

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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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 watch-makers' 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 title 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 artificial 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 sq. foot.	In pounds per sq. 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 ¼ 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 height 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 height 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 practiced 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 inconceivable. 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 pa-

trons 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. Childs 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. Childs, 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. Childs 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. Childs 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. 82½ North 10th street, as the materialized spirit of Katie King.

Henry T. Childs, 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.