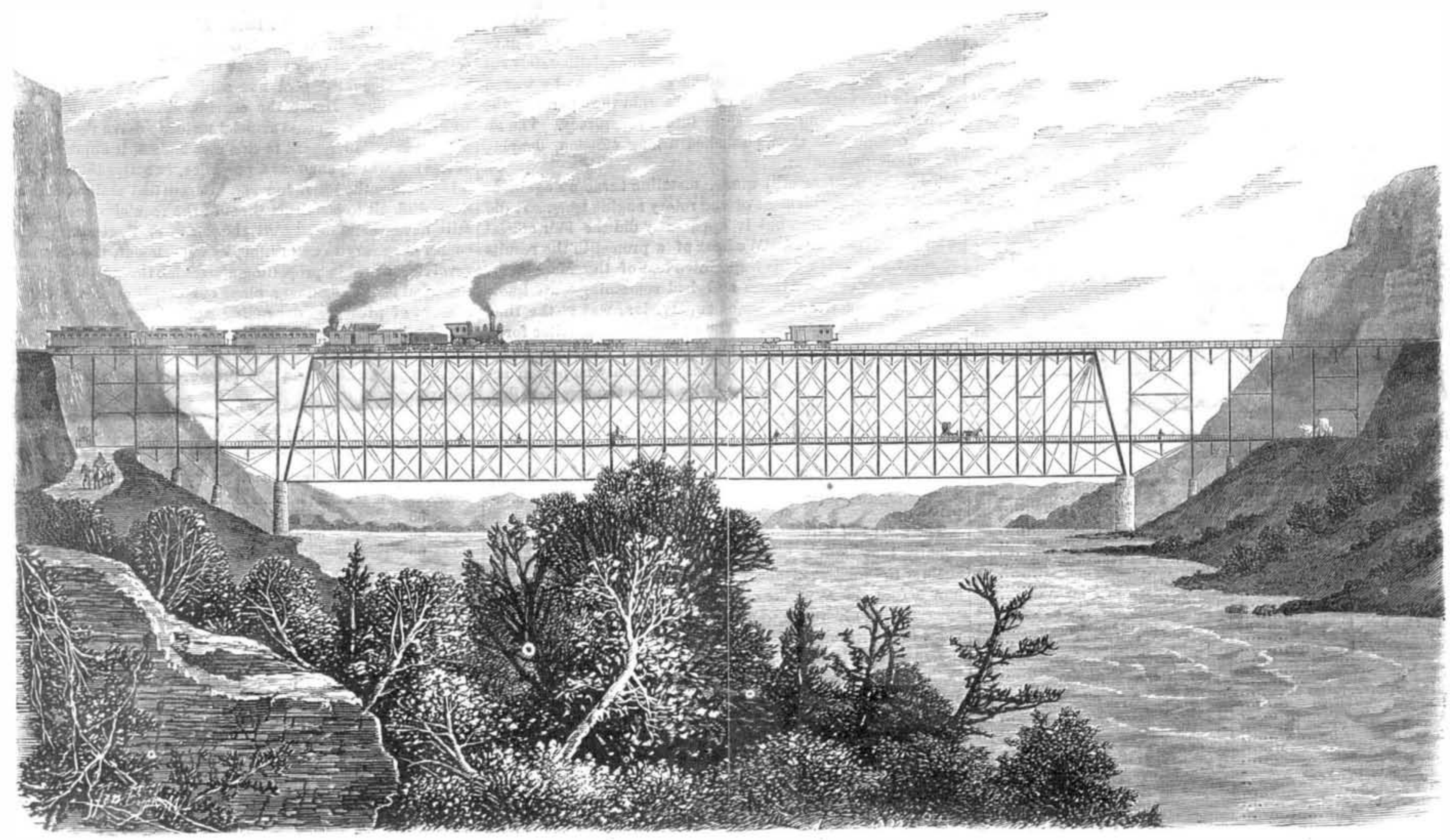
SCIENTIFIC AMERICAN
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.
Vol. XXXII.—No. 8.
[NEW SERIES.]
NEW YORK, FEBRUARY 20, 1875.
[$3.20 per Annum, Postage prepaid.

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.*

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....................................$3 20
One copy, six months, postage included..................................... 1 60

Club Rates:

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VOLUME XXXII., No 8. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, FEBRUARY 20, 1875.

Contents.

(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 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 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 ⅕ 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