in large barges, towed by steam. It is delivered directly from the barges into the ice carts, and in them conveyed to the doors of private dwellings. For a quarter to half a tun a month is a common supply for a small family. The price charged is from $15 to $30 a tun for families, according to the scarcity or abundance of the supply. Large consumers, such as market men and hotel and restauraunt keepers, get the article at a much less price.

### MEASURING MOUNTAINS.

Mr. Verplanck Colvin, in his report on the topographical survey of the Adirondack wilderness, elucidates some new

theories on the subject of mountain measurement, and describes one method as follows:

"For short distances, I carefully measure on the mountain side a base line with steel tape, and from its extremities take the angular position of the object, afterward computing the distance. For very distant mountains, an adaptation of tri-linear surveying has been employed. From the station of the barometer, the angles between any three of the surrounding peaks, whose positions I have before found trigonometrically, are measured, and afterward, by three point problem (usually graphically upon the survey map) the distance is obtained and the proper allowance made for curvature and refraction. Now that we have so many trigonometrically determined points throughout the region, the tri-linear method is found not only the easiest, but the most accurate.

The practical application of this method to the work of the survey is well shown by the illustration, which represents a survey party engaged in leveling observations with mountain barometers, at the levels of the different peaks seen in the distance. At A is seen the transit, by which the horizontal angular distances between three of the distant peaks are measured in order to obtain the data for correction for curvature and refraction. Below, on the same same mountain side, at e, e, and e, are stations of barometers at the apparent levels of the peaks by the lines of sight level.

At the foot of the mountain is the bark camp, and the assistant observing on barometer at lower station: a guide near by is cutting night wood for camp.

The sight lines, or lines of apparent level (e —— to —— e), are taken from points on the mountain side, which are really lower than the distant peaks; for, following to the left the curve of the earth from the barometer station (h .... to .... h), it will be seen to descend below the level of the peaks in proportion to their dis ance—the true level of the distant peaks being the curved dotted line of equal hight—above sea level, evidently considerably higher than the stations of their apparent level. The effect of refraction is not shown in the illustration. In practice, the observer on barometer at the lower station takes observations upon his instrument and the attached and detached thermometers every five minutes; and (whenever possible) similar observations are taken on the summit of the peak above the intermediate leveling stations, affording both a lower and an upper station when well determined. The observations, therefore, taken at any five minutes, will be synchronous with those taken on the mountain sides, at leveling stations, or on the peak above; they can then be computed as usual, by the upper or lower station records, and, by the tri-linear measurements, the proper corrections for curvature, etc., made, and the true hight of the distant peak is found."

## SCIENTIFIC AND PRACTICAL INFORMATION.

### NOT A "NEW JERUSALEM."

It may perhaps be unnecessary to assure our devouter readers that Virginia City, Nev., is not the much longed for "New Jerusalem, the city of the Saints," notwithstanding its streets are paved with precious metals. It is true, nevertheless, that the denizens of that unsaintly city boast that the very mud of their streets is rich in silver and gold. It happens that the principal streets of the city were macadamized with refuse ore taken from the mines in early days; and since then, they have been steadily dusted with rich ore sifted down upon them from passing ore wagons, making a surface so precious that an ounce or two of mud (taken from the wheel of a wagon to decide a wager) proved on assay to contain, to the tun, silver, $7.54; gold, $2.32; total $9.86. "After this," exults the *Enterprise* of that richly paved city, "we may put on airs, even though our streets are villanously muddy occasionally, for the very mud on our boots contains both silver and gold."

### A NEW USE FOR MINERAL OILS.

In a late number of the *Australian Medical Journal*, Dr. John Day maintains that certain of the mineral oils, gasoline especially, are of great use as disinfectants, their value depending, he believes, on the fact that they are rich in peroxide of hydrogen. He employs the gasoline in various ways as a disinfectant, applying it to walls, to articles of furniture, and to clothing; also as a wash for the hands after treating infectious diseases, allowing the moistened hands to dry in the open air. A peculiar and valuable property of these oils as disinfectants is their continuous action, while they improve and gather force by exposure to the air.

### THE MARTIAL SEAS.

M. Meunier has recently advanced the theory that the planet Mars is much older than the earth, because of the rarification of its atmosphere and the small extent of its seas. The form of the latter, he says, is exactly that which the terrestrial oceans would assume after partial absorption by the earth's crust. If, for example, the Atlantic were absorbed so that only that portion included in the contour made by the uniform depth of 12,000 feet were left, the shape would be exactly similar to that of some of the seas recognized in Mars.

### LEMON JUICE IN DIPHTHERIA.

Dr. Revillout states that lemon juice, used as a gargle, is an efficacious specific against diphtheria and similar throat troubles. He has successfully thus employed it for over eighteen years.

### By Whom are Inventions Made?

In the course of a paper at the Society of Arts recently, on the "Expediency of Protection for Inventions," Mr. Bramwell, F. R. S., said: "The bulk, one might almost say the whole, of real substantive inventions have been made by persons not engaged in the particular pursuit to which those inventions relate. Take a few instances. Watt was not a maker of steam engines, the fire engines of his day, but he was a mathematical instrument maker; Arkwright, the inventor of the 'water twist,' was a barber; Cartwright, the inventor of the power loom, was a parson; Neilson, the inventor of the hot blast, was wholly unconnected with smelting operations, he was the manager of gasworks; Wheatstone, who has done so much for electric telegraphs, was engaged in the manufacture of musical instruments; and Ronalds, the very originator of the electric telegraph, had nothing to do with the visual telegraphs in use in his time; Bessemer, who has so enormously increased the manufacture of steel within the last quarter of a century, was in no way connected with that industry. The fish joint for railways, the greatest improvement in permanent way that has been made since railways were introduced, was the invention of a carriage builder. I trust I have given instances enough to establish my position, that the great substantive inventions are made by persons unconnected with the manufacture or art to which those inventions relate; and we can readily see why this should be. The person who has been brought up to pursue any particular manufacture has, even before he had sufficient knowledge to be able to appreciate the merits and the principle of the processes he was taught to follow, been trained in the belief that 'certain ends are to be obtained by particular means.' Under such circumstances, it is difficult for even a powerful mind to break through the trammels which have been imposed upon it, and to approach the consideration of the subject of the particular art with the same broadness of view and power of detecting and grasping the true principles upon which that art is based, as would be possessed by a mind devoting itself to the subject for the first time; and thus the man untaught and unprejudiced in the art is more likely to make a substantive invention than is one who has been trained in it from his youth. Improvements of detail such a person may make; but there, in all probability, will be the limit of his inventions.

One can understand that a man who had been taught from his boyhood to make steel by the process of cementation—that is, by packing bars of wrought iron into brick boxes containing charcoal, and exposing the whole for several days to considerable heat, and thus carbonizing the iron and producing blistered steel—might, not unnaturally, devise some improvement by which this process could be expedited, though one can hardly imagine such a man breaking with the traditions of the industry, and casting away the whole process of cementation. But one bringing a totally fresh mind to the consideration of steel manufacture would, in all probability, study the question from the very beginning, and would say: 'What is steel? What is wrought iron? What is cast iron?' and when he discovered that steel was something between cast iron and wrought, that is to say, it contained less carbon than the one and more than the other, and when he found that cast iron was a cheaper article than wrought iron (wrought iron being commonly produced from cast by practically abstracting the whole of its carbon), he would seek a means by which he might abstract from cast iron, not the whole of the carbon, to leave wrought iron, but so much of the carbon as would leave steel. To one brought up in the steel trade, the very word 'steel' would be associated with the addition of carbon, and it would be most unlikely that he should attempt the manufacture by a process which had for its object the taking away of carbon. Once concede that the great inventions are made by 'outsiders,' then it appears to me that, to continue this, the highest class of invention, protection is an absolute necessity. An inventor must nearly in every case make trials and experiments, and these, as a rule, can only be conveniently done in places where the manufacture is being exercised; but now we are assuming that the inventor is not engaged in the manufacture: he has therefore either to incur great expense to make his experiments—an expense in many cases prohibitory—or to forego the experiments altogether, or else he must seek the aid, and trust to the honor, of some manufacturer.

Imagine a country clergyman who has some knowledge of chemistry making an invention of an improvement in smelting iron ore. If he were a man of real ability, as I have supposed, he would appreciate the great complexity, and the many practical difficulties, of that process, and he would know that nothing short of a trial of his invention in the actual furnace could assure him that his method would not be frustrated by some such difficulty. What, without a patent law, is that inventor to do? Forego the trial? Devote $25,000 of the large property which usually belongs to a country clergyman to the erection of an experimental blast furnace; trust to the honor of a manufacturer; or give up the invention? I think the probability is that he would pursue the last course, and that thus the invention would be lost to the community. But even supposing the preliminary difficulty of a practical trial not to exist. Assume, for example, that the invention be one such as that of the Giffard injector, one of the most substantive of the present day. This might have been tried in private by its inventor without insuperable difficulty, even although he were wholly unconnected with any of the mechanical arts, and he might have perfected his invention in every detail. But when he had done this, what would have been his chance of reward? How would he have set about reaping the pecuniary benefit which he would desire, and which would be his reasonable due? Would he make up his mind to forego all his usual habits of life, and to become a manufacturer? Say that he did so, and that, in spite of the difficulties to which I shall have to revert, he succeeded in making a certain number of the injectors for sale, and that then he knew enough of business to obtain purchasers for them, what would be the inevitable result? The very first mechanical engineer (a steam pump maker) into whose hands one of these injectors fell, would say: 'Here is an implement that seems likely to compete seriously with the use of steam pumps. Why should not I make it? At present I know it is being manufactured by the inventor only, a *person* who was not brought up to the trade, and who is living in a purely agricultural district; it is a hard case if I cannot hold my own against him.' Thereupon the steam-pump maker goes to work, with all the advantages of an established factory, with its befitting plant, its staff of superintendents, its foremen, and its body of workmen, to produce injectors, and with a whole system of travellers and agents, and the advantage of a large connection, to dispose of the injectors when made. What chance would the inventor have, in his capacity of manufacturer and seller, against such an organization as this? Obviously, none; therefore, as it seems to me (equally obviously), he (foreseeing this) would not have bestowed the thought necessary to invent, and even if he had, he would not have incurred the labor and expense of experimenting upon his invention."

### Useful Recipes for the Shop, the Household, and the Farm.

Frosted glass, useful for screens, etc., is made by laying the sheets horizontally and covering them with a strong solution of sulphate of zinc. The salt crystallizes on drying.

A teaspoonful of powdered borax dissolved in a quart of tepid water is good for cleaning old black dresses of silk, cashmere, or alpaca.

Butter will remove tar spots. Soap and water will afterwards take out the grease stain.

Black shoes may be bronzed by a strong solution of anilin red in alcohol.

Four parts borax and three parts Epsom salts, mixed with three or four parts warm water to one part of the combined substances, is said to form an excellent fireproof wash for clothes. It should be used immediately after preparation.

Flaxseed and tallow are used in Germany as a stuffing for cushions. One part of tallow to ten parts of flaxseed are employed, the mobility of the greased seed rendering the cushion very soft and pliable.

Gold bronze for furniture is a mixture of copal varnish mixed with gold-colored bronze powder. The last is bisulphate of tin.

The total number of strings in a piano, when properly stretched to produce the right tones, exert a pull of over ten tuns; this explains why good pianos must be durably and heavily built.

To prevent moths in carpets, wash the floor before laying them with spirits of turpentine or benzine.

Straw matting should be washed with a cloth dampened in salt water. Indian meal sprinkled over it and thoroughly swept out will also cleanse it finely.

In washing windows, a narrow-bladed wooden knife, sharply pointed, will take out the dust that hardens in the corners of the sash. Dry whiting will polish the glass, which should first be washed with weak black tea mixed with a little alcohol. Save the tea leaves for the purpose.

Gray marble hearths can be rubbed with linseed oil, and no spots will show.

Sprigs of wintergreen or ground ivy will drive away red ants; branches of wormwood will serve the same purpose for black ants.

Papering and painting are best done in cold weather, especially the latter, for the wood absorbs the oil of paint much more than in warm weather; while in cold weather the oil hardens on the outside, making a coat which will protect the wood instead of soaking into it.

Never paper a wall over old paper and paste. Always scrape down thoroughly. Old paper can be got off by damping with saleratus and water. Then go over all the cracks of the wall with plaster of Paris, and finally put on a wash of a weak solution of carbolic acid. The best paste is made out of rye flour, with two ounces of glue dissolved in each quart of paste; half an ounce of powdered borax improves the mixture.

An oaken color can be given to new pine floors and tables by washing them in a solution of copperas dissolved in strong lye, a pound of the former to a gallon of the latter. When dry, this should be oiled, and it will look well for a year or two; then renew the oiling.

Kerosene and powdered lime, whiting, or wood ashes will scour tins with the least labor.

Spots can be taken out of marble with finely powdered pumicestone mixed with verjuice. Cover the spots and allow the stuff to remain for twelve hours; then rub clean, dry, and rinse.

Soapstone hearths are first washed in pure water and then rubbed with powdered marble or soapstone, put on with a piece of the same stone.

A strong solution of hyposulphite of soda is said to be excellent for cleaning silver.

Two ounces of common tobacco boiled in a gallon of water is used by the Chatham street dealers for renovating old clothes. The stuff is rubbed on with a stiff brush. The goods are nicely cleaned, and, strange to add, no tobacco smell remains.

Never use wrought iron instead of steel simply because it is more easily worked and cheaper than the latter; nor brass instead of gun metal in heavy machinery.

Shellac is the best cement for jet articles. Smoking the joint renders it black to match.

Barrels intended for alcohol may be rendered perfectly tight by applying inside a solution of 1 lb. leather scraps and 1 oz. oxalic acid in 2 lbs. water, afterwards diluted with 3 lbs. warm water.

A solution of chloride of iron will remove nitrate of silver stains from the hands.

Unslaked lime is excellent for cleaning small steel articles, such as jewelry, buckles, and the like.

Glass may be powdered to render it suitable for glass paper, for filtering varnishes, etc., by heating it red hot and then suddenly plunging it in water.

To remove old paint, cover with a wash of 3 parts quick stone lime, slaked in water to which 1 part pearlash is added. Allow the coating to remain for 16 hours, when the paint may be easily scraped off.

### Aluminum Utensils.

Seventeen years have passed since Deville first produced aluminum on a commercial scale; but the expectations regarding this very interesting and meritorious invention of the distinguished French chemist have not as yet been fulfilled. Although many of those expectations were somewhat exaggerated, they were not so unreasonable as many people believed them to be; for a metal with so many valuable properties would be useful in many of the technical arts. Among these properties are a beautiful color that does not change in the air, nor yet in sulphurous exhalations, and further remarkable lightness, an agreeable reasonance, and a capability of being worked into any shape. Moreover, in the use or manipulation of aluminum, there have not hitherto been observed any deleterious effects.

It is generally conceded that the cost, and not the absence of properties which make other metals valuable, has prevented the more extensive application of aluminum; and the price, although it was considerably less than it was at first, has remained high for many years. The cost of production of this metal, which can only be extracted by the use of sodium, cannot possibly be the only cause of its high price; for the commercial manufacture of sodium may be considered as a solved problem; and as soda ash is very cheap, sodium might be produced at a moderate cost if the demand were greater than it is. Large production is caused by large consumption, and the use of aluminum has been hitherto limited, mainly because custom and use have in a measure opposed the introduction of such a novelty, except for fancy articles.

Stories have been told and written about poisoning by cooking vessels made of copper, by glazings containing lead, and the formation of verdigris on spoons of (alloyed) silver; but if people were only determined to produce these utensils from aluminum, all danger from poisoning would be removed, and they would have vessels, the appearance and durability of which would leave scarcely anything to desire. They would be more convenient to handle than our light crockery ware, for they can be made as light, and, what is important, cannot be broken. Splendid pitchers, plates, goblets, lamps, etc., might be manufactured from deadened and embossed aluminum; and the lightness of spoons of this metal would make them more convenient than those of silver now in use. In this case it is not the price, but only prejudice, which presents itself as a drawback, for the price is only half of that of good silver; beside, the difference in the specific weights of both metals and the consequent cheapness in the use of aluminum are so great that, for the value of one silver spoon, at least seven equally large aluminum spoons might be bought. True, aluminum is neither a rare nor a noble metal; but it possesses, nevertheless, advantages over alloyed silver which give it a much finer appearance; it does not get black, nor does it form verdigris, and what it lacks in brilliancy and appearance is well compensated for in its agreeable lightness. But, unfortunately, it has been found impossible to plate with aluminum, either by the electro-galvanic or the foil method.

### Poisonous Magenta Colors.

Dr. Springmühl, the editor of the *Musterzeitung*, states that out of 25 specimens of magenta only one was found free from arsenic. In 14 the amount was sufficient for quantitative determination. In four samples the proportions were respectively 6·5, 5·9, 5·9 and 5·1 per cent. Such qualities, of course, must prove dangerous if used for coloring liquors, confectionary, and toys. In dyeing, however, the amount of the poisonous matter which attaches itself to the wool is relatively trifling. This the author ascertained by an interesting experiment. In a beaker he dissolved 1·55 grains of the most poisonous sample in hot water. The solution, of course, contained 0·093 grains of arsenic. In it a square foot of pure wool (woolen tissue) was dyed. It was then well rinsed in a second beaker of pure water, and again in a third. The dyed wool, the residual dye, and the two wash waters therefore contained 0·093 grains of arsenic, and it remained to ascertain its distribution. In the dye bath were found 0·072 grains, in the first washing water 0·016. In the second washing water, the amount was too small to be determined. It, however, and the dyed wool must together contain the residue, 0·005. According to Marsh's test, the wool appeared to contain less than the second washing water. Hence a square inch of the woolen could contain scarcely 0·0003 of a grain of arsenic. If the proportion of arsenic is low, as in well purified magentas, the wool, when dyed, gives no indications by Marsh's process.

The two most frequent adulterants are oxalic acid and sugar. The author has found 21 per cent of the former, and

twenty-four per cent of the latter. Joly has detected sugar to the extent of 50 per cent.

Aniline violets are more liable to sophistication than magentas, from the fact that they are sold, not in well defined crystals, but in powder or in cakes. The author has detected gum in a Hofmann's violet to the amount of 12 per cent, and 8 per cent of finely ground charcoal in a common phenyl violet.

Of 32 samples of iodine green examined, 5 were unquestionably sophisticated. One contained 18 per cent of sugar. An English sample was cleverly sophisticated with a salt of lead, probably the picrate, and deflagrated when a portion was heated upon platinum foil. Metallic lead was found to the extent of 10 per cent, corresponding to 21 per cent of the picrate. Two other samples contained respectively 14 per cent of common salt and 26 per cent of magnesia. Oxide of chrome is also a possible adulteration.

The finest sample of iodine green examined was from the manufactory of H. Siegle, in Stuttgart. The author considers that in the production of this beautiful and costly color the Germans are superior to the English and the French.

## Correspondence.

### The High Lakes in the West.

*To the Editor of the Scientific American:*

In your issue of December 22, under the caption of "The Highest Lake in the United States," you claim for Lake Harkness, Plumas county, Cal., that distinction, accrediting it an altitude of but 7,330 feet.

We have in Clear Creek county, Col., two beautiful little lakes, each of about a mile in circumference, very deep; and the water, of dark bluish green, is extremely cold. There is no apparent source of supply, as the lakes are surrounded by high mountain walls of granite blocks, piled in magnificent confusion, and quite heavily timbered. They are at an altitude of at least 9,000 feet, and are the source of the famous Clear Creek Cañon stream.

Again, about six miles south of these lakes and at an altitude of fully 10,000 feet, as it is just above our timber line, is situated Chicago Lake, now widely known as the scene of Bierdstadt's "Storm in the Rocky Mountains." It is a most picturesque sheet of clear, limpid water, but appears at a little distance to be almost black, owing to its great depth. The water is intensely cold, but contains an abundance of trout. The lake is about a half mile in diameter; and at the upper or northwest side, a perpetual bank of ice and snow creeps down to the water's edge. On the south, an imposing wall of smooth granite towers almost vertically to the hight of 2,000 feet; while on the west, there are a series of majestic terraces, like huge steps 300 to 400 feet high. The north wall slopes away at an angle of about 45°; and to the south and east, there is an easy, gradual slope down into Chicago Cañon. This lake would appear to have been the crater of some volcano. Yet there are no traces, that we could find, of any volcanic action. C. R.

St. Louis, Mo.

*To the Editor of the Scientific American:*

Your journal for December 22, 1874, states that a certain lake in California, having an elevation of 7,330 feet, is probably the highest in the United States.

There are hundreds of lakes in the Rocky Mountains having a greater altitude than 7,330 feet. Prominent among these are the Twin Lakes, 8,700 feet, San Cristobel and Lake Mary in the San Juan county (somewhat higher), and Grand Lake in Middle Park. There are many smaller lakes in the region of the timber line, varying in elevation from 10,000 to 12,000 feet. These lakes are all along the snowy region: in the National, Elk, Saguache, San Miguel, Uncompahgre, Sangre de Christo, and other ranges. In the National range, which, according to Professor Hayden, "is by far the largest and grandest in the United States," there are several considerable lakes above 9,100 feet, and many smaller ones, from 10,000 to more than 12,000 feet, above the sea level.

West Hallock, Ill. HERBERT R. SAUNDERS.

### Hollow Bolts and Axles.

*To the Editor of the Scientific American;*

For several years it has cost me five dollars a week to keep the bolts on my trip or cushioned hammer heads in repair, and, finding it to wear on my patience, I tried all kinds of iron, but to no use; break they would. I made the threads of a round or U shape, which worked much better than the V; but still they broke. I finally bored a hole, one third the diameter of the bolts (1¼ inches), and put a ⅜ of an inch hole down, some way below the thread, which formed a tube. I have now run them for three months, and they show no signs of giving out. The wrench used would break the other bolts easily; but it cannot do so with these. My work on spindles requires the dies to snap together about nine times in ten, which tells very severely on the bolts; and I believe that the bolts broke because the severe strain on the nuts stretches the outside grain of the iron by the concussion, so that there is a contention between the outside and inside strain.

I was apprenticed to William Fairbairn, in Manchester, England, and I have known his 8 inch axles on locomotive engines to break, owing probably to the rails resting on stone sleepers. They had some 6 inch tubular axles made, with 2 inch holes; and they never broke one of them, to my knowledge. JOHN BIRKENHEAD.

Mansfield, Mass.

### Bolting Reels.

*To the Editor of the Scientific American:*

There is at present considerable interest manifested by millers as to the best method of constructing bolting reels and clothing the same, the best arrangement of the various numbers of cloths, etc. It is now almost universally conceded by the most intelligent millers that the less violently the meal is acted upon in the reel in the process of bolting, or, in other words, the nearer the motion of the meal is to a slide, the cleaner and whiter will be the flour. In endeavoring to attain this sliding principle, various plans of constructing and clothing bolting reels have been resorted to. Among some of the methods employed are putting the cloth on the inside of one rib and on the outside of the adjacent one putting the cloth on the inside of all the ribs, using large reels and running them at a slow motion, also using the round form of reel. The writer has tried all the plans above mentioned, and more too, but finds the round reel much the most satisfactory, both on account of the improved color of the flour and the greater capacity of the reel.

It is the practice in many of the best mills in the Northwest to bolt the meal in the usual manner, and then rebolt the flour through a bolt of the round form, covered with a somewhat finer cloth, one round bolt of twenty feet long being of capacity sufficient to rebolt two hundred barrels of flour in twenty-four hours.

I would like to hear from brother millers as to what they consider the best style of dress for millstones for grinding spring wheat. D. T. CHOAT.

Cedar Falls, Iowa

[For the Scientific American.]

## THE VOICES OF ANIMALS.

BY PROFESSOR JAMES ORTON.

Aquatic animals are mute. A world of radiates, molluscs, and fishes, therefore, would be silent. Insects are about the only invertebrates capable of producing sounds. Their organs are usually external, while those of higher animals are internal. Insects of rapid flight generally make the most noise. In some the noise is produced by friction (stridulation); in others, by the passage of air through the spiracles (humming). The buzzing of flies and bees is caused in part by the vibrations of the wings; but it comes mainly from the spiracles of the thorax.

Snakes and lizards have no vocal cords, and can only hiss. Frogs croak, and crocodiles roar by the vibration of the glottis. The huge tortoise of the Galapagos Islands utters a hoarse, bellowing noise.

The vocal apparatus in birds is situated at the lower end of the trachea, where it divides into the two bronchi. It consists mainly of a long drum with a cross bone, having a vertical membrane attached to its upper edge. Five pairs of muscles (in the songsters) adjust the length of the windpipe to the pitch of the glottis. The various notes are produced by differences in the blast of air, as well as by changes in the tension of the membrane. The range of notes is commonly within an octave. Birds of the same family have a similar voice. All the parrots have a harsh utterance; geese and ducks quack; crows, magpies, and jays caw; while the warblers differ in the quality rather than the kind of note. Some species possess great compass of voice. The bell bird can be heard nearly three miles; and Livingston said he could distinguish the voices of the ostrich and lion only by knowing that the former roars by day and the latter by night.

The vocal organ of mammals, unlike that of birds, is in the upper part of the larynx. It consists of four cartilages, of which the largest (the thyroid) produces the prominence in the human throat known as Adam's apple, and two elastic bands, called vocal cords, just below the glottis or upper opening of the windpipe. The various tones are determined by the tension of these cords, which is effected by the raising or lowering of the thyroid prominence. The will cannot influence the contraction of the vocalizing muscles, except in the very act of vocalization.

The vocal sounds produced by mammals may be distinguished into the ordinary voice, the cry, and the song. The second is the sound made by brutes. The whale, porpoise, armadillo, ant eater, porcupine, and giraffe are generally silent. The bat's voice is probably the shrillest sound audible to human ears. There is little modulation in brute utterance. The opossum purrs, the sloth and kangaroo moan, the hog grunts or squeals, the tapir whistles, the stag bellows, and the elephant gives a hoarse, trumpet sound from its trunk and a deep groan from its throat. All sheep have a guttural voice; all the cows low, from the bison to the musk ox; all the horses and donkeys neigh; all the cats *miau*, from the domestic animal to the lion; all the bears growl; and all the canine family (fox, wolf, and dog) bark, howl, and whine. The howling monkeys and gorillas have a larger cavity or sac in the throat for resonance, enabling them to utter a powerful voice; and one of the gibbons has the remarkable power of emitting a complete octave of musical notes. The human voice, taking the male and female together, has a range of nearly four octaves. Man's power of speech, or the utterance of articulate sounds, is due to his intellectual development rather than to any structural difference between him and the apes. Song is produced by the glottis, speech by the mouth.

To cement metal to glass, mix two parts powdered white litharge and one part dry white lead into a dough with boiled linseed oil and lac copal. The metal is to be coated with the cement and then pressed upon the glass.

## RECENT RESEARCHES IN THE SPECTRA OF THE PLANETS.

Professor Vogel has recently published an important work on the above subject, in which are embodied the results of his latest observations. The light of each planet has been analyzed by the aid of the spectroscope, and from the luminous bands and rays the author translates the self-written history of the other worlds.

The principal rays of the spectrum of Mercury coincide absolutely with those of the solar spectrum. Furthermore, certain bands which are not produced in the solar spectrum, except when the sun is very low in the horizon and when the absorption due to the atmosphere is considerable, appear permanently in the Mercurial spectrum. From this the existence of a gaseous envelope about the planet may be concluded, which exercises on the solar rays an absorbing action equal to the maximum similar effect of our atmosphere. Generally the least refrangible portions of the Mercurial spectrum are more brilliant that those of greater refrangibility; but it is impossible to separate here the effect due to our atmosphere from that produced by the atmosphere of the planet.

The light from Venus is also similar to that from the sun, with the addition of like absorption rays. It is concluded that the light is reflected from the cloud envelope which is known to encompass the planet. So far as the atmosphere of Venus is concerned, water must be present, so that one indispensable necessity for life there exists.

The spectrum of Mars gives a great number of the solar spectrum rays, beside, as in the two planets before referred to, others similar to the absorption lines of our atmosphere. It is concluded that Mars possesses an atmosphere not differing essentially from our own in composition, though richer in watery vapor. The red color of the planet seems to result from an absorption which takes place generally on the red and violet rays in their entirety. In the red, between C and B, lines appear which are peculiar to the Martial spectrum, but it has not been possible to fix their position definitely, owing to their feeble luminous intensity.

M. Vogel's observations on the minor planets, Vesta and Flora, have not been very productive of results, owing to the dimness of the spectrum; though sufficient indications relative to the former planet have been obtained to point to the existence of an atmosphere about it.

The greater portion of the lines in the spectrum of Jupiter coincide with others in the solar spectrum; but the Jovial spectrum differs from that of the sun in the existence of dark bands in the least refrangible portion, among which one in the red may be especially noted. The length of the luminous wave to which it is due has been estimated at 0·00185353 of an inch. The other lines present, different from those of the solar spectrum, coincide with the telluric lines.

While bands are produced in the less refrangible portions of the spectrum, the radiations of the more refrangible blues and violets experience a uniform absorption. The gaseous envelope which surrounds Jupiter exercises, then, on the solar rays which traverse it, an action analogous to that of our atmosphere. Hence, the presence of water in the Jovial atmosphere may be inferred. With reference to the band above mentioned, it cannot be precisely determined whether the same is due to the presence of some body not found in our atmosphere, or to the gas composing the Jovial atmosphere being mixed in proportions different from that of air. It is possible that the composition of the two atmospheres may be the same, but that their action on the solar rays varies only through circumstances of temperature and pressure, quite different on Jupiter from those found on the earth. The spectra of the dark belts observed across the disk of Jupiter are especially characterized by a very marked, uniform absorption, which is undergone by the blue and violet rays. The new absorption bands, peculiar to the spectrum of the planet, never appear, but the lines are more marked and are larger than elsewhere. This proves clearly that the dark portions of the Jovial surface are deeper than the neighboring parts. The solar light penetrates more deeply into these portions of the planetary atmospheres, and thus is subjected to more marked alteration. The red color of the planet, and especially the more decided tint of the dark belts, is attributable to the uniform absorption exercised by its atmosphere upon the blue and violet rays.

In the spectrum of Saturn, the most marked rays of the solar spectrum are present. A few bands, especially in the red and orange, have no equivalent in the spectrum of the sun; but they coincide with some groups of spectral lines belonging to the terrestrial atmosphere. The greatest absorption of blue and violet rays takes place at the obscure equatorial zone. In general, it may be stated that the spectra of the body of Saturn and of Jupiter are very similar. The same is not the case with the rings of the former planet. The characteristic band in the red is absent or marked by a feeble trace: whence it may be concluded that the rings have no atmosphere, or are surrounded only by a gaseous envelope of very small density and thickness.

The feeble light of Uranus prevents the distinguishing of the Fraunhofer lines, except to a degree which might admit extensive errors in drawing deductions from their positions. It appears, however, that the absorption of the solar rays may be sufficiently recognized to infer the presence of an atmosphere about the planet; but the direct causes of the absorption it is not possible to determine. The Neptunian spectrum is essentially different from that of the sun, but, for the same reason as in the case of the planet last referred to, little can be definitely ascertained regarding it, except a general supposition that it closely resembles that of Uranus.

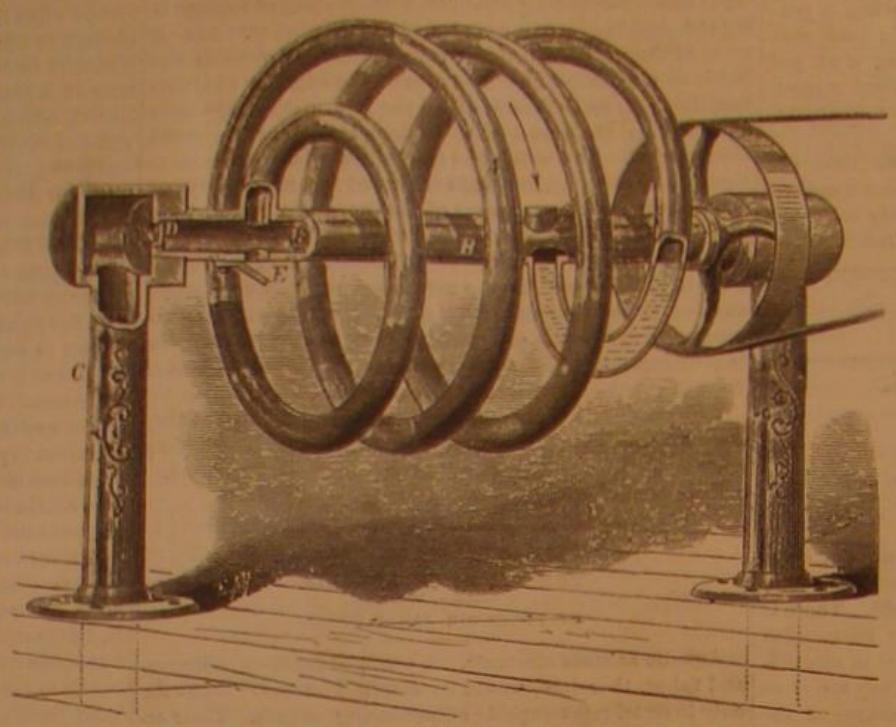
If gilt frames are varnished with copal varnish, they can be washed with cold water without injury.

## IMPROVED PLENUM AND VACUUM PUMP.

The novel form of pump herewith illustrated may be used either for a bellows to force an air blast, or as a pump for raising water. By producing a vacuum in one of its receivers, and compressing air into the other, both of the above capabilities may be utilized simultaneously, or both receivers may be maintained either in a state of continuous vacuum or filled with compressed air, as may be desired.

A is a spiral tube coiled about (and the ends of which are in communication with) the hollow axial shaft, B. C C are hollow supports for the latter, and, at the same time, supply conduits, the water passing therefrom into shaft, B, by the inlet valves at D. E are the exhaust valves, and at F is a partition which divides shaft, B, into two compartments, so that, through its axis, there is no communication between the ends of the coiled tube, A. A portion of the coil is filled with mercury, as indicated by the broken-away section on the right, the hight of the column being equal to or greater than 28 inches, so as to overbalance atmospheric pressure.

When the coil is turned by the action of the belt pulley or by hand, in the direction of the arrow, the mercury, flowing along the spiral tube from one end to the other, will create a vacuum in its rear while compressing the air before it. In so doing, it will draw water or air through the valve, D, at one end of the shaft, and expel the air before it from the valve, E, at the opposite extremity. If the motion be reversed when the mercury has traversed the length of coil, A, the same takes place with the other pair of valves, while, of those first affected, the inlet valve now closes and the outlet valve opens. A moment's inspection of the arrangement of the valves in the diagram will show that a continuous suction and exhaust is thus maintained.



CAMERON'S PLENUM AND VACUUM PUMP.

If the positions of the inlet and outlet valves be changed—valves, E, being inlet valves and D, outlet—the apparatus may be used as an air compresser, of which the tubes, C, may be conduits to the reservoir. In such case valves, E, which, as represented, open outside the shaft, would open inwardly, while valves, D, now opening inside the shaft, would open into the receivers.

It is claimed that, by this device, water may be raised 33 feet. The amount of compression attained is dependent upon the weight of the mercury column and the size of the machine. Air, however, it is stated, can be compressed five times, equal to a pressure of 60 pounds to the square inch. The receivers may be made of any desired size. The diameter of the tubes and number of coils may be increased at pleasure. The diameter of the coils may be from three to fifteen feet, and either hand or steam power may be utilized for their rotation.

Patented through the Scientific American Patent Agency, November 24, 1874, to Daniel L. Cameron. For further particulars regarding sale of rights, or of patent, etc., address the patentee at Madison Station, Madison county, Miss.

## A NEW SAD IRON.

Flat irons with fixed handles are fast becoming things of the past. They occupy too much room on top of the stove or range, cost more to manufacture, and, besides, require the use of a holder, which is not always at hand when required. It is a much better arrangement to have the flat portion of the iron separate, with provisions made to accommodate a light handle, which may be inserted and removed at pleasure, one handle answering for a number of irons, and which, being detached while the iron is heating, keeps cool enough to manipulate without the interposing cloth holder or the liability of burnt fingers.

*Fig. 1*

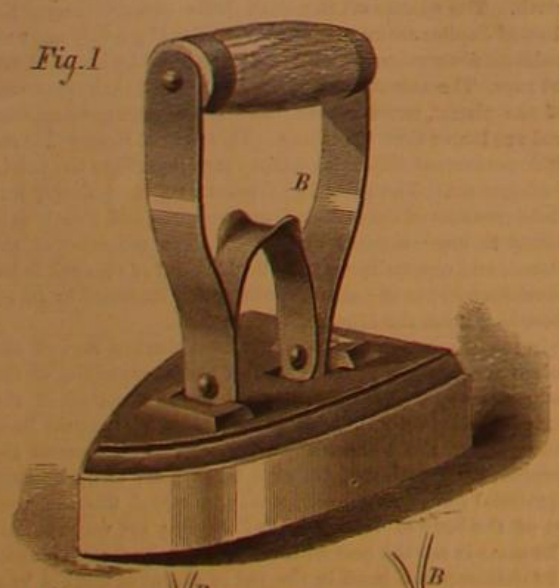
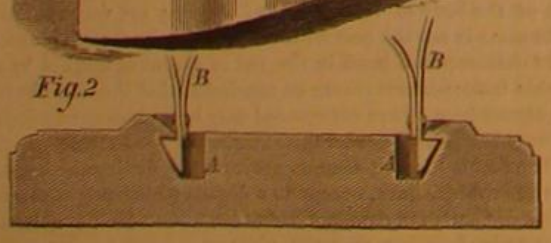



*Fig. 2*




An invention of this description is represented in our engraving, and is one of the simplest of the many that have come under our notice. The sectional view, Fig. 2, shows that, in the stock part of the iron, two recesses, A, having lips, are formed. The handle consists of two spring braces, B, of steel, attached to each end of the wooden piece which receives the grasp. These, at their lower extremities, are provided with catches beveled and notched to fit the lips of the recesses of the stock. The side pieces are united by an arched brace. The fingers are inserted beneath the flattened upper portion of this last, pulling it upward, and so drawing the catches on the ends of the side pieces together, so that they may be easily inserted into the recesses. On relaxing the pressure, the elasticity of the springs carries the catches under the lips. Removal is effected in the same manner.

Patented September 22, 1874, to Daniel B. Snow, of South Lancaster, Worcester county, Mass., who may be addressed for further information.

## HAYDEN'S REVOLVING CARTRIDGE BELT.

Sportsmen will recognize, we think, at a glance that the new cartridge belt, represented in the engraving given here-


with, offers a very convenient way, not merely of carrying ammunition, but of so disposing it about the person that it is always in the most accessible position. This belt is double, consisting of an inner girdle, A, which is buckled about the waist and to which are attached four guides. The outer belt, B, to which the sockets for the cartridges are affixed, slides in the guides, so that any portion of it may be readily turned to the front of the wearer. The ammunition is thus always near the hand; and the necessity of reaching awkwardly about the body, as is the case when the belt is immovable, is avoided. Stout straps, which pass over the shoulders, are secured to the guides and inner belt, and sustain the weight, which is thus distributed about the person in a convenient and comfortable manner. The inner belt is fastened by a strap and buckle, and the outer one by an ingenious latching clasp, which, when closed, makes a firm and rigid joint.

The device may be worn over the vest and under the coat, and its contents are thus protected from the weather, while the outer garment need not be unbuttoned to reach the cartridges. It is also equally serviceable without a coat for summer shooting. The belt is especially adapted for army use, as it can be arranged to carry metallic cartridges of any caliber. The usual make, however, is for paper or metallic cartridges for fowling pieces. The invention appears to us to be excellently calculated both for easy loading and for rapid firing, no matter in what position the wearer may be placed.

For further particulars address the Hayden Belt Works, Columbus, Ohio.

## When to Get Up.

The Duke of Wellington always slept on an iron camp bedstead eighteen inches wide. "When a man wants to turn over," he said, "it is time for him to turn out." The Emperor Nicholas did the same, Mr. Owens says. The principle is well enough; but I think the detail is wrong. Sleep itself is far too important to be made uncomfortable. My old friend Rossiter fixed his alarum so that, at the fore-ordained moment, the bed clothes were dragged from the bed, and Rossiter lay shivering. I have myself somewhere the drawings and specifications for a patent (which I have never applied for), which arranges a set of cams and wheelwork under the bedstead, which, at the moment appointed, lift the pillow end six feet, and deliver the sleeper on his feet on the now horizontal footboard. He is not apt to sleep long after that.

Rossiter found another contrivance which worked better. The alarm clock struck a match, which lighted the lamp, which boiled the water for Rossiter's shaving. If Rossiter staid in bed too long, the water boiled over upon his razor, and clean shirt, and the prayer book his mother gave him, and Coleridge's autograph, and his open pocketbook, and all the other precious things he could put in a basin underneath when he went to bed; so he had to get up before that moment came.—*Old and New.*

## A Good Lawn.

The first great requisite in making a lawn is to have good drainage, after which prepare the ground by deep plowing and also by subsoiling the soil requiring to be well pulverized and enriched, to expect any success in our hot climate.

A good lawn is one of the most pleasant appendages to a house; but to make it so, it requires to be well attended to, both in the formation and by keeping it mown every two weeks at farthest, using the most approved lawn mower. By doing so you will soon have a lawn like a carpet. Inexperience and neglect have been the causes of numerous failures.

## WELLMAN'S IMPROVED CAR SEAT.

The novel feature of the car seat, represented in the accompanying engraving, consists in the manner in which it is reversed. Instead of turning the back over, as is usually done, arrangements are provided whereby the back is slid from one side of the seat to the other, without being lifted or turned. To this end, fixed rods, A, are provided at the ends of the seat, over which slide the staples, B, which confine the three portions of the back. The latter consists of a center piece, C, which may be of wood or metal, or both, to the top of which are secured the outer parts, D. These last are each made in two portions, which spring out and in independently. The backs of each part, D, are of wood, and


springs or upholstery are inserted between them and the central portion, C, to give further elasticity.

It will readily be understood that the entire back is supported on the staples and rods, and hence, by the sliding of the former over the latter, is readily pushed from front to rear of the seat, or *vice versa*.

Patent pending through the Scientific American Patent Agency. For further particulars address the inventor, Mr. Edwin G. Wellman, Canandaigua, Ontario county, N. Y.

### A HAIRY FACED FAMILY.

Mr. W. B. Tegetmeier, a well known English naturalist, publishes in a contemporary the portraits of three members of a Burmese family, the whole of which, through several generations, have exhibited a remarkable development of long hair over their entire faces.

"The case," says Mr. Tegetmeier, "is one of the most interesting examples on record of the hereditary transmission of a singular and very abnormal natural variation through several generations. I feel bound, even at the risk of repeating, to some extent, the previous statements, to give, as far as practicable, the history of those singular people at length. Nearly fifty years since, Mr. John Crawford, so well known to ethnologists for his researches into the history of languages of the inhabitants of the Malay peninsula and adjacent countries, described, in his 'Journal of an Embassy from the Governor General of India to the court of Ava,' a hairy man named Shwe-Maon, and his daughter, Maphoon. Mr. Crawford wrote: "We have heard much of a person said to be covered all over with hair, and who, it was insisted upon, more resembled an ape than a human being—a description, however, I am glad to say, which was by no means realized by his appearance. Having expressed a curiosity to see this individual, the king politely sent him over to our dwelling some days ago, and Dr. Wallich and I took down on the spot the following account of himself and his history. His name was Shwe-Maon, and he stated himself to be thirty years of age. Saubwa, as the chief of the country, presented him to the king as a curiosity when a child of five years of age, and he had remained in Ava ever since. His hight was 5 feet 3½ inches, which is about the ordinary stature of the Burmese. His form was slender, if compared with the usually robust make of the Hindoo-Chinese race, and his constitution was rather delicate. In his complexion there was nothing remarkable, although upon the whole he was rather fairer than the ordinary run of Burmese. The color of his eyes was a dark brown, not so intense as that of the ordinary Burmese. The same thing may be said of the hair of the head, which was also a little finer in texture and less copious. The whole forehead, the cheeks, the eyelids, the nose, including a portion of the inside, the chin—in short, the whole face, with the exception of the red portion of the lips—were covered with a fine hair. On the forehead and cheeks this was 8 inches long, and on the nose and chin about 4 inches. In color it was of a silvery gray; its texture was silky, lank, and straight. The posterior and inferior surface of the ears, with the inside of the external ear, were completely covered with hair of the same description as that on the face, and about 8 inches long; it was this chiefly which contributed to give his whole appearance, at first sight, an unnatural and almost inhuman aspect. He may be strictly said to have neither eyelashes, eyebrows, nor beard, or at least they were supplanted by the same silky hair which enveloped the whole face. He stated that when a child the whole of this singular covering was much fairer than at present. The whole body, with the exception of the hands and feet, was covered with hair of the same texture and color as that now described, but generally less abundant; it was most plentiful over the spine and shoulders, where it was 5 inches long; over the breast it was about 4 inches; it was most scanty on the bare arms, the legs, thighs, and abdomen. We thought it not improbable that this singular integument might be periodically or occasionally shed, and inquired, but there was no ground for this surmise—it was quite permanent.'

THE HAIRY FACED BURMESE FAMILY.

Twenty years since, these hairy people were seen and described by Capt. H. Youle, in his 'Narrative of the Mission sent by the Governor General of India to the Court of Ava.' By this time Shwe-Maon's child had grown into a woman of thirty, and the abnormal growth of hair had increased until it covered the whole body. Capt. Youle states:

'The whole of her face was more or less covered with hair. On a part of the cheek, and between the nose and mouth, this was confined to a short down, but over all the rest of the face was a thick, silky hair of a brown color, paleing about the nose and chin, four or five inches long. At the alæ of the nose, under the eye, and on the cheek bone, this was very fully developed; but it was in and on the ear that it was most extraordinary. Except the upper tip, no part of the ear was visible. All the rest was filled and veiled with a large mass of silky hair, growing apparently out of every part of the external organ, and hanging a pendant lock to a length of eight or ten inches. The hair over her forehead was brushed so as to blend with the hair of the head, the latter being dressed (as usual with her countrywomen) *à la Chinoise*. It was not so thick as to conceal her forehead.

'The nose densely covered with hair, as no animal's is that I know of, and with long locks curving out and pendant, like the wisps of a fine Skye terrier's coat, had a most strange appearance. The beard was pale in color, and about four inches in length, seemingly very soft and silky.

'Poor Maphoon's manners were good and modest, her voice soft and feminine, and her expression mild and not unpleasing, after the first instinctive repulsion was overcome. Her appearance rather suggested the idea of a pleasant-looking woman masquerading, than that of anything brutal. This discrimination was, however, very difficult to preserve in sketching her likeness.

'Her neck, bosom, and arms appeared to be covered with a fine pale down, scarcely visible in some lights. She made a move as if to take off her upper clothing, but reluctantly, and we prevented it. Her husband and two boys accompanied her. The elder boy, about four or five years old, had nothing abnormal about him. The youngest, who was fourteen months old, and still at the breast, was evidently taking after his mother. There was little hair on the head, but the child's ear was full of long silky floss, and it could boast a moustache and beard of pale silky down that would have cheered the heart of many a cornet. In fact, the appearance of the child agrees almost exactly with what Mr. Crawford says of Maphoon herself as an infant.

'This child is thus the third in descent exhibiting this strange peculiarity; and in this third generation, as in the two preceding, this peculiarity has appeared only in one individual.

'Maphoon has the same dental peculiarity also that her father had—the absence of the canine teeth and grinders, the back part of the gums presenting merely a hard ridge. Still she chews pawn like her neighbors.'

Six or seven years since, the family were again seen by Capt. Haughton, and photographed. By this time Maphoon's youngest child was approaching manhood, and, the early indications above alluded to having been fulfilled, he demonstrated the perpetuation of this singular variation through three generations.

The investigation of monstrosities of the kind at present under consideration has an interest beyond that of the gratification of mere vulgar curiosity. The hereditary transmission of accidental variations throws much light on the vexed question of the origin of species, and it is exceedingly interesting to note how readily variations, occurring naturally, are perpetuated in the offspring, while malformations or mutilations produced artificially never show any tendency to reproduction. The combs and wattles of game fowls have been cut off for 150 generations, yet a game cock ready dubbed for the cockpit never issued from an egg. It would be indeed a sad condition of things if the mutilations of mankind were inherited by the unfortunate children. We know, unhappily, that the constitutional defects of the drunkard and the debauchee descend to their offspring, and that in this manner 'the sins of the fathers are visited on the children even unto the third and fourth generations;' but, fortunately, we are exempted from the inheritance of accidental mutilations and losses."

### Removing Snow by Steam.

Mr. William Edwards lately presented a paper on this subject before the New York Society of Practical Engineering, in which he gave a review of the various plans for melting snow in the streets to insure its removal.

The system began in the use of a steam hose, furnished with a nozzle and fitted to a stationary boiler, the hose being extended to the sidewalk, and the steam jet, properly guided, rapidly melting the snow and ice, and heating the resulting water so that it quickly evaporated, leaving the flagstones dry.

One of the earlier projects was to lay steam pipes along the gutters so that snow, brushed upon the pipes by a street sweeping machine would be melted and run off to the sewers.

Another step forward, at least theoretically, is the plan of a perambulating apparatus, constructed to act upon the snow by jets of steam, by blasts of hot air, or contact with metal plates. It is calculated that the combustion of one pound of coal would, theoretically, melt about 100 pounds of snow; in practice, perhaps three fourths of that quantity.

Within the past two years renewed attention has been given to the subject, and numerous novel inventions made. In one of these a hollow case is provided with a furnace, through which an air blast is forced by a blower. The hot air and gases from the furnace pass through a narrow horizontal opening at the front of the machine, and are directed forcibly downward against the snow and ice.

In another a portable engine operates a revolving shovel, made with a steam space, so that, when the snow is lifted by the shovel, it is melted therein.

In another a horizontal tank, supplied with steam from a boiler on wheels, is perforated at its under side, so that a shower of steam jets is thrown down upon the snow.

In still another a revolving brush sweeps the snow into a double walled hopper; steam is conducted between the walls of the hopper and melts the snow.

In another the perforated steam tank is replaced by a perforated hot air tank and blowing devices that shower down streams of hot air instead of steam.

In another hot water, or steam and hot water together, are thrown upon the snow-covered surface, and in still another the steam is superheated before use.

In still another, movable plates are heated in a furnace and lowered in contact with the pavement.

These examples give some idea of the amount of ingenuity lavished upon the subject, but nothing yet done seems to afford

an adequate solution of the problem of how to cheaply and quickly remove snow from the streets. The mere cost of coal for melting would probably not prove an insuperable obstacle, but the freezing of water resulting from the operation would be a greater evil than that sought to be remedied. The writer believed that melting the snow would be more economical than carting it away; but in order to do this, the snow must be swept from the street ways, either to the traveling machine or to fixed pipes, previous to melting; and the water must be conducted direct to the sewers to prevent the formation of ice in the streets. He knew of no means by which this could be accomplished, but expressed the opinion that improvements yet to be made will, in the future, make snow melting the most satisfactory method of cleaning city streets in winter.

### Combustion.

At a recent meeting of the Edinburgh and Leith Engineers' Society, a paper on "Combustion" was read by Mr. Wm. Allan Carter, C. E. He remarked that an ordinary sample of anthracite coal is found to contain the following constituents in something like the following proportions:—Carbon, 86·32 per cent; oxygen, 7·21 per cent; hydrogen, 3·75 per cent; nitrogen, 0·41 per cent.; ash, 2·21 per cent; sulphur, 0·10 per cent. But in ordinary bituminous coal, such as from Edinburgh, Glasgow, Newcastle, Lancashire, or Durham, we find the carbon ranging from 74 to 88 per cent, and the hydrogen from 5 to 6 per cent; and in bituminous coal, the amount of hydrogen is an important feature, as it is from this gas that flame is produced during combustion.

We will suppose some time has elapsed since fresh fuel has been thrown on the fire, and we find that the fuel on the bars presents to our view a glowing, incandescent mass, with no appearance of smoke and no flame, and we will suppose that the only access for the air necessary for supporting combustion is through the fire bars from the ashpit, through the incandescent fuel and finally away to the chimney; and it need scarcely be said that the supposed case is one of very common occurrence.

The moment the air comes in contact with the incandescent fuel it is resolved into its constituents, nitrogen and oxygen, the nitrogen passes on to the chimney with no further change than increase of volume from increase of temperature; the oxygen, however, is arrested, and each atom of carbon seizes two atoms of it, and one atom or equivalent of carbonic acid is formed. If this carbonic acid got away to the chimney, nothing further could be desired, and complete combustion of the coke would be effected. But it is not destined to escape in this manner, for before the atom of carbonic acid has struggled through the mass of fuel and got free from it, it has taken up another atom of carbon, and now, instead of being carbonic acid, $CO_2$, it has been converted into $C_2O_2$, or two equivalents of carbonic oxide, and it is this gas which escapes to the chimney. Experiment has proved that carbonic acid is not combustible, but that carbonic oxide is, and it stands to reason, if anything of a combustible nature is escaping from the chimney, we cannot be having complete combustion in the furnace; but there are very few practical men who have any idea whatever as to the magnitude of the loss of heat when carbonic oxide is the result of combustion instead of carbonic acid; for we find from calorimetrical experiments that, in the former case, we only get three tenths of the evaporative power produced in the latter. Now in order to burn this carbonic oxide, we must supply each atom of carbon in it with another atom of oxygen while the carbon is at a sufficiently high temperature; if the combination is effected, then our carbonic oxide is reconverted into carbonic acid, and has given out during its reconversion the seven tenths of heat which we noted were deficient in the formation of the oxide.

The next point considered was the gaseous portion of the coal, and it was pointed out how fuel might be lost, either by the gas escaping wholly or by being only partially burned, the latter alternative causing the formation of smoke and soot. Mr. Carter showed how this latter alternative was generally attributable to the want of a proper supply of air admitted above the fire, or to the flame being brought into contact with the metal plates of the boiler, and so cooled down below the temperature necessary for ignition of the gas, and mentioned the following instance:

"Last winter I had a little stove in one of the rooms of my house; it is one of those commonly known as a gill stove; the whole of the air supporting the fire had to pass from beneath through the bars, and consequently through incandescent fuel, before reaching the flue. I was greatly disappointed with the performance of this little stove, as far as its heating power was concerned; eventually I took off the door and drilled a number of small holes in it so as to admit jets of air above the fire; the fire inside has been as bright and as lively again since this surgical operation, and the quantity of soot collecting in the flue, which before proved a constant nuisance, is now almost reduced to *nil*. This is an instance of how easily a remedy may sometimes be applied."

After going through various calculations to show the quantity of air required above and below the fire for certain quantities of coal, and how smoke and soot were formed, Mr. Carter concluded in the following terms:

"So long as popular errors prevail amongst that class of men who have the direct control of furnaces of all descriptions—I allude to the practical managers or foremen in manufacturing works—little will be done to prevent waste of fuel; and as a rule, when you begin to speak to them about carbonic acid and carbonic oxide, they look at you with an incredulous smile, you at once lose caste with them and fall from the high position of a practical man to the pitiable *status* of a mere theorist. But I maintain that this is not simply a matter of theory, but that the principles involved are of an eminently practical nature, and if applied in practice may be turned to good account. We must impress on the practical man that air is required in certain quantities and delivered in certain methods; we must combat the idea that gas is smoke, or that gas and smoke are synonymous terms. We must point out that volumes of black smoke do not constitute the only indication of waste of fuel, for, as I have shown, the waste may be enormous although no vestige of smoke is to be seen. We must challenge the idea that a furnace can consume its own smoke, that is simply impossible; we can construct a furnace to prevent the formation of smoke, but let smoke once be formed, and it cannot be consumed in the *same* furnace, its presence indicating that the furnace is wanting in those conditions essential for the completion of combustion."

### OCEAN TELEGRAPHY.—THE FOREIGN CONNECTIONS OF NEW YORK CITY AND THE EXISTING RATES OF CHARGES.

Telegraphic communication between the United States and the West Indies is maintained over the following routes: From Punta Rassa, Florida, *via* Key West to Havana by cables, thence by land lines to Batabano; thence by cable to Santiago de Cuba; thence by cable to Kingston, Jamaica. From Kingston a series of cables extend to Demarara, South America, touching at Porto Rico, St. Thomas, St. Kitt's, Antigua, Guadaloupe, Dominica, Martinique, St. Lucia, St. Vincent, Barbadoes, Grenada, and Trinidad. A cable also extends from Jamaica to Aspinwall on the Isthmus of Panama.

A cable steamer is now on her way to Trinidad to lay a cable from Port of Spain, Trinidad, to Ponce, Porto Rico, touching at St. Croix, after which she will proceed to lay a cable between Cienfuegos, Cuba, to Jamaica. When these are completed, the United States and West Indies will be substantially united by a double series of cables, so that, in case of failure of any one of them, communication will not be interrupted. The shore ends of a cable to extend from Demarara, South America, to Cayenne, South America, were laid last month, and the cable steamer Hooper is now on her way to Cayenne, to lay the deep sea cable to Demarara. When this link is laid, there will be a complete line of telegraphic communication between the United States and Rio Janeiro, South America; and when another link is laid between Rio Grande do Sul and Maldonado, Uruguay, the United States will be in telegraphic communication with all of South America, bordering on the Atlantic ocean, north of Buenos Ayres, and with Chili on the Pacific. A singular fatality has thus far attended the laying of the cable between Rio Grande do Sul and Moldonado. The telegraph steamer Gamas was first wrecked in attempting to lay it, and more recently the La Plata was chartered to pursue the work and was wrecked in the Bay of Biscay, the cable and all persons on board being lost.

Until the cable is laid down between Cayenne and Demerara, communication between the United States and other parts of South America must be forwarded *via* Europe, the cable between Lisbon, Portugal, and Pernambuco, Brazil, furnishing the only means of telegraphic intercourse.

Communication between the United States and England is maintained by land lines to Sydney, Cape Breton, thence by cables, to Placenta, Newfoundland, thence by land lines to Hearts Content, Newfoundland, thence by three cables to Valentia, Ireland, thence by land lines to Wexford, Ireland, thence by cable to Haverfordwest, England, thence by land lines to London.

Communication between the United States and France is maintained by cable from Duxbury, Mass., to St. Pierre, and thence by cable to Brest, France. Communication between Great Britain and the various continental states is transmitted over two cables to Denmark; two to Germany; two to Holland; two to Belgium; one to Norway; one to Portugal; two to Spain; and six to France.

There is one cable between France and Denmark; one between France and Spain; two between France and Algeria; two between Portugal and Gibraltar; one between Gibraltar and Malta; one between Algeria and Malta; two between Sicily and Gibraltar; one between Malta and Alexandria; one between Italy and Alexandria, touching at Corfu, Zante, and Candia; one cable between Russia and Turkey, through the Black Sea; one between Norway and Denmark; one between Denmark and Sweden; one between Sweden and Russia; one between Denmark and Russia; one between Sweden and Germany; one between Egypt and India, through the Red Sea and Indian Ocean, touching at Aden; one between Persia and India, through the Persian Gulf, touching at Gwadar in Beloochistan; one from Madras, India, to Penang in the Strait of Malacca; one from Penang to Singapore; one from Singapore to Saigon, Cochin China; one from Saigon to Hong Kong and Shanghai, China; one from Shanghai to Nagasaki, Japan; one from Nagasaki to Hiogo and Yokohama, Japan; one from Nagasaki to Wladivastok, Asiatic Russia; one from Singapore to Batavia, Java; one from Java to Australia; one from Australia to Tasmania or Van Diemen's Land. The following cables are projected: From Australia to New Zealand; Ceylon to Australia; Singapore to Borneo; Borneo to Luzon; Luzon to Hong Kong; Yokahama to Hokodadi; Siberia, mouth of the Amoor, to Kamtchatka; Calcutta to Penang; Hong Kong, China, to San Francisco, touching at the Sandwich Islands; Havana to Vera Cruz; Aspinwall, Isthmus of Panama, to Carthagena, South America; Panama to Buenaventura, New Grenada; Buenaventura to Callao, Lima; Callao to Valparaiso, Chili; England to Virginia, touching at the Azores and Bermudas; Portugal to New York, touching at the Azores; Scotland to Labrador, touching at the Faroe Islands, Iceland, and Greenland.

Communication between England and India is mainly confined to the following routes: First, from Penzance on the southeastern coast of England to Lisbon, Portugal; thence to *Gibraltar*; thence to Malta; thence to Alexandria, Egypt; thence by land line to Suez, and thence by cable to Aden and Bombay. Second, by cable from Lowestoft, England, to Emden, Germany, thence by land line, *via* Berlin, Germany, Warsaw, Jitomer, Odessa, Kertsch and Tiflis, Russia; Teheran, Bushire, Henjaum, and Jask, Persia; Gwadar, Beloochistan, and Kurrachee, India. This is known as the special Indo-European line, and is worked in one circuit from London to Teheran, a distance of six thousand miles. From Kurrachee and Bombay, land lines extend to Calcutta, Madras, and Paumben. *From* Paumben a cable extends to the Island of Ceylon. From Madras a cable extends to Penang and Singapore. From Singapore cables extend to Saigon, Cochin China, and thence to Hong Kong and Shanghai in China and Nagasaki, Hiogo, and Yokohama, in Japan. From Nagasaki a cable extends to Wladivostok, the terminus of the Russian land lines in Siberia. From Singapore a cable extends to Batavia in the Dutch island of Java; from Java a cable extends to Port Darwin, Australia, and there connects with a land line extending to Victoria, Australia; from Victoria a cable connects with Tasmania or Van Diemens Land. Telegraphic communication exists between Victoria, British Columbia, and Hobart Town, Tasmania, embracing 273 degrees of longitude, and thus lacking but 87 degrees of encircling the globe; and when the projected cable from San Francisco to China is laid, the circle will be completed. When this latter enterprise is carried out, the telegraphic correspondence between North and South America and the West of Europe, with China, Japan, and Australia, will take this route, as it will be the shortest, cheapest, and most expeditious.

The telegraphs of the world, aerial and submarine, embrace 385,872 miles of line, 871,417 miles of wire, and 30,150 stations. The annual traffic amounts to about 80,000,000 messages.

The tariff upon telegraphic despatches from New York to other countries is as follows: Great Britain and Ireland $1 per word, France $10 for 10 words or less, Cuba $5.40 for 10 words or less, Jamaica $7.75, Porto Rico $11.50, St. Thomas $11.88, St. Kitt's $12.75, Antigua $13.00, Guadaloupe $13.38, Dominica $13.75, Martinique $14, St. Lucia $14.25, St. Vincent $14.50, Grenada $15.00, Barbadoes $15.13, Trinidad $15.50, Demarara $17.50, Berbice $17.50, Aspinwall $12.75, Panama $13.75, Aden, Arabia, $20.00, Port Darwin, Australia, $56.62, New South Wales $57.88, South Australia $56.62, Victoria, Australia, $57.12, Tasmania and Queensland $59.12.

Austria and Hungary $11.50, Baden $11.50, Belgium $10.84, Channel Islands $11.66, Denmark $11.40, Germany $11.10, Holland $11, Norway $11.80, Portugal $12, Roumania $11.88, Russia in Europe $12.50, Servia $11.88, Spain $12, Sweden $11.75, Switzerland $11.75, Turkey in Europe $12.25, Wurtemberg $11.50.

Beloochistan $18, Bushire, Persia, $16.12, Ceylon $20.50, Hong Kong, Amoy, and Shanghai, China, $40, Saigon, Cochin China, $38.50, Corfu $12.50, Egypt $15.30, Gibraltar $12.75, Greece $12.75, India $20, Japan $50.38 to Nagasaki and $52.62 to Hiogo, Osaka, Simonosaki, Yeddo, or Yokohama.

Java $40.62 Madeira Islands $15.38, Malta $12.50, Penang $33.50, Persia $16.12, Russia in Asia from $13.12 to $19.16, Cape de Verde Islands $24.38, Singapore $37.50, South America: Buenos Ayres $68.75, Chili $68.75, Montevideo $68.75, Pernambuco $40.50, Bahia and Para $51.50, Rio de Janeiro $56.50, Santos $62.25, Rio Grande do Sul $63.25.

### Machine Belts.

In a recent paper read by John W. Sutton, M. E., before the New York Society of Practical Engineers, the author made the following observations:

Although the use of belts for the transmission of power is not, strictly speaking, an American invention, the great improvements made in this country have caused it to be known in Europe as the American system. In Europe the greater part of the power is transmitted by cog wheels, but in this country 99 per cent is transmitted by belting. The latter is used everywhere, from the sewing machine to the 500 horse power engine of the largest factory. Belts can be run in any way, at any angle, of any length, and at any speed, and can be put up by any one of ordinary skill. They can be made of any flexible material—leather, rubber, gutta percha, cloth, paper, raw hide, cord, or wire—and they may be either round or flat; and the last novelty is a sheet iron belt, and it is said to work well. Every one uses them. While so handy and so popular, they have one fault. They are not positive. If you start from the motor with a certain number of revolutions, you lose a portion of them with every belt used. This is the only fault of the system. It is noiseless, yielding, and regular, but, unlike cog wheels, it is not positive. The number of revolutions that are lost may, and do, vary continually by changes of the load or of the atmosphere. It is upon these peculiar changes of our favorite system that I propose to speak to night. Belts derive their power to transmit motion from the friction between the surface of the belt and the pulley, and from nothing else, and are governed by the same laws as friction between flat surfaces. The friction increases regularly with the pressure.

The lecturer then gave the results of some experiments with belts and pulleys to prove this. He found that there was a great difference in the friction of belts, and it was due to their elasticity of surface, that is, the more elastic the surface, the greater the friction. He made experiments with a pulley and belt, moved by a lever and spring balance, to show the difference in the actual friction between the grain and flesh sides of a leather belt in contact with a

smooth cast iron pulley. He said that the old rule, "that the number of inches in contact, multiplied by one half the velocity of the belt in feet per minute, and divided by 33,000, would give the horse power," might give it once in a hundred times, but not oftener. The rule is that a belt holds upon a pulley as the tension (pressure) and as the square of the degrees of wrap. A belt wrapped one quarter around a pulley has only one fourth the power of a belt wrapped one half around the same pulley with the same tension.

A line around a post will give a good illustration of this. One half a turn, and a man's weight is doubled: while a full turn, and his weight is nearly enough to stop a heavy boat, and two turns and his weight will stop the boat, or the line will part.

Belts always run to the high part of a pulley when the shafts are parallel; but when they are not, the belt will always run toward the ends of the shafts that are nearest together, and this tendency is much stronger than to run to the highest part of the pulley. If you have a belt that gives trouble in this way, you can see if it is the fault of your shafting by drawing a line across the edges of the two pulleys. Sometimes the bearings may be in line; but the tension of your belt is so great as to spring the shaft, so as to throw the pulleys out of line. A stiffer shaft or another bearing is the remedy. Leather and rubber belts each have their advocates, and each party say theirs is very much better; but each kind is better in its place. Where the belt is clear, a rubber belt will transmit 20 per cent more power with the same tension, and will last as long and run perfectly straight. It can be made of any length or width, of exactly the same thickness in every part, perfectly smooth on its surface; and when in use, every part will come in contact with the face of the pulley. The greater tractile power of a rubber belt is due to its surface elasticity.

Leather belts have to be made from pieces, and, as the leather is not perfectly flat, a perfectly flat belt cannot be made from it. If a belt is cut from the back of a hide, the edges are not so firm as the center, and upon a crowned pulley they will not hug as well as if they were of the same firmness as the center. If the belt is cut from one side of the back, then one edge will be less firm than the other, and the belt will be crooked, and one side will have more tension than the other. Leather belts are usually riveted at the joints. Now, if a rivet head touches the pulley, the friction is less than if the leather touched. If the head is above the surface of the belt, then a portion of the belt is not in contact with the pulley; and if the head is below the surface of the pulley; then of course there is no contact. Now every rivet in a belt is in one or the other of those positions, and leather belts would be improved by using something else in their place. Double leather belts are used more than single ones; but it is clearly a mistake, as a single leather one will transmit more of the power than a double one. If you look at the face of a leather belt, you will see when it has been used for a time, the face has a mottled appearance, light and dark, showing how much of the surface of the belt has been in contact with the pulley. If an average of one inch of width has not touched, then you have paid for one inch of belt that is of no use, but is really a detriment. Double leather belts run straighter than single ones, as the flank side of one part can be put against the back of the others. A double belt will stand a greater tension than a single one, but a single one will stand all that should be put upon any belt.

The cost of belting is increasing every year, and it is well to look out for the belt of the future. My impression is that it will be made of low steel of great tensile strength, and will run upon pulleys, with an elastic surface to give greater friction. The instance I mentioned, of a sheet iron belt running upon cast iron pulleys, is, I believe, in Pittsburgh. But we have a hundred instances of the steel belt upon an elastic surface pulley in this city, in the band saw, and one of a large sawmill sawing logs with a band saw about three inches wide. Now a band saw is a belt, and the power to do work is all derived from the friction between the band saw and the lower pulley. In the case of the sawmill spoken of, it amounts to from 10 to 15 horse power, and this is all transmitted by the saw itself. It may be said that we cannot get belts of steel wide enough to take the place of our large belts. Whenever such belts are wanted, they will be made of any width and length asked for.

Belts of the present make are run with a strain of one fifth their strength; and as the strength of low steels is over 100,000 pounds to the square inch, a belt one foot wide and one eighth of an inch thick would have a strength of 150,000 pounds or more. One fifth of that would give us 30,000 pounds; this strain, upon an elastic surface pulley of, say, 16 feet, running at a speed of 2,000 feet per minute, would give us a belt with the power to transmit over 1,800 horse power. If the belt were one sixteenth of an inch thick, it would be able to transmit 900 horse power. We have no belts now capable of anything like this. How will this belt be joined? When the band saw first came out, that was looked upon as the stumbling block in its way, but to-day they are joined without a thought, and in about the same time that it would take to join a belt of leather. The steel belt would be joined in the same way. Whether this steel belt is the belt of the future or not, there will be wanted a better and cheaper one than we now have, and it is to the practical engineers that we are to look for it.

### Encke's Comet.

The return of Encke's comet to our heavens has been for some time expected, but its immense distance (182,000,000 miles) rendered all search with ordinary instruments useless. The large equatorial at the Naval Observatory, Washington, D. C., was recently put into service, and the comet was seen through this superb instrument by Professor Holden and Paymaster Tuttle of the U. S. N. Its distance rendered the use of the micrometer impossible, and it will scarcely be observable under ordinary conditions for several weeks.

It is known to our readers that the equatorial telescope above mentioned is one of the finest in the world. It is Alvan Clark's masterpiece, and has an objective 26 inches in diameter. Its power is now demonstrated in a remarkable manner

### THE POST OFFICE A CARRIER OF MERCHANDISE.

Since the adoption of postal cards for cheap communication by mail, there has been no modification of our postal laws which so greatly accommodates the public as the one permitting the sending through the mails of nearly all classes of merchandise, in packages not exceeding four pounds in weight, at the low price of one cent for every two ounces. The following are some of the articles officially named as belonging to the class of merchandise that can be mailed at this low rate:

We copy from the *Post Office Guide*, which gives this provision of the law:

*Rates of postage on third class matter:* Mailable matter of the third class embraces all pamphlets, occasional publications, transient newspapers, magazines, handbills, posters, unsealed circulars, prospectuses, books, book manuscript, proof sheets, corrected proof sheets, maps, prints, engravings, blanks, flexible patterns, articles of merchandise, sample cards, phonographic paper, letter envelopes, postal envelopes and wrappers, cards, plain and ornamental paper, photographic representations of different types, seeds, cuttings, bulbs, roots, scions, and all other articles not above the weight prescribed by law, which are not, from their form or nature, liable to destroy, deface, or otherwise injure the contents of the mail bag or the person of any one engaged in the postal service.

All packages of matter of the third class must be wrapped or enveloped, with open sides or ends, so that their contents may be readily and thoroughly examined by postmasters without destroying the wrappers; but seeds and other articles liable, from their form or nature, to loss or damage unless specially protected, may be inclosed in unsealed bags or boxes which can readily be opened for examination of the contents and reclosed; or closed bags, made of material sufficiently transparent to show the contents clearly, without opening, may be used for such matter.

No writing will be permitted on articles of this class, or their wrappers or envelopes, except the address of destination. Any other writing in or upon any package or article of this class will subject it to letter rates of postage.

Matter of the third class inclosed in sealed envelopes notched at the ends or side, or with the corners cut off, cannot be mailed except at letter postage rates.

The following, and some other articles unnecessary to specify, are unmailable: Packages containing liquids, poisons, glass, explosive chemicals, live animals, sharp pointed instruments, sugar, flour, or any other matter liable to deface or destroy the contents of the mail, or injure the person of any one connected with the service.

Persons living at a distance can send small models much cheaper by mail than by any other means; and if properly packed, they usually arrive at their destination in good condition. We receive a number of models from various parts of the country by every mail; and the only trouble we have with packages so sent arises from the sender not following the official rule, which requires that the package shall not be sealed, and shall not contain any writing; and that the full postage on the package shall be prepaid. When the sender does not observe these requirements, we are obliged to pay full letter postage, which makes the cost by mail greater than by express.

By observing the law's requirement, inventors can avail themselves of the mail, for transmitting their models from distant places to this office, to great advantage. But one thing which we would forcibly impress upon our clients is that, by the same mail in which they forward the model, they should *announce the sending* in a separate letter, giving description of the invention, time of sending model, name of post office and State, and full name of inventor. Observing these rules will save us much trouble, and insure a prompt answer to the sender.

### Spiritualism to be Medically Considered.

Dr. G. M. Beard lately read before the Medical Society of the County of New York an extensive paper on "The Relation of the Medical Profession to Popular Delusions, Spiritualism, Mind-Reading, Clairvoyance and Animal Magnetism." He reviewed the many delusions which have appeared in this country on this subject. He looked upon them as a species of epidemics which from time to time immemorial have periodically made their appearance.

A committee of five, consisting of the following gentlemen, Dr. J. C. Peters, Dr. Fordyce Barker, Dr. Ellsworth Eliot, Dr. Austin Flint, and Dr. A. B. Crosby, was appointed to consider, and report on, the following questions:

1. Is the state or condition of mind known generally as the mesmeric state a reality or a deception?

2. If it is a real physiological state, what are the conditions necessary to its production, and what the phenomena attending it?

3. Is it a state to which one mind can subject another, or does it depend on some conditions voluntarily submitted to by the individual?

4. Is it possible, while in this so-called mesmeric trance, or at any other time, or in any other condition known to man in his mundane experience, for one person to divine what is passing in the mind of another, except through the medium of signs?

5. Is there any such faculty known to our race as perceiving, by some mysterious second sight, what is transpiring in places far beyond the reach of ordinary human vision, or what is written on a paper when an opaque object lies between it and the person attempting to read?

6. Is there any evidence that the well known law of gravitation is ever overcome by a force hitherto unrecognized by scientists?

The members of the committee are all of them eminent physicians in this city, and will doubtless be glad to receive statements of evidence and experience from all who can supply such information.

In no case in general practice should the pressure, on even the slowest moving journals, be allowed to exceed 1,000 pounds per square inch of longitudinal section with steel journals, or about 600 on iron, in well-worn boxes.

Apples should be stored in cellars where there is a thorough circulation of air.

### DECISIONS OF THE PATENT OFFICE.

NEW PATENT RULE CONCERNING REJECTED CASES.

In the matter of the application of George L. Rouse and M. W. Stoddard for a patent for an alleged "Improvement in Wheels," filed May 18, 1874. On appeal from the Examiner-in-Chief:

Two claims are left in the application which the examiner rejects for want of novelty, citing as references the patents of P. Murphy, August 12, 1873, and the application of Charles Spofford filed August 2, 1874, and rejected the 8th day of the same month. The Examiners-in-Chief have affirmed the decision of the Examiners below, on the ground that the patent of Murphy is a good and sufficient answer to the claims of applicants. They have not discussed the pertinency of the rejected application of Spofford, as a reference.

After a careful examination, I have come to the conclusion that the Murphy patent is not a sufficient answer to the claims of Rouse and Stoddard, which are limited to the special construction shown and described by them. It is admitted, however, that the construction of wheel hubs shown and described in the application of Spofford is almost identically the same as that of applicants. More than two years having elapsed since the final rejection of Spofords' claim, his application is regarded as abandoned under the 32d section of the patent act.

It is insisted on the part of the applicants that, in view of recent decisions of the courts, a rejected and abandoned application does not constitute a bar to the grant of the patent sought by them. It becomes necessary, therefore, to examine this question and determine the practice of the Office in view of the decisions referred to.

Within a few years, several decisions have been rendered in the United States Circuit Courts, in which the effect on patents of prior rejected applications has been discussed; but the question did not receive the attention of the Supreme Court, until the case of Brown *vs.* Guild came up on appeal during the October term of 1873. One of the defenses set up against the Brown patent was an old application filed by Remy and Kelley in June, 1850, which was rejected and withdrawn the August following. The evidence showed that only one machine was ever made by them, and this merely for experiment, in the year 1849. In discussing the effect of this application on the validity of Brown's patent, the court uses the following language:

"The experiment made in 1849, when Remy worked it by hand, was a mere experiment which was never repeated. It may have presented one or two ideas in advance of other machines, but it can hardly be said to anticipate the machine which we have described as Brown's. Were it not for the application for a patent, it would justly be regarded as an abandoned experiment, incapable of being set up against any other claim. Can the fact that such an application was made and afterward voluntarily withdrawn, and never renewed make any difference? We think not. Had a patent been actually granted to Remy and Kelly it would have been different. The case would then have come directly within the seventh section of the act of 1836, which makes a "patent," or a "description in a printed publication" of the invention claimed, a bar to further patent therefor. But a mere application for a patent is not mentioned as such a bar. It can only have a bearing on the question of prior invention or discovery. If upon the whole of the evidence it appears that the alleged prior invention or discovery was only an experiment, and was never perfected or brought into actual use, but was abandoned and never revived by the alleged inventor, the mere fact of having unsuccessfully applied for a patent therefor cannot take the case out of the category of unsuccessful experiments." Brown *vs.* Guild, 6 *Off. Gaz.*, 392.

There can be no mistake as to the meaning of this language; the doctrine is distinctly announced that a mere application is not a legal bar to the grant of a patent to a subsequent applicant. This decision must be heeded by the Commissioner of Patents, and govern him in regulating the practice of the Office. I have had frequent occasion to state my views on the necessity of harmony between the practice of the Patent Office and rulings of the courts. There can be no question about the propriety of this course. The Commissioner ought not either to issue patents which the courts will declare invalid, nor to refuse the grant on grounds which have already been considered judicially and declared insufficient. But it will be noticed that the Supreme Court does not entirely ignore abandoned applications, for it is stated that they have a bearing on the "question of prior invention or discovery," and the effect of the application is made to depend on the question of actual use of the invention described therein.

It has been urged in argument that, if no objection appears to the grant sought by Rouse and Stoddard except the abandoned application of Spofford, the Commissioner should issue the patent and allow the question of public use to be determined hereafter in the courts. The suggestion must have its origin in a misconception of the duty of the Commissioner of Patents. The law makes him something more than a mere ministerial officer, whose function is to issue letters patent simply for the asking. The Commissioner is made the guardian not only of the rights of inventors, but also of the interests of the public. It is just as solemnly his duty to refuse to issue a patent which clearly ought not to be granted, as to grant the issue when the applicant shows an unimpeached right to the invention.

In this case, if without further inquiry the Commissioner should issue a patent to Rouse and Stoddard, and it should afterwards appear that the invention of Spofford was put into public use, it would be invalid, as I understand the decision which has been quoted.

It is his duty, therefore, to inform himself on this question, if possible, and the application of Spofford indicates the direction in which inquiry may be made. The only question in my mind is how to prosecute the investigation. The law restricts interferences to unexpired patents and pending applications.

An interference, therefore, cannot be declared with an abandoned application. I have no doubt whatever, however, that the Commissioner of Patents has ample authority to institute an *ex parte* inquiry at any time, for the purpose of determining whether or not a statutory bar exists to the grant of a patent for which application is pending. This is necessary to enable him to comply with the statute. Unsatisfactory as *ex parte* evidence may be, it appears to be the only source of information open to the Commissioner in cases like the present, without further legislation; and I do not believe that in a single instant a patent should issue for an invention shown in a prior abandoned application without an attempt, at least, to settle the question of public use.

The decisions of the Examiners-in-Chief, affirming the Examiner on reference to the patent of Murphy, is reversed. The application of Rouse and Stoddard is remanded to the Examiner, who is instructed to forthwith dispatch letters of inquiry to the applicant Spofford, and to his attorney of record, for the purpose of ascertaining whether the invention of the former has been brought into actual use. At the same time, they will be informed that an application is now pending for the same invention, and that the inquiry is made for the purpose of determining the right of subsequent applicants to a patent therefor. Information furnished by them should be in the form of affidavits, clearly and fully setting forth the facts in the case. Counter affidavits will also be received from applicants if they so desire. The issue of a patent will be determined by the information thus received.

Until otherwise ordered, this will be the rule and practice in the Patent Office in like cases.

J. M. THACHER, Commissioner of Patents.

Jan. 28, 1875.

### NEW BOOKS AND PUBLICATIONS.

DIGEST OF PATENTS RELATING TO BREECH LOADING AND MAGAZINE SMALL ARMS (except Revolvers), granted in the United States from 1836 to 1873, inclusive, Classified according to the Movements for Opening and Closing the Breech. By V. D. Stockbridge, Examiner in the U. S. Patent Office (Class of Fire Arms). Price $25. Washington, D. C.

The author, in undertaking a work requiring very laborious and patient research, has done good service to a large class of inventors. Over 700 patents are here fully described and illustrated, forming a complete history of the art during nearly 40 years. The illustrations are very clear and elaborate, and the work is sure to be much referred to by inventors and patent solicitors. The author states, with apparent justice, that the high price of his work is justified by the limited sale which such a production can attain.

REPORT OF THE TOPOGRAPHICAL SURVEY OF THE ADIRONDACK WILDERNESS FOR THE YEAR 1873. By Verplanck Colvin. Albany, N. Y.: Weed, Parsons, & Co.

The important survey of the Adirondack region covers nearly 5,000 square miles, and was commenced by Mr. Colvin at his own expense; but it was found to be so important that State aid was, in 1872, granted for the extension and continuation of the work. It is not possible here to describe the scenes of grandeur and the picturesque traveled, or the many valuable results in meteorology and topography achieved, by the investigators; but if any of our readers are interested in this region, the volume now before us will well repay them for the trouble of perusal.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC AND PHOTOGRAPHER'S DAILY COMPANION. Edited by J. Traill Taylor. New York city: E. & H. T. Anthony & Co., 591 Broadway.

This volume is replete with information on the latest discoveries in photography, written in a pleasant and readable style. We have read the book with

much pleasure, and cordially recommend it to the profession.

THE AMERICAN SPORTSMAN, West Meriden, Conn.

The issue for January 30 has been received. It contains many articles of interest both to the naturalist and the sportsman.

PRINCIPLES OF METALLIC MINING. By J. H. Collins, F. G. S., Honorary Secretary of the Miners' Association of Cornwall and Devon, Author of "A First Book of Mineralogy," etc.

ELEMENTS OF MAGNETISM AND ELECTRICITY, with Practical Instructions for the Performance of Experiments, etc. By John Angell, Science Master of the Manchester Grammar School.

These two excellent little treatises are issued by Messrs. G. P. Putnam's Sons, Fourth avenue and 23d street, New York, at 75 cents each. They are included in the publishers' "Elementary Science Series."

### Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 28, 1874, to January 14, 1875, inclusive.

BUTTON FASTENER.—D. Heston, Providence, R. I.
CAR JOURNAL BOX.—J. N. Smith, Jersey City, N. J.
CASTING UNDER PRESSURE.—J. Mackintire, Cambridge, Mass.
CLASP OR BUCKLE.—C. J. Weldon, San José, Cal.
CRIMPING APPARATUS.—A. B. Lowerre *et al.*, Newark, N. J.
CUTTING PLANE.—R. E. Lowe, Kane, Ill.
DRAWERS.—J. J. Fitzpatrick, Philadelphia, Pa.
ENAMELING PIPE, ETC.—American Enamel Co., R. I.
FIRE ARM.—J. Lee, Milwaukee, Wis.
FORMING HAT BODIES.—J. Wharton *et al.*, Newark, N. J.
FURNACE GRATE.—H. Ryder, Mass.
GAS LIGHTING AND HEATING.—L. Arnold, New York city.
HAMMER.—C. Parker, Meriden, Conn.
HAT MAKING MACHINE.—J. W. Corey, Newark, N. J.
KINDLING FIRES.—D. S. Silcox, Charleston, S. C.
KNITTING HATS, ETC.—A. Reed *et al.*, New York city.
LIFE MATTRESS.—J. F. Peck, Springfield, Mass.
LITHOLYCITE.—H. W. Bradford, Randolph, Mass.
LOOM.—C. H. Chapman, Shirley, Mass.
LOOM.—G. Crompton, Worcester, Mass.
MAKING HORSE SHOES.—J. Russell, New York city.
METAL CARTRIDGE.—A. C. Hobbs *et al.*, Bridgeport, Conn.
MUSICAL INSTRUMENT.—M. J. Matthews, Boston, Mass.
PACKING MATERIAL.—W. S. Fish (of Mystic, Conn.), Glasgow, Scotland.
PIANOFORTE.—W. R. Miller, Baltimore, Md.
RIVETING MACHINERY.—M. Bray, Boston, Mass.
ROTARY PUDDLER.—W. Sellers, Philadelphia, Pa., *et al.*
SCHOOL TEACHING APPARATUS.—M. McVicar, Potsdam, N. Y., *et al.*
SHARPENING TWIST DRILLS.—C. Van Haagen, Philadelphia, Pa.
SLIDE VALVE.—S. F. Dodge, Detroit, Mich.
STEAM OR AIR ENGINE.—G. J. Wardwell, Rutland, Vt.

## Recent American and Foreign Patents.

### Improved Self-Discharging Hay Rake.

S. G. Huribut, South Union, Ky.—This invention consists of pivoted parallel rake heads, mounted on a rockshaft, for the purpose of dumping or raising the teeth off the ground when the rake is being transported from place to place. The wheels are smaller than usual, and the heads extend over and beyond them on either side. The teeth, which are hinged at their connection with the head by means of a hinge plate, are so controlled that they can be set at an angle receding one from the other, to the right or left, for the purpose of discharging the hay at either side of the rake in one continuous windrow without lifting them from the ground, thereby making a continuous raking, discharging the hay as fast as gathered from the side in a neat, light manner, leaving it in good condition for further curing.

### Improved Coffee Roaster.

Michael W. Fry, Guyandotte, W. Va.—This invention relates to certain improvements in coffee roasters, and it consists in the combination, with a rotary moving cylinder, of an angular projecting air chamber upon the inside of said cylinder, which causes the coffee, when passing from one side of the cylinder to the other, to leave the hot periphery of the cylinder and fall over the shelf formed by the air chamber, by means of which the coffee is roasted uniformly and prevented from burning. It also consists in combination with the air chamber of a stop pin or plate attached to the cylinder, and ledges or flanges upon the framework, which limit the reciprocating motion of the cylinder to a semi-revolution.

### Improved Hay Derrick.

George W. Martin and James C. Moor, Brookston, Ind.—This invention relates to certain improvements in hay derricks. It consists in two A-shaped frames, connected at the top by a wire cable, and held slightly inclined toward each other by guy ropes attached to picket pins. Upon said cable rests a movable frame containing two sheaves, one running upon the cable and the other supporting the rope attached to the hay fork. This movable frame engages with a latching catch at one end of the cable to hold it stationary until an adjustable stop unlatches the devices and allows the frame to pass laterally to the desired position, the movable frame being restored to its original position by a weight suspended upon a pulley running on the guy rope.

### Improved Shutter Fastening.

John D. Jones, Omaha, Neb.—The invention consists in using a box that allows the notched locking bar or rod to pass through slots thereof, while the bolt and spring are fully protected, and yet easily operated by the thumb piece.

### Improved Lamp Burner.

Aaron C. Vaughan, Rainsburgh, Pa.—The invention consists in means whereby a stronger light may be obtained without the consumption of additional oil, the same being accomplished by a more perfect supply of oxygen and less consequent waste in the shape of partially combusted carbon.

### Improved Car Coupling.

Menasseh Pettengill, Minneapolis, Minn.—The invention is an improvement in automatic car couplings, and consists in providing the sliding head of the buffer with a series of parallel, horizontal, semi-circular grooves or cavities to receive the curved end of the link, the construction being such that the latter may be held or supported horizontally at various angles, or readily changed from one groove to another without withdrawing the coupling pin.

### Improved Lamp Stove.

Edward A. Rippingille, Holborn, Middlesex county, Eng.—The object of this invention is to provide a combined stove and lamp in which the heating properties of a lamp are utilized to form a small cooking stove, and the lamp still allowed to perform its function of lighting the room. It consists in a flat lamp of peculiar construction which slides into the stove frame, which latter is provided with reflectors and a glass door.

### Improved Car Coupling.

Benjamin Slusser, Sidney, Ohio.—The invention consists in novel means whereby cars may be conveniently coupled, securely held together, and easily uncoupled, while a car that switches off the track will at once become disengaged, and those whose drawbars are of unequal hight are coupled with the same facility. It is without a coupling pin or other device susceptible of being lost or readily stolen.

### Improved Croquet Mallet.

Thomas H. Logan, Fort Leavenworth, Kan.—The invention consists in making the mallet stock in two sections, recessed to receive a handle, and held by clamp screws.

### Improved Smoke Stack.

Darerick Allard, St. Albans, Vt.—This invention relates to certain improvements in smoke stacks for locomotives, etc, and it consists in an adjustable discharge pipe for the cinders and sparks contained inside the smoke stack, and terminating above in a funnel-shaped mouth, in combination and concentric with an inverted conical plate provided with spiral grooves, an annular cap for directing the current down the interior of said plate, and an inverted conical cage of gauze wire; whereby the draft of the smoke stack is regulated and the sparks and cinders eliminated and carried off.

### Improved Funnel for Barrels.

August Pforr, Baltimore, Md.—The invention relates to funnels through which liquids are run into barrels, casks, and other packages, and consists in a novel indicator by which it will always be promptly shown when the package is full, and by which all waste is effectually prevented.

### Improved Box for Car Axles.

John M. Brosius, Richmond, Va.—The invention relates to axle boxes generally, but particularly to the middle boxes of trucks adapted to changeable gages, and consists in the several features of improvement whereby the axle box is rendered more easily removable, the lubricant more readily injected upon the ends of the journals, and each axle to certainly follow the other in turning off upon switches.

### Improved Design for Graves.

Isaac G. Lunday and C. G. Anglin, Hickory Flat, Ala.—The invention consists in placing over the grave successive slabs growing successively smaller, until the highest is reached, when a monument, shaft, or column surmounts them all.

### Improved Railroad Car Truck.

John M. Brosius, Richmond, Va.—The invention consists in certain novel features of invention by which car trucks may be adapted to use on railroads of different gages, spacing the wheels automatically to suit each change of gage, and thus rendering entirely unnecessary the breaking of bulk in the freight, or the transfer of passengers from one road to another.

### Improved Car Coupling.

George W. Call, Nashua, N. H.—On the approach of cars, link-supporting lever frames are first brought in contact, and are gradually swung below their respective drawheads, while the link enters at the same time into the cavity of the drawhead to be coupled. The concussion of the drawheads carries both in backward direction, and releases thereby latch levers from their seats, dropping thereby pin guide frame and pin, and coupling the cars.

### Improved Cotton Press.

William T. Crenshaw and Robert J. Carothers, Burton, Tex.—The invention relates to a perforated hopper into which the cotton is received from the gin, and from which it is discharged by feed rollers into the press; also, to locking the revolving press box to a fixed base, and thereby relieving its pivot bearings of the strain due to the action of the screw which operates the follower.

### Improved Car Coupling.

Henry Dutcher, Port Jervis, N. Y.—As the cars are run together and heads formed upon the coupling bars catch upon each other, the downwardly projecting parts of the upper head straddle the body of the lower head, which prevents the coupling from being uncoupled by the lateral movement of the cars.

### Improved Toy Bubble Pipe.

F. Wright Pease, Metuchen, N. J.—This invention consists in the combination, with a flexible stem and suitable mouth piece, of a bowl provided upon the edges of its mouth with ledges, projections, or grooves, which, by retaining a portion of the soap solution, enable the operator to blow a much larger bubble.

### Improved Eaves Trough Hanger.

Edward Kirk, Jr., Sheridan, Ill.—This consists of a lateral brace, with forked ends or prongs, which are driven in horizontal direction through the gutter near its inner edge into the frame of the roof. The prongs are bolted to a metallic band, arranged to embrace with one end the outer rim of the same, while the upwardly inclined rear part is attached to the shingles and roof frame.

### Improved Range.

Edwin O. Brinckerhoff, New York city.—The space between the bottoms of the inner and outer cases is occupied by a drawer, the interior of which is divided into two equal parts by a vertical division plate. The side parts of the drawer are divided into flues by vertical division plates, extending from the ends of said drawer nearly to the central division plate. The rear division plates are placed a little in front of the rear wall of the inner case. The spaces between the inner ends of the rear division plates and the central division plate are provided with dampers, which are raised and lowered, to close and open said spaces. The flue for conducting the products of combustion from the range to the chimney projects in the rear of the middle part of the back of the outer case, and fits into a recess formed to receive it in the brick work inclosing the rear part of the range. The flue is divided into two equal parts by a vertical division plate, openings into the flue being formed through the lower middle part of the back wall of the outer case, and in line with the spaces at the sides of the central division plate of the drawer.

### Improved Horse Power.

Reuben Stiles, East Troy, Pa.—This invention is an improved horse power for operating a churn, and for other purposes, which is so constructed that its rear end may be conveniently raised and lowered to give the endless chain any required inclination, and the endless chain may be conveniently tightened or slackened, as may be desired. To the front parts of the frame of the machine, at a suitable distance from their lower ends, are attached bearings in which a shaft revolves. To one end of the shaft is attached a crank wheel, from which motion is given to the machinery to be driven, and which is made heavy, to adapt it to serve as a fly wheel. To the middle part of the shaft, at a suitable distance apart, are attached two wheels, the rims of which are notched to receive rods, which are connected to each other by straps to form an endless chain, and to which are attached the cross bars or planks, upon which the horse or other animal walks, to give motion to the machine. The inventor is willing to negotiate for the sale of territory or to manufacture on royalty, and can furnish patterns and directions for the use of intending manufacturers.

### Improved Harrow.

Peter S. Carhart, Collamer, N. Y.—The bars of which the beams are composed are clamped together by bolts with teeth, and bars or metal plates between them, either one or both being notched to receive and hold the teeth. The notches in the clamping plates are contrived with extensions inclined front and back, above in one direction and below in the other, and the teeth are pivoted, so that when the harrow is drawn in one direction the teeth will be vertical, and when drawn in another direction they will be inclined. The tooth shifts according to the way the harrow is drawn, but at the same time is held tight.

### Improved Cheese Knife.

George E. S. Phillips and William A. Young, Berryville, Va.—The knife is made of such a length as to reach from the center to the edge of the cheese, and the ends are attached to a semicircular bar so that it has a slight longitudinal rock. The outer end of the knife and bar are held down by a spring, the free end of which rests upon the outer end of the curved bar, so that the knife may operate with a sliding cut, cutting the cloth first. A suitable construction enables the arm, to which the knife and bar is secured, and its attachments to be swung out of the way to enable a cover to be placed over the cheese.

### Improved Pump.

George Harrison Laub, West Lebanon, Ind.—The invention relates to the means whereby the lower valve is detachably connected to the side of the inclosing cylinders, and the seat for said valve is adapted for ready removal when the sand collected beneath and around it requires to be washed out of the cylinder.

### Improved Bouquet Holder.

Jurias G. Dreher, Pine Grove, Pa.—This invention is an improved bouquet holder, simple in construction and convenient in use, which will keep the stems of the flowers moist, and thus keep the flowers fresh for a long time, and which may be carried about without spilling the water. It consists in the combination of a slotted tube, conical flange or cup, gum elastic case, and sponge with each other and with a rod and conical base, a rubber plate, a flanged tube, and a spring bolt, which together form a well arranged device for the stated purpose, adapted for use as a vase as well as for carrying in the button hole, etc.

### Improved Beer Regulator.

John Obrecht, Tell City, Ind.—For the purpose of providing a simple apparatus for regulating and preserving beer, a larger water receptacle is provided, with an interior smaller gas reservoir. The same is connected, by intermediate branch pipes with a check valve and stopcock, to the gas-distributing pipes, with stopcocks and water indicators, and then to the kegs containing the beer for the action of the gas thereon. The water tub is connected by a pump with the faucets of the empty kegs, for pumping water therein, and so as to force, by the distributing and reservoir connecting pipes, the liberated gas back to the reservoir for being applied to the next keg to be tapped.

### Improved Process of Coloring Photographs.

Jeremiah Gurney, New York city.—The photographs are retouched and colored on the front side in the usual manner, and then rendered transparent by the application of a suitable mixture of white wax and kerosene. The colors are thus already fastened to some extent to the front side of the picture. A thin coat of glycerin is then applied to the front side of the picture, for fixing the colors and protecting them completely against the action of the gelatin, into which the picture is immersed, and then, face downward, placed on the collodionized plate glass. The gelatin or binding substance forms the connection of the photograph and the collodionized surface. The excess of gelatin is then gently pressed out and the whole dried and hardened, being ready to receive the finishing coloring on the back of the picture. As the picture is transparent, it may be worked up with equal facility as on the front side, without the risk of losing the likeness, while the colors appear with an exquisite softness and delicate finish. One or more thicknesses of cardboard soaked in warm gelatin are next placed on the back of the picture and the whole dried again, to be then cut around the edges for taking it, with the enameled surface, off the glass plate, the enameled surface adhering firmly to the photograph and protecting the same.

### Improved Car Propeller.

Casper Devilbiss, Shellsburg, Iowa.—A series of posts is set in the ground on each side of the railroad, in order to support wheels having a high flange on the outside. These wheels may have each a separate shaft, but it is preferred to hang them on the ends of shafts which span the road. The bars of the car frame are made to run between the flanges of wheels and on their peripheries. A guide and friction bar is elevated over the middle of track, and friction rolls are provided, between which the bar is passed. The upper roll is attached to a sliding gate and made adjustable, so as to increase or diminish the friction, according to the load. The lower roll is connected with and worked by the engine, which is arranged on the car in any convenient position. By turning the crank the rolls are turned so as to then bite upon the bar, thereby drawing the car over the wheels.

### Improved Sawing Machine.

George W. Bell, Orange, Tex.—In this device sleeve boxes for the shaft which drives the saw are employed in consequence of the great weight of the saw and swing frame, to relieve the shaft, by being permanently fixed in the frame, so as to support the weight. The push bar, for feeding the saw to the log, is jointed to the swing frame at one end, and works between friction feed rollers, one of which is arranged in fixed bearings, and the other in sliding bearings, which are connected with a lever. The latter is forced down on the feed bar to set it in motion by the hand, and raised to throw it off to stop the bar by a spring. A weighted cord turns an eccentric pulley, which is so connected with the swing frame by a cord that, when the feed rollers are thrown out, the weight will, by turning the pulley and winding a rope upon it, swing the saw back.

### Improved Machine for Melting Snow.

Charles G. Waterbury, New York city.—The essential feature of this invention consists of a series of burners for hydrocarbon oils, arranged on a portable machine, in combination with a reservoir or a retort and suitable pipe connections for supplying the oils or vapors to the burners. The arrangement is such that when vapors are burned they will be discharged into the burners with the requisite force by means of pressure in the retort, to drive the flame down on the snow and ice to be melted with great force. The invention also consists of the combination, with the above, of a steam boiler and pipes, for discharging steam jets into the burners, or below them, to combine with the vapors or oils, both for impelling the flame and for increasing the heat. Another feature of the invention consists of runner plates attached to the sides of the machine for closing in the space under the machine to the ground, for confining the heat, the said plates being capable of rising and falling, as required by irregularity of the surface, and for lifting them off the ground when the machine is to be turned around. There is also a horizontal revolving brush of steel wires, closing in the under space immediately in front of the burners, to prevent the escape of heat that way, and to be used for stirring and breaking up and throwing the particles of snow into the flames behind.

### Improved Combined Baby Jumper and Swing.

Clara Jane Haney and Sarah Ann Coleman, Edwardsburg, Mich.—A bracket supports, by means of a strap, a frame made of two vertical rods and two cross bars. The vertical rods pass through a sliding cross piece, beneath which are spiral springs. The straps for holding the child are connected with the cross piece.

### Improved Almond Grater.

Julius Levy, San Francisco, Cal.—This is a roughened porous cylinder revolving within a hopper, the bottom and sides of which are also roughened, and conform with the roundness of the cylinder near its base. This insures the almonds being thoroughly grated before passing into the receptacle below.

## Notes & Queries

R. can mold rubber by the process described on p. 393, vol. 30.—F. will find a description of harness oil on p. 284, vol. 30. Black ink is described on p. 233, vol. 29; it may be made copyable by the addition of a little refined sugar.—R. H. will find full directions for modeling in clay on p. 58, vol. 24.—W. F. should consult a physician.—T. F. W. will find directions for removing ink stains on p. 43, vol. 31.

(1) E. H. asks: 1. What was the name of the first steamship that crossed the Atlantic Ocean from west to east? A. The Savannah, in 1818. 2. What was the first steamship that crossed from east to west? A. The Savannah returned in the same year.

(2) J. P. L. asks: How can I tint tracing cloth so that the tinted places will not wrinkle? A. Common tracing cloth will wrinkle at the first touch of moisture; but there is an oiled or varnished cloth that can be tinted with water color.

(3) J. A. K. asks: How can I cement amber? A. Take 4 ozs. orange shellac and 3 ozs. strongest rectified alcohol. Digest in a warm place. When of the consistence of molasses, it is ready for use.

(4) G. F. asks: If a man takes a pistol loaded with ball, and shoots straight up in the air, standing so that the bullet should happen to hit him, would it not kill him? A. We think not, as the resistance of the air would affect its velocity. We would not care to try the experiment, however.

(5) F. H. asks: Which is the hardest, 14, 16, or 18 carat gold? A. 14 carat is the hardest of the three.

How long are the days on the equator? A. The days and nights at the equator, meaning by day, the time the sun is above the horizon, are equal.

(6) E. asks: 1. Can copper be tempered? If so, to what degree, and what is the process? A. It can be hardened by hammering or rolling, but the temper cannot be drawn as in the case of steel. 2. Did the ancients know of a process by which copper could be tempered as hard as steel is now? A. The very hard ancient tools and weapons were made from an alloy of copper with other metals.

(7) N. N. asks: What action will frost have on cast iron pipe ⅝ inch in thickness, about 20 inches under the street paving, with the water all out? A part of the pipe is flanged and bolted together; the other is common socket soil pipe with leaded joints. A. It would cause the pipe to contract somewhat in length; but if provision were made for this, it would give no trouble.

1. I am about to build some sprinkling tubs of 900 gallons capacity. Can you give me an idea of the best shape to make them, to get the widest spread of water? A. It makes little difference about the shape of the tub, as the spread of water is usually obtained by the use of a sprinkling pipe of suitable form. 2. Is fresh or salt water used for sprinkling the streets in New York city? A. Fresh water. 2. Is fresh water considered unhealthy? A. We do not consider it so. There are some persons, however, who do.

(8) E. H. asks: What is the radius of the sharpest curve that a train can safely turn? Is there any difference whether the train be long or short? Is there any difference whether it be an arc of 10° or the whole circle? A. We doubt whether any one can answer these questions, as there are many curves on railroads, to-day, that a few years ago were declared to be impossible. They are not desirable features, however, and most engineers make the curves as large as circumstances will permit.

(9) F. W. asks: How can I cut a design in iron, as on a watch case? A. The designs on watch cases are usually cut by a tool, either by hand or machine.

How can I polish iron and brass? A. Use emery cloth for iron, after it has been filed or turned, and polishing brick for brass.

What power can I get out of an engine with a cylinder, 3¼ inches bore by 6 inches stroke, with 80 lbs. of steam? A. From 2¼ to 3 horse power.

(10) W. D. asks: What kind of cement is generally used between French millstone blocks when they are put together? A. A mixture of alum, the dust of the stones, and water, or molasses.

(11) M. V. O. says: A question has arisen as to how the lead of the valve of a locomotive is affected by raising or lowering the link. One party contends that the lead is greatest when the reversing lever is in full gear, either forward or back, and is least as the lever is hooked up nearer the center of the quadrant. Another party thinks that the lead is increased by hooking up. How is it? A. Both parties may be right, since the lead increases by hooking up if the forward eccentric works the top of the link, and diminishes if the contrary is the case.

(12) W. S. W. asks: How can I set the valves of a locomotive? Can it be done without taking off the steam chest covers? A. It would require a treatise to answer your question. Consult Auchincloss on "Link and Valve Motions."

(13) R. C. asks: What are the ingredients and what their proportion for enameling iron pots, sauce pans, etc.? A. A paste is made by fusing together 100 parts by weight of calcined ground flints, and 50 parts calcined borax, grinding the product, mixing it with 20 parts potter's clay, and enough water to give it the proper consistence. The pot is lined with this paste, which is allowed to dry in a warm room. Then fuse together 125 parts white glass, 25 parts borax, 20 parts soda. Pulverize the compound; and make it into a paste with 4 lbs. of soda and a sufficient quantity of hot water. Cover the lining of the pot with the paste, and heat it in a muffle until the glazing is fuzed.

(14) P. W. D. says: My friend says that the same power that will run a circular saw through a log with a feed of ¼ inch to revolution, will start the saw when standing in the middle of the log, with the same feed choking the teeth of the saw. I say that it will not. Who is right? A. Judging from the general practice of sawyers, who back the carriage when a saw stops in the cut, we should say that you were right. The amount in the difference of the two cases could only be determined by experiment.

(15) L. G. asks: What chemical preparation will purify or improve strong and rancid butter? I noticed recently an account of experiments (by Sonstadt) with iodate of calcium, which kept butter for three weeks, and rancid butter was improved by it; also that stale herring, immersed in a weak solution, came out perfectly fresh, etc. I sent for some of the iodate and received iodide of calcium. Is there any difference in the effect of the two salts? A. What you received is not the required salt, being a compound of calcium with iodine, whereas the salt employed for this purpose is a compound of calcium with iodic acid. The characteristic properties of the two are widely different.

(16) J. M. R. asks: 1. Would a shot gun barrel manufactured of decarbonized steel be apt to burst? A. We do not think it would be perfectly safe. 2. Is not decarbonized steel a fancy name for common iron? A. Probably.

(17) L. S. C. says: In a recent issue you state that a large circular saw requires more driving power than a small one, which is apparent, the number of revolutions per minute being the same with both saws: but will it require more power to drive a sixty inch saw, through a piece of timber, than a thirty inch saw, time employed being the same and size of timber the same in both cases? I claim that the larger saw will require only half the number of revolutions to give the same speed to the teeth as the smaller, and that the same power will do the same work in the two cases. A. You appear to have the correct idea. As we recollect the former question, however, it was supposed that both saws made the same number of revolutions per minute.

1. Does water expand in passing from the boiling to the freezing point? A. Yes. 2. Will a piece of ice exposed to an atmosphere of zero become as cold as the atmosphere, or as cold as any other object exposed in same atmosphere, or does it remain at same temperature as when changed from water to ice? A. Yes. 3. Does it expand in passing from 32° to zero? A. It will contract.

(18) E. E. K. asks: 1. Would a receptacle having an internal hydraulic pressure sufficient to show an external moisture cause the cast iron receptacle to break? A. Not necessarily. It would depend upon the strength of the receptacle or casting. 2. If such moisture should appear, would the internal pressure be reduced? A. We think not. 3. Would a constant pressure producing such a moisture eventually fracture a casting? A. Not necessarily.

(19) P. & W. ask: 1. How are burglar alarms applied to the doors and windows of a dwelling house? A. Strips of metal are attached to the doors and windows, and to the frames, in such a manner that the raising of a window or the opening of the door will close a circuit and ring a bell. 2. What kind of a battery is best? A. A Callaud, Smee, or Leclanché battery will furnish a cheap and constant electromotive force, and all are equally good.

(20) R. asks: How can india rubber be hardened? A. Take 30 parts sulphur, and 70 parts pure rubber cut fine, mix thoroughly, put into a mold; keep under pressure of about 12 lbs. to the inch in a heat of 315° Fah. for 2 hours.

(21) G. C. P. Jr. asks: How can I make printer's ink? A. Take balsam capivi 9 ozs., lampblack 3 ozs., indigo and Prussian blue together 1¼ ozs., Indian red ¾ oz., yellow turpentine soap (dry) 3 ozs. Grind to an impalpable smoothness.

(22) W. H. H. asks: Can you give me a recipe for a baking powder containing ammonia? A. Take tartaric acid ¼ lb., alum ¼ lb., bicarbonate of soda ¾ lb., farina 1 lb.; powder them all, dry, mix, and add 3 ozs. sesquicarbonate of ammonia in powder. Keep closely packed or in a stoppered bottle.

(23) J. J. asks: How can I solder brass? A. Mix copper and zinc in equal proportions, cover the surfaces to be joined with a paste of borax and water, put in the alloy in powder, lute together, and hold in a flame till the solder melts.

(24) C. A. R. asks: How can I soften old putty on window frames? A. Pass a red hot iron over it, near the surface of the putty.

(25) F. M. H. asks: What materials are used in making a nickel solution for plating with? A. Dissolve the nickel in nitric acid; add cyanide of potassium to precipitate the metal. Wash the precipitate, and then dissolve it by the addition of more cyanide of potassium. Another method is to precipitate the nitrate solution with carbonate of potash. This should be well washed, and then dissolved in cyanide of potassium. This method of preparing the nickel-plating solution is simple and good. The electrotyping is done by a process analogous to that of silver plating. Of course you must use an electrode of nickel.

(26) W. H. F. asks: 1. Given the resistance of a line, how shall I determine the electromotive force necessary to operate it? A. You require about one volt for each 80 ohms, or about one cell of Daniell or gravity battery for each two miles of wire. 2. Can you give me the average resistance of No. 23 copper wire, B. W. G., at 60° Fah.? A. It is 83·16 ohms. 3. What is the electromotive force of the ordinary Hill gravity battery compared with the electropoion cell? A. Calling the electropoion 100, the electromotive force of the Hill, Callaud, gravity, Minotti, Eagles, or any other modification of the Daniell battery, is 56.

(27) A. M. says: I would often make use of the electric light if the Grove and Bunsen batteries were not so troublesome. I have seen a metallic battery praised as the most powerful of constant batteries. Could I produce, with such a battery, an electric light equal to one produced by 50 Groves (the platinum being 6 by 2½ inches), and what number of cells would be required for this purpose? A. Yes. It would require 100 cells.

(28) C. C. asks: 1. In electrotyping, must the wood blocks or engravings be oiled before taking a wax impression? A. No. Brush them over with black lead. 2. How is the electro deposit removed from the wax (after it is taken out of the battery) so as to be perfectly true and level? A. Melt the wax by dipping the plates in hot water. 3. What is the metal backing composed of? A. Lead. 4. How long must it remain in the battery to receive a sufficient coat of copper for ordinary printing? A. About 24 hours. 5. What battery would be necessary for electrotyping an engraving 4 inches square? A. Two cells of a Daniell or Callaud battery.

(29) C. E. C. asks: What are the best treatises on electroplating? A. "Elements of Electro-Metallurgy," by Alfred Smee; "A Manual of Electro-Metallurgy," by James Napier; Walker's "Electrotype Manipulation;" Sturgeon's "Art of Electrotyping," and How's "Manual of Electro-Metallurgy."

(30) E. T. T. says: A friend and myself have a couple of telegraph instruments, with a large wire between them. We tried to use a ground, but we could not close the circuit. Our houses are only about 200 feet apart, and we had 4 cups of battery. I then bought enough of No. 18 copper wire for another main wire; and it worked splendidly and has never troubled us since. At what distance will a certain number of cups close a ground? At what distance will they close a double wire circuit? A. Different substances conduct electricity with more or less freedom, according to their composition. Dry earth conducts very poorly. It is the moisture in the earth which gives it most of its conductive capacity, but water itself is many million times a poorer conductor than copper; hence, in order to conduct as well as a copper wire, the volume of water must be many million times as great as the wire. If the two ends of your wire had been soldered to a water pipe which was buried for a considerable distance in wet earth, it would have worked; or if you had buried copper plates twelve feet square in wet earth at each end of your line, and attached the ends of your wire to them, it would have served your purpose. The cheapest plan for you, however, was to run another wire, and make a metallic circuit.

(31) J. N. G. asks: How many Callaud cells would be required to work three relays on a small copper wire of *half* a mile long, wire No. 17? A. Four.

(32) E. A. F. T. asks: 1. Will an engine, 1½ inches bore x 3 inches stroke, with a conical boiler 18 inches high and 8 inches across at top, and 12 inches at bottom, of ¼ inch iron, be large enough to run a 6 inch swinging lathe for ordinary work, or an 18 inch grindstone? A. Yes. 2. Could

I run such a boiler safely for two hours with one filling? A. Yes. 3. Why is it that engines for the above purpose are not more extensively used in small shops, as it hardly costs anything to run run them? A. We judge from the number of letters that we receive on the subject that they are in extensive use.

Are gunpowder engines in use? A. We do not think that there are any in the market.

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

F. D. L. says: I enclose you a specimen of deposit which is found floating upon the surface of the water and covering the flues of several boilers in this vicinity. It works over into the cylinders of the engines, stopping up the cylinder cocks, and in one instance caused the breaking of the fly wheel, by so closing the cocks that, upon the steam being let on (the water not escaping from the cylinder), the wheel was completely demolished. What is it? A. It consists of silica, silicate of alumina (the basis of clay) and carbonate of lime, along with a little vegetable matter. On heating to whiteness, the latter is burnt off, and the powder becomes quite white. The difficulty lies in the excessive fineness of the particles of the powder, which, under the microscope, look like fine specks and needles, and, when put into water, float upon the surface. They would subside if allowed to stand in a settling reservoir for a very long time, or your water might be run through one of the sponge or other filters now in use.—E. B. S.—It is a lead ore containing 85·5 per cent of lead, the remainder being sulphur, iron, and a trace of silver.—R. G.—This is similar to a great many other pieces recently sent to us, and consists of quartz and decomposed mica. It contains no lead, and is of no pecuniary value.—R. C. H.—It is a very impure coal, containing a large amount of ash. It may be used for fuel in certain cases.—A. B.—It is radiated limonite, which is a brown hydrated sesquioxide of iron. Send the specimens, but not too small ones, in which case satisfactory analysis and determination are often impossible.

Some of our correspondents who send mineral specimens in powder are so careless in doing up the packages that they come to us in a leaky condition, soiling desks and papers, and other articles upon which they are laid. All such packages are thrown into the waste basket without an examination. In sending specimens of soft or powdery substances, care should be taken to enclose the same so that the packages will not leak.

G. E. K asks: What can I mix with ordinary printer's ink to make it indelible?—P. S. H. says: I have heard that on old Christmas night, January 5, no matter how cold the weather might be, the elder bushes would sprout, and leaves put forth, where previously not a sign of any was visible. I supposed it to be mere tradition; but this year I saw it demonstrated, and saw elder leaves an inch long gathered, there being no sign of any on the previous day. The weather was exceedingly cold, and the leaves were frozen stiff. How is that accounted for?—O. B. asks: Supposing a fly to be on the rim of a locomotive wheel, of 8 feet diameter, through what space would the insect travel while the locomotive travels 50 miles?—F. C. says he wants to make linseed oil varnish, and wants to know what kind of a vessel to use to heat the oil to 600° Fah., how to secure the thermometer bar to conduct a vessel to be filled and emptied, capable of making 25 to 30 gallons at once.

## COMMUNICATIONS RECEIVED.

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

On Meteorological Observations. By J. B. W.
On a Match under the Microscope. By H. A. W
On Railroads on Ice. By C. E. T.
On Experiments with Honey. By J. H. M.
On a Cheap Galvanic Battery. By W. H. S.
On Mill Dams. By J. W.
On the American Institute Fair. By J. W. B.
On Meteorology. By L. W.
On Heating Horse Cars. By B. F. L.
On Amalgam Fillings. By D. W. C.
On Heat as a Mode of Motion. By X.
On Spiritualism. By H. W.
On the late Dr. Sarphati. By M. C.
On a Flying Machine. By D. J.
On Transportation. By I. I. S.
On the Glacial Theory. By D. B.
On a Steamer's Log. By ——.

Also enquiries and answers from the following:

C. H. B.—W. M. H.—R. G. S.—J. K. L.—J. B. R.—S. M. V.—A. J. T.

## HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who makes automatic fountains Who sells ferns, rock work, fish, etc., for aquaria, and who publishes a good book on the subject? Who sells the best churn? Who publishes a book on tanning? Who makes steam, water, and mechanical elevators? Who makes a knife sharpener and glass cutter? Who makes steel or iron ferrules for walking canes? Why do not makers of small engines (3x6 inches cylinders, and less) advertise in the SCIENTIFIC AMERICAN?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,008.—ADVERTISING DESK.—G. E. Carhart, Washington, D. C.
8,009.—COOKING RANGES.—L. W. Harwood, Troy, N. Y.
8,010.—STREET LANTERN, ETC.—R. B. Hewitt, Phila., Pa.
8,011.—INKSTAND BASE.—J. H. Johnson, Newark, N. J.
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8,018.—SODA WATER APPARATUS.—F. H. Shephard *et al.* Lowell, Mass.

## TRADE MARKS REGISTERED.

2,171.—SHIRTS.—Markewitz & Price, New York city.
2,172.—PERFUME.—Miller Bro's, New York city.
2,173.—CARPET WARP.—H. E. Vogell, New York city.
2,174 & 2,175.—COFFEES.—Barkley *et al.*, Baltimore, Md.
2,176 to 2,178.—PUMPS.—W. & B. Douglas, Middletown, Ct
2,179.—PERFUMERY, ETC.—Eddy Bro's, New York city.
2,180.—PAINTS.—Hainemann & Steiner, New York city.
2,181.—FIRE KINDLERS, ETC.—J. D. Husbands, Jr., St Louis, Mo.
2,182.—SAUCE.—Lewis & Co., Chicago, Ill.
2,183.—CIGARS.—J. F. Miles, Boston, Mass.
2,184.—PILE CURE.—Montgomery & Co., Philadelphia, Pa.

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## CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, JANUARY 21 to JANUARY 25, 1874.

4,282.—F. H. Wilson, Chicago, Ill., U. S. Improvements on cans for oils, called "Wilson's Oil Can." Jan. 21, 1875.
4,283.—G. W. Bowman, Morrow, Warren county, Ohio, U. S. Improvements in dryers, called "Bowman's Champion Dryer." Jan. 21, 1875.
4,284.—J. B. White, Fort Wayne, Allen county, Ind. U. S. Improvements on omnibuses, called "White's Omnibus." Jan. 21, 1875.
4,285.—C. R. Taylor, Ionia, Ionia county, Ind., U. S. Improvements on apparatus for steaming and treating lumber, called "Taylor's Lumber Steamer." Jan. 21, 1875.
4,286.—E. B. Decker, New York city, N. Y., U. S. Improvements in flexible shanks for boots and shoes, called "Decker's Flexible Shanks for Boots and Shoes." Jan. 21, 1875.
4,287.—W. R. King, Chicago, Cook county, Ill., U. S. Improvements on baling plastering hair, called "King's Improvement in Baling Plastering Hair." Jan. 21, 1875.
4,288.—Wm. Ascough, Buffalo, Erie county, N. Y., U. S. Improvements on a combined bevel square, try square, protector, level, slope level, and compasses, called "Ascough's Combination Square." Jan. 21, 1875.
4,289.—Wm. Inglis, Bolton, Lancaster county, England. Improvement on floating vessels for storing grain, called "Improved Grain Storage Boat." Jan. 21, 1875.
4,290.—H. Ryder, Somerville, Mass., U. S. Improvements on grates for furnaces, called "The Ryder Grate." Jan. 21, 1875.
4,291.—F. Rhind, Brooklyn, N. Y., U. S. Improvements in lamps, called "Rhind's Safety Lamp." Jan. 21, 1875.
4,292.—R. C. Brooks and A. J. Van Winkle, San Francisco, San Francisco county, Cal., U. S. Improvements on a process and apparatus from distilling alcohol extract from wort so that said alcoholic extract shall be free from fusel oil, called "Brooks' Improved Distilling Apparatus." Jan. 22, 1875.
4,293.—J. K. Feick, Berlin, Waterloo county, Ont. Improvements on lasts for making seamless boots, called "Feick's Improved Last for Making Seamless Boots, etc." Jan. 23, 1875.
4,294.—W. S. Wisner, Brantford, Brant county, Ont., assignee of C. P. Brown, Manchester, Ontario county, N. Y., U. S. Improvements on seed sowing maching, called "Valve for Grain Drill Double Distributer." Jan. 23, 1875
4,295.—C. C. Moore, Elizabeth, Union county, N. J., U. S. Improvements in pencil holders for slate frames, called "Moore's Pencil Holder for Slate Frames." Jan. 23, 1875.
4,296.—J. O. Peacock, Finsbury Park Row, Middlesex county, Eng. Improved form of stove and apparatus connected therewith, called "Peacock's Diathermic Gas and Fuel stove." Jan. 23, 1875.
4,297.—D. D. Cattanach, Providence, Providence county, R. I., U. S. Improvements on treating oil for paints, called "Cattanach's Oil Process." Jan. 23, 1875.
4,298.—M. Hutchinson, Norfolk, St. Lawrence, N. Y. U. S. Improvements on heating drums, called "M. Hutchinson's Heating Drum." Jan. 23, 1875.
4,299.—T. A. Edison, Newark, Essex county, N. J., U. S. Improvements in electric telegraphs, called "Edison's Domestic Telegraph." Jan. 23, 1875.
4,300.—T. and J. C. Peacock, Finsbury Park Row, Middlesex county, Eng. Improvements in gas cooking apparatus, called "Peacock's Thermostatic Gas Roaster." Jan. 23, 1875.
4,301.—Wm. A. Lamb, Orleans, Ontario county, N. Y., U. S. Improvements on wagon seats, called "Lamb's Seat Fastener." Jan. 23, 1875.
4,302.—M. Goldman, Syracuse, N. Y., U. S. Improvement on a pocket candlestick, called "Goldman's Attachable Candlestick." Jan. 23, 1875.
4,303.—J. W. Morgenmeier, Sheboygan, Sheboygan county, Wis., U. S. Improvements in varnishes for coating photographs, negatives, and glasses, called "Morgenmeier's Ground Surface Negative Retouching Varnish." Jan. 23, 1875.
4,304.—G. Ramsdell, Detroit, Wayne county, Mich. Improvement in the process of making wood gas, called "Ramsdell's Wood Gas Generator." Jan. 23, 1875.
4,305.—J. J. Higgins, New York city, N. Y., U. S. 1st extension of No. 4,151, on "Higgins' Automatic Umbrella Runner." Jan. 23, 1875.
4,306.—J. J. Higgins, New York city, N. Y., U. S. 2d extension of No. 4,151, on "Higgins' Automatic Umbrella Runner." Jan. 23, 1875.

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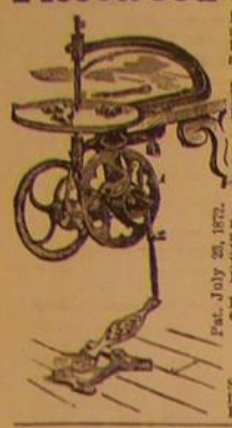

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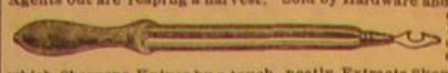

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