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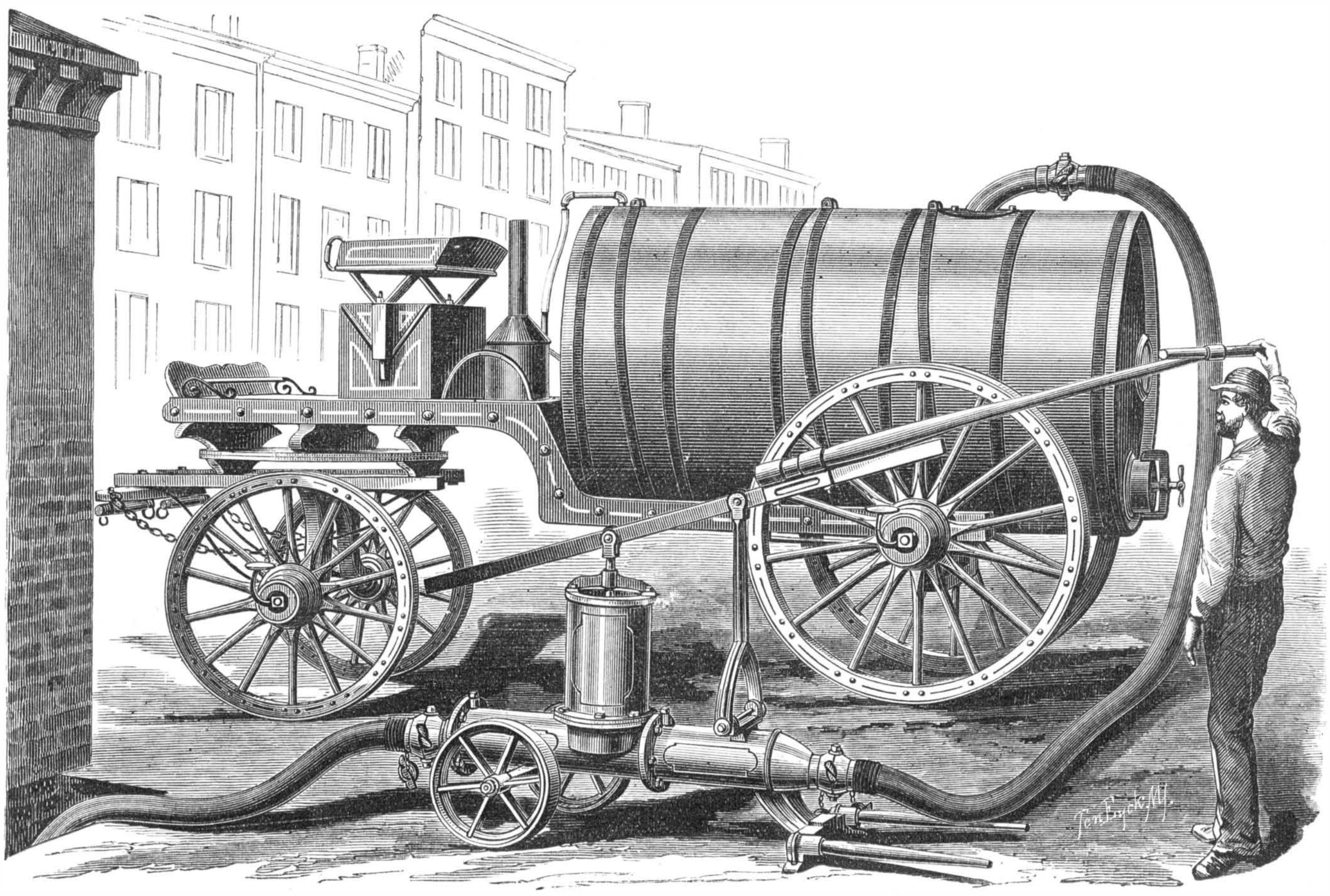
IMPROVED DEODORIZING EXCAVATING APPARATUS.

We devote our initial page this week to engravings of an improved apparatus for removing any kind of thick, semi-liquid material, or fluids heavily laden with solid obstructions, from vaults or excavations. The widest application such a machine necessarily finds is in the cleaning of cesspools, and similar receptacles for refuse, for which work it is remarkably well adapted in construction. The device, as represented in Fig. 1, consists of a pump which raises the material and forces it into the tank. The air at the same time driven into the latter, escapes through a deodorizer shown at the front part of the truck, and is there deprived of all noxious emanations by percolation through a suitable chemical solution. In this last respect the apparatus differs from others, in which the deodorization is accomplished by forcing the air through burning charcoal; and among the advantages thus claimed to be realized, besides the more complete removal of foul smells, is the obviation of sparks from the furnace, which a strong blast might throw upon and thus endanger adjacent buildings.



JOHNSON AND NETTLETON'S DEODORIZING EXCAVATOR.

The essential features of the system lie in the construction of the pump. This consists first of a barrel, mounted on trucks and provided with handles for convenience in transportation, and second, of a simple pump cylinder placed at right angles thereto and containing a piston operated by the lever shown in the hands of the figure. To each end of the barrel is connected a section of hose, by means of a simple and effective form of coupling. The pipe which leads from the vault is secured to the more elevated end of the barrel when the latter is placed for working, so that the natural tendency of the material is to flow directly into the pump. The other hose of course leads from the pump to the vat in which the refuse is carted away.

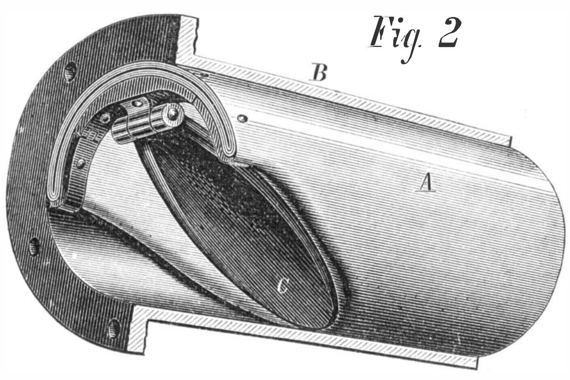
In all apparatus designed for pumping out the contents of cesspools, etc., the main difficulty encountered is to construct the valves so that they will allow of the passage of solid substances as large as the pump barrel will admit, and at the same time remain tight for fluids: and this without becoming choked so as to render necessary the repeated dismemberment of the machine in order to clear them. In tanneries, where similar material is dealt with, the old boot leg valve has long been employed; but to this the objection is urged that gravel or small solids are liable to fall between the sides of the valve and the barrel, and so ultimately to prevent the opening of the valve. To obviate this trouble the novel form of valve represented in Fig. 2 has been devised, and to this it is desired especially to direct the attention of the reader. It consists of a section of strong rubber tube, A, inserted into the barrel, B, for some distance from the end. This done, the lower edge of the tube at the end is brought up against the upper and opposite edge, and the two thicknesses of rubber are fastened together and to the inner periphery of the barrel. A metal strengthening plate is added to the valve, and to this is hinged the spoon-shaped piece, C.

From this construction it will be seen that the action of the pump must draw the material under the tube and between it and the barrel, and further that any solid capable of being pushed between these surfaces will easily pass through. The return stroke of the pump, forcing back on the valve, acts on the inside of the tube, B, pressing the same tightly against the entire periphery of the barrel. The object of the metal piece, C, is to receive the compact of hard substances and thus shield the rubber tube. The inventors inform us that, no matter how large the object which, at the end of the up stroke of the pump, may remain caught between the outside of the tube and the inside of the barrel, the rubber on the down stroke will be forced around the obstruction, and sufficient surface will pack against the barrel to render the valve perfectly tight.

One of these valves is placed at the inlet orifice and the other at the outlet, each opening in the same direction, so that the up stroke of the pump which opens the inlet closes the outlet, and *vice versa*. No material passes through the piston, and only liquid matter comes in contact with that portion; sand, gravel, stones, etc., being heavier, fall to the bottom, thus avoiding all grinding of the cylinder, while from their own gravity they move forward to the mouth of the second or outlet valve.

The inventors have exhibited to us huge stones and obstructions which it would appear must prove a stoppage to any pump, but which, they affirm, were easily drawn through.

Fig. 2



The apparatus is now on exhibition at the American Institute Fair in this city, where it may be inspected. Patented by A. W. Johnson and H. A. Nettleton, June 15, 1875. For further information address the manufacturers, Messrs. Mathewman & Johnson, New Haven, Conn.

Joints in Carpentry.

Professor Rankine sums up the principles, which should be adhered to in designing joints and fastenings in carpentry, concisely as follows: 1. To cut the joints and arrange the fastenings so as to weaken the pieces of timber they connect as little as possible. 2. To place each abutting surface in joint as nearly as possible perpendicularly to the pressure which it has to transmit. 3. To proportion the area of each surface to the pressure which it has to bear, so that the timber may be safe against injury under the heaviest load which occurs in practice; and to form and fit every pair of such surfaces accurately, in order to distribute the stress uniformly. 4. To proportion the fastenings so that they may be of equal strength with the pieces which they connect. 5. To place the fastenings in each piece of timber so that there shall be sufficient resistance to the giving way of the joint by the fastenings shearing or crushing their way through the timber.

The Sinking of the Vanguard.

One of the finest vessels in the British navy, the Vanguard, was recently sunk by her consort, the Iron Duke, through an accidental collision during a fog. The Vanguard, it seems, was leading, and, suddenly sighting a large merchantman ahead, in accordance with the usual rules of the road ported her helm. In so doing she presented her broadside to the Iron Duke, which, though rendered invisible by the fog, was closely following. Before the Vanguard could get out of the way, the Iron Duke crashed into her. Both vessels were heavily armored, and both especially built for ramming. The result was that the Iron Duke's prow cut into her consort's broadside as if it were so much paper. The strict discipline of the man-of-war averted what probably would have been, in a merchant passenger vessel, a fearful loss of life, as, in the very short time which intervened between the shock and the sinking of the ship, the entire crew of 450 men was safely removed in the boats.

The vessel cost, it is said, $2,500,000, and this loss is still further increased by all the personal property of the crew sinking with the ship. The casualty furnishes, however, an expensive but nevertheless valuable experiment as to the powers of the ram. The Vanguard is the first modern ironclad upon which the capabilities of this terrible weapon have been tested. Even the very heavy armor proved no protection to the blow delivered at the moderate speed of five knots per hour. The effect of impact, had the ironclad been driven at double or treble that speed, as she might be, can be imagined.

The Vanguard was well provided with compartments, but these, though airtight, and hence buoyant when sealed, were, at the time of the accident, not all closed. To those that were shut, the fact of the ship's remaining above water as long as she did (one hour) is due.

Dr. Leverett Bradley.

Dr. Leverett Bradley died recently in Jersey City, N. J., in the 77th year of his age.

For a number of years past Dr. Bradley has been well known as an electrician of considerable ability; but he is best known from the invention, which he patented in 1865, for winding helices with uncovered wire. In 1859 he secured a patent for an automatic telegraph apparatus, with which, on a short circuit, he succeeded in recording about 15,000 words per hour, but he was unable to practically work the apparatus on a telegraphic line of ordinary length.

In 1873, he obtained a patent for an apparatus for electric measurement, being a combination of a tangent galvanometer and rheostat, which proved very successful, and is now being much used in colleges and other institutions of learning as a means of instruction and experiment.

Professor Samuel D. Tillman, LL.D.

The death of Professor Tillman, which occurred on the 4th of September last, will be deplored not only by the members of the American Institute, with which society he has been identified for many years, but by scientific men throughout the country. Few men have attained so wide a knowledge of every branch of mechanical, scientific, and general learning; and few have worked more earnestly in behalf of the mechanic and the inventor, and toward the furtherance of scientific progress. Professor Tillman was a native of Utica, New York, and was born in 1808; he graduated at Union College, and subsequently studied law. About twenty years ago, he came to New York and devoted himself to scientific and literary pursuits. Becoming a member of the American Institute, he was elected corresponding secretary and also chairman of the Polytechnic Club, which positions he held at the time of his death. He edited the transactions of the Institute, published annually, and also wrote several essays, principally on musical and chemical subjects, which exhibited marked ability and originality of thought.

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NEW YORK, SATURDAY, OCTOBER 9, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE RELATIONSHIPS OF NATIVE AMERICANS.

There has been so much wild guesswork indulged in, with regard to the origin and racial affinites of the natives of this part of the world, that any new attempt to determine who they were or where they came from is more apt to be received with derision than with over credulity. History, tradition, and archæology have been appealed to, in turn and all together, to settle the question, but it has refused to be settled. Now the younger science of comparative philology essays the task, with, let us hope, a better promise of success.

The task is an enormous one, since all the dialects of America must first be compared with each other, then collectively with all the dialects of the old world, particularly with the little known dialects of the old world of antiquity. Unfortunately the task is too generally complicated with irrelevant questions of migration, points of original dispersion, routes, etc., questions which there can be little hope of answering save for the most recent of national origins and movements. It lies with geology—not history or philology—to tell where man originated, and when. In course of time, may be, traces of man's earliest migrations will be discovered; but for a long time, probably, the data for determining the order of his conquest of the earth must remain hidden under soil and sea. Certainly every attempt to account for the peopling of America by migrations along existing routes must be obviously absurd, since the evidences of man's presence here point to an age anterior to the geographical conditions by which those routes came into existence. Whether the new world was first settled from the old, the old from the new, or both from some continent now submerged, there is as yet no evidence for deciding. We doubt the possibility of determining absolutely the relationships even of those comparatively modern races whose names appear in the songs and traditions of the early history.

Still, comparative philology has done much toward making out the affinities of existing races in both worlds with those that preceded them at the dawn of the historical period; and the linguistic connection between the native races of America and those of the eastern hemisphere seem to be far closer than has been supposed of late.

Señor Lopez, who has given much time to the study of the languages of South America, goes so far as to assert, in his *Races Aryennes du Pérou*, that the descendants of the Incas still speak an undeveloped Aryan tongue; and that their ancestors must have come from the same stock which furnished the great inflected languages of India and Europe, our own among them. He finds their language—the Quichua still spoken over a large part of Ecuador, Peru, Bolivia, and the Argentine Republic—full of Aryan roots, though it remains at a pre-Aryan grammatical stage, the agglutinative. His inference is that, before the grammatical forms of Aryan speech had been developed, there had been a separation of the people speaking the yet undeveloped tongue, the portion represented by the ancient Peruvians failing—as all non-Aryan races have done—to carry on their linguistic changes to the inflected stage.

The author of the latest comparative study of the dialects of America, Robert Ellis, is quite willing to grant that the Aryans were akin to the ancient Peruvians (all languages pointing more or less clearly to a single original source), but not that they were next of kin. "The American nations, considered as a whole," he says (*Peruvia Scythica*, page 3,) "and the Iberian and Turanian nations on the shores of the Pacific opposite to Peru, must, I think, stand before the Aryans in this respect." In other words the Quichua language is a highly developed representative of the American family of languages, and these as a whole are more nearly related to the Iberian and Turanian languages than to the Aryan. Indeed the Americans, the Iberians, and the Turanians are regarded by him as branches of one race—Rask's "Scythians."

Evidence of the close relationship of the Quichua language with the other dialects of America is found in their numerals. Comparing them again with the numerals of Africa, Asia, and Europe, the nearest parallels are found among the Turanians (Tungusians, Samoyeds, Turks, Chinese, Siamese, Malays, etc.), and the Iberians (Circassians, Georgians, Basques, etc.) The Aryan and Semitic parallels are more remote. "The Quichua numerals," says Mr. Ellis, "plainly connect the ancient Peruvians with he nations of the old world, their nearest kindred there appearing to be the Turanians, especially those of the yellow race."

The same is learned from a comparison of the personal pronouns of these different peoples; and similar testimony is borne by the parallels existing in American and Turanian languages between the forms of words for man, woman, head, hair, eye, nose, mouth, tongue, ear, hand, foot, bone, blood, sun, moon, star, sky, day, night, tree, stone, egg, bind, fish, ant, etc., words sure to be found in every language, however primitive, and of such common use that they are little likely to be lost or changed in course of centuries. The inference drawn from a comparison of this class of words, as found in dialects of every race and every part of the world, is that the ancestors of the Iberians, the Turanians, and the Americans were more closely united to each other, by race and speech, than either of them were to the Aryans, the Semites, or the Negroes. In other words any tribe of Indians is more directly related to the Chinese than these are to the Hindoos: more nearly related to the Basques than these are to their Spanish neighbors.

Supported as it is by much evidence drawn from the stores of archæology, architecture, national customs, etc., this testimony of comparative philology seems worthy of a good deal of credit. If future researches sustain it, our fast decaying Indians might boast—if they were able to appreciate the honor—of family ties of no mean order: with Etruria of old; with the mighty Empire of Gengis Khan in Marco Polo's day: with China and the rising empire of Japan in our own times.

AMATEUR ENGINEERING.

An effect of the widening use of steam machinery is that it tends to raise up a multitude of men who—trusting rather to that familiarity which breeds contempt than to the practical knowledge of the nature and properties of steam which every trustworthy engineer must have—are ever willing, if not eager, to step into the engineer's berth. They have seen an engine run, day in and day out. Perhaps they have helped occasionally to run one. At any rate, they have worked about an engine a good deal; and as the engineer does not impress them as a man of remarkable ability, they do not see why anybody cannot do as well as he. At least, they are confident that they can, and, in case of emergency, are willing to put their knowledge (or their lack of it) to a test.

When the emergency arises, employers are too apt to give such amateur engineers a chance to try their hand. The actual engineer is called off suddenly, is sick, or otherwise kept from his post. Somebody must take his place or every body must stop work. What shall be done?

Dick is handy. Not a regular engineer, to be sure, still a bright fellow who knows an engine well enough to keep it running if all goes right; and the particular engine, the engineer says, is in such good condition that it will almost run itself. So Dick is called in and the gap is filled. Some times the engineer is away longer than was anticipated; sometimes he never comes back. Dick has done well so far; he has gained some experience in caring for the engine; and if he is willing and modest in his charges—of course, he won't expect a full fledged engineer's pay at first—his sudden promotion is likely to be a permanent one. He may turn out equal to every emergency: then, again, he may not.

It is not long since a case of the kind resulted, in our harbor, in the blowing-up of a crowded ferry boat. There was a terrible list of killed and wounded; and Dick (an illiterate negro) was returned to his proper place as deck hand or fireman. It was criminal, in the first place, to let him step out of it.

But a few weeks since an English manufactory was blown up, killing several workmen. The regular engineer was absent, sick; and the substitute, who succeeded in making such a mess with things, was one of the workmen, promoted for the occasion on the strength of his pretended ability to run an engine—ability gained from observation, apparently, since his engineering education was but the slightest, and his practice as limited as it was disastrous.

With characteristic deference to the rights of property, the coroner's jury in this case modestly suggested that, in future, the proprietors of the works would do well not to trust their boilers with any one in whose capacity they had not perfect confidence!

In a leading family paper we saw, the other day, a well written story, telling "How Tom became an Engineer." Tom was of the genus loafer: specific habitat, a country railway station. The hight of his ambition was to run an engine. A commonplace lad would have gone to work in a locomotive shop, or, more modestly, would have begun by shoveling coal as fireman. Not so Tom. He was to be engineer or nothing. So he loafed about the station, watching his opportunity. His time came with a smash-up on the road, a relief train called for, and no engineer at hand. Of course Tom volunteered, was accepted, and performed his task with the *élan* of all great geniuses. Equally of course he was thereupon made master of an engine, and speedily rose to be president of as many railways as if his name had been Tom Scott.

The moral of the story is plain, and very encouraging to all boys given to loafing about railway stations. It is significant, too, of a prevalent belief that the art of managing an engine comes, like Dogberry's reading and writing—by nature. Such a belief, however covert, cannot prevail to any extent without frequent occasion for putting it into practice. With regard to the entrusting of boilers to incompetent amateurs, we have evidence for believing it far too common. The wonder is that more explosions do not occur, and the risk of serious accident from this source is likely to continue just so long as presumption and general smartness are allowed to take the place, even temporarily, of technical skill gained through patient and studious apprenticeship.

Steam is a clever giant, an obliging servant; but, like all giants, it will not stand fooling, and is obedient only when under the hand of a master.

TEASPOONFULS.

Everybody knows that cookery book recipes are rarely exact. They say what they do not mean, and do not say what they do; and in the majority of cases, leave no small amount to be interpolated or understood by the wisdom of the user. To them is to be ascribed such standards of measure as the teacupful, and the teaspoonful or tablespoonful; and occasionally the exasperating pennyworth or handful. So long as the cookery originators keep these standards to themselves—even if they must, in their multitudinous publications, inflict them on the unfortunate housewife—we shall not complain, because we are used to it; but is it not about time that some one's voice was lifted up in condemnation of the tablespoon and teaspoon being measures in physicians' prescriptions? Will some M.D. give us his idea of a teaspoonful? "A drachm," he will probably inform us. Then why not write drachm on the prescription? Because every one has teaspoons, and few have drachm measures, perhaps? See how absurd this is. We took occasion recently to ask a large silver ware dealer how many sizes of teaspoons were made. He could not answer us definitely, but he supposed more than a dozen. He showed us four teaspoons, of which one was fully twice the size of the other. One held fully a drachm and a half, the other perhaps two thirds of a drachm. These variations were in teaspoons known as teaspoons to the trade. When we consider that every thing smaller than a tablespoon, from a moderate sized dessert to the smallest coffee or berry spoon, is known to the average housewife as a teaspoon, the chances of still further variations are greatly increased. Again, the sizes of the spoons follow closely the prevailing fashions. At present, the style is large; fifteen years ago, it went to the other extreme. Consequently, a recipe in an old book which talks about teaspoonfuls is certainly unreliable now.

A manslaughter case came before a coroner's jury in England recently, on this very point. The prescription gave directions to give a child a teaspoonful of a drug of which a small quantity would not ordinarily be deadly. A big teaspoonful, probably half as much again as was contemplated by the prescriber, was administered, and the child died. The jury took these facts into consideration, and found a verdict accordingly, which absolved the person who followed the directions of the prescription from blame.

It is a very easy thing to abolish this arbitrary standard, since a simple and very excellent substitute is found in apothecaries marking the sides of their phials in drachms, etc., as they now do their glass measures. This might easily be done by projections on the glass, made during the shaping of the bottle. Then the patient can have the exact amount given to him in a teaspoon of any kind, shape, size, or pattern.

PROPORTIONS OF BOILERS.

A common question, among the many that are sent to us, is as follows: "What are the dimensions of a boiler suitable for an engine of a given horse power?" It is impossible to answer this question generally, from the fact that the economy of engines of different design varies so greatly. Thus, while a large engine of the most approved form may produce an indicated horse power with a consumption of 15 lbs. of steam per hour, it is not uncommon to see engines which require many times this amount. When the amount of steam required, however, is known, it is possible to give approximate figures for the dimensions of a boiler that will evaporate this amount of water, and an approximate estimate can also be made of the quantity of steam which will be required for any particular style of engine. We propose, in this article, to consider these questions in detail, and give plain rules, which will doubtless be of interest to very many of our readers. The data upon which these rules have been constructed are taken from the most reliable records at our command, and give the results of average performance; so that very good boilers will do much better than is indicated by the rules, and some few will fall below this standard. This, however, is to be expected from any general rules for cases of this nature.

A. Dimensions suitable for a boiler which is required to have a given evaporation:

(*a*) To ascertain the grate surface, in square feet: Divide the number of pounds of water to be evaporated per hour, from and at 212°, by 75, for cylinder boilers; by 77, for flue boilers; by 78, for tubular boilers; by 80, for locomotive and vertical boilers.

Evaporation "from and at 212°" signifies evaporation at atmospheric pressure, from feed water having a temperature of 212°. This is assumed as a convenient standard, since in practice the pressures at which evaporation takes place and the temperatures of the feed water are quite variable. Two tables are appended, by the aid of which the necessary reductions can readily be made. The second table is taken from Professor Rankine's "Treatise on the Steam Engine."

TABLE I.—PRESSURE AND TEMPERATURE OF STEAM.

Pressure by gage.	Temperature Fahrenheit.	Pressure by gage.	Temperature Fahrenheit.
0	212°	110	344°
10	239°	120	350°
20	259°	130	356°
30	274°	140	361°
40	287°	150	366°
50	298°	160	370°
60	307°	170	375°
70	316°	180	379°
80	324°	190	384°
90	331°	200	388°
100	338°		

TABLE II.—FACTORS OF EVAPORATION.

Temperature of the steam.	Temperature of the feed water.										
	32°	50°	68°	86°	104°	122°	140°	158°	176°	194°	212°
212°........	1·19	1·17	1·15	1·13	1·11	1·10	1·08	1·06	1·04	1·02	1·00
230°........	1·20	1·18	1·16	1·14	1·12	1·10	1·08	1·06	1·04	1·02	1·01
248°........	1·20	1·18	1·16	1·14	1·13	1·11	1·09	1·07	1·05	1·03	1·01
266°........	1·21	1·19	1·17	1·15	1·13	1·11	1·09	1·07	1·06	1·04	1·02
284°........	1·21	1·20	1·18	1·16	1·14	1·12	1·10	1·08	1·06	1·04	1·02
302°........	1·22	1·20	1·18	1·16	1·14	1·12	1·11	1·09	1·07	1·05	1·03
320°........	1·22	1·21	1·19	1·17	1·15	1·13	1·11	1·09	1·07	1·05	1·03
338°........	1·23	1·21	1·19	1·17	1·15	1·14	1·12	1·10	1·08	1·06	1·04
356°........	1·23	1·22	1·20	1·18	1·16	1·14	1·12	1·10	1·08	1·06	1·04
374°........	1 24	1·22	1·20	1·18	1·17	1 15	1·13	1·11	1·09	1·07	1·05
392°........	1·24	1·23	1·21	1·19	1·17	1·15	1·13	1·11	1·09	1·07	1·06
410°........	1 25	1·23	1·22	1 20	1·18	1·16	1·14	1·12	1·10	1·08	1·06

The following examples will illustrate the use of these tables:

If a boiler evaporates $8\frac{1}{2}$ lbs. of water per lb. of coal, the steam pressure being 150 lbs., and the temperature of the fuel water 120°, what is the equivalent evaporation from and at 212°? The temperature of the steam is 366°. According to table II., the factor of evaporation is about 1·15 (u-ing the temperature of steam and feed water in the table, nearest to those given in the example). Hence the evaporation at and from 212° is 1·15 times $8\frac{1}{2}$, or about $9\frac{8}{10}$ lbs. of water per lb. of coal.

Suppose that a cylinder boiler is to be proportioned for an evaporation of 500 lbs. of water per hour, at a pressure of 75 lbs., the temperature of the feed water being 80°. The equivalent evaporation will be 1·17 times 500, or 585 lbs., and the grate surface 585 divided by 75, or $7\frac{8}{10}$ square feet.

(*b*) To ascertain the heating surface in square feet: Multiply the grate surface by 11, for cylinder boilers; by 17, for flue boilers; by 30, for tubular, locomotive, and vertical boilers.

(*c*) To ascertain the cross section of flues or tubes in square feet: Multiply the grate surface by 0·134. This is an average value for good practice, and it can be varied between the limits of 0·125 and 0·143, as may be most convenient.

(*d*) To ascertain the length of boiler: Cylinder boilers should be from 10 to 12 times the diameter; flue boilers, from 5 to 6 times the diameter; tubular boilers, and shells of locomotive and vertical boilers, from 3 to $3\frac{1}{2}$ times the diameter.

There is very great variation from these figures in practice; but the numbers given above represent the most general limits, so far as they can conveniently be classified. There are some other proportions which are of interest, such as area over bridge wall, and size of chimney. These may be given in a future article treating of the setting of boilers.

B. To ascertain the quantity of water that must be evaporated to supply an engine of a given horse power:

[In determining this quantity, the computations are made for small engines, such as were considered in the article on "The Power of Small Engines," page 33 of our current volume; and in the use of the term "horse power," the effective power that can be exerted to produce useful work, and from which the power required to overcome the friction of the engine has been deducted, is to be understood.]

Multiply the number expressing the horse power of the given engine by the amount of water required per hour for one horse power, as given in the accompanying table:

Pressure of steam in boiler by gage.	Pounds of water per effective horse power per hour.	Pressure of steam in boiler by gage.	Pounds of water per effective horse power per hour.
10	118	60	75
15	111	70	71
20	105	80	68
25	100	90	65
30	93	100	63
40	84	120	61
50	79	150	58

The following example calls for the application of all the foregoing rules:

What are the dimensions of a tubular boiler for an engine that is to develop $4\frac{1}{2}$ horse power, with a steam pressure of 100 lbs., the temperature of the feed water being 160°?

The equivalent evaporation required per horse power per hour is 1·1 times 63, or $69\frac{3}{10}$ lbs. The total equivalent evaporation is $4\frac{1}{2}$ times $69\frac{3}{10}$, or about 312 lbs. Hence the grate surface, being the quotient arising from dividing 312 by 78, is 4 square feet. The heating surface is 30 times 4, or 120 square feet.

The cross section of the tubes should be about 0·536 square feet (4 times 0·134), or it should vary between the limits of 0·5 (4 times 0·125) and 0·572 (4 times 0·143) square feet.

SUSPENDED ANIMATION AS A PRESERVING AGENT.

Among the many experiments which have been made in order to discover some way of preserving fresh meat for an indefinite period of time, none have as yet been conducted, so far as we are aware, with the object of finding out how to keep the flesh other than in a dead state, to preserve, in other words, the living animal itself. A rather anomalous suggestion, the reader may say to himself, for will not the mere presence of life answer that end? Certainly, we reply, if the animal be fed and cared for, and that is not the question. The problem we set out with is: How can we box up an ox, for example, in the narrowest space, strike him into the hold of a vessel, pile other boxes of oxen on top of him like bales of goods, nail down the hatches, and transport our bovine cargo for a hundred days' voyage, and at the expiration of that time take out our animals, kill them, and proceed to eat them up?

In all original investigations, there is but one source for answers to our questions, and that is Mother Nature. What hints, then, will that venerable dame accord, which seem to bear on our subject, and through which at some time perhaps a clue may be found leading to a solution? Three: first, the power which some animals have of rendering their natural prey utterly insensible for an indefinite period; second, the peculiar effect of cold on some of the lower animals, which reduces them to a state not death, nor yet the ordinary torpidity caused by low temperature in other organisms; third, hibernation. We propose to consider, briefly, each in turn.

There abounds in this country a peculiar species of wasp known as the "digger." The male insect does no work, but the female does the double duty of bearing offspring and providing for its wants. She begins by boring a hole in a clay bank, in order to form a nest, and then sets out on a hunt for the peculiar spider or other insect which forms her natural prey. Pouncing upon her victim, she pricks it very gently with her formidable sting. No sooner is the wound made than the assailed insect falls paralyzed; even the great tarantula succumbs as quickly as the tiniest spider. Seizing the apparently inanimate body, the digger flies off to her nest, therein deposits it, and, renewing her hunt, captures victim after victim, until a sufficient supply is secured to feed one of her larvæ to maturity. Then she deposits her egg among the bodies, seals up the nest, sets to work on a new hole and a new hunt, and thus she continues until her stock of eggs is exhausted. In course of time the larvæ, soft white maggots, appear; but before they are ready to form cocoons, several weeks must elapse, during which time their nourishment must be fresh meat. It has doubtless already been divined how beautifully Nature provides for this want, for were the captured insects shut up in the nest dead, they would speedily putrefy and be unfit for their purpose. Kept alive, however, though inert and senseless, they remain in natural condition indefinitely, or until eaten by the maggot; and this is the effect of the digger's sting. The wasp administers a hypodermic injection of something—some virus, perhaps, which paralyzes the brain and its sensory ganglia, while the spinal system remains awake. Nature suggests to us a definite question to be put to her, through the chemist and physiologist, namely: What substance, injected hypodermically into the veins of an ox or sheep will reduce the animal to the state of the digger's prey? What will produce complete anæsthesia, to last as long as we choose, without causing death or injury?

To pass to the second hint: Dr. Grusselbake, Professor of Chemistry in the University of Upsala, Sweden, has succeeded, we are told by a foreign scientific contemporary, in so treating a little serpent, by cold, that the reptile, to all appearances, becomes dead, and as stiff and as rigid as stone. By rubbing it, however, with some stimulating substance, the reptile revives and becomes as lively as when captured over ten years ago. Now, this is not the effect of hibernation, for, as will be seen below, there is an entire absence of irritability—nor yet is it identical with the torpidity produced by cold. It is a state difficult to explain, and is the same as that of several species of fish which, if completely congealed, die; but yet, when frozen stiff, possess sufficient vital action in the circulatory organs to ensure their revivification when thawed in warm water. What the condition is remains to be seen; and such an examination would lead us to the thought of whether there is not a point at which the higher animals may be brought to the same state. If there is, then can it be attained by the skillful use of chemical freezing mixtures in lieu of ice? Or, if an ox cannot thus be reduced, can he be rendered actually torpid by cold?

Lastly, we have to deal with the phenomenon of hibernation, or that peculiar lethargy into which certain animals fall, principally during winter. During this period no nutriment is required; the blood-making processes cease; respiration is very nearly or entirely suspended; the heart beats regularly, but the circulation is very slow; the blood, from the absence of respiration, is entirely venous. The muscular irritability of the left ventricle, highly increased, however, permits it to contract under the weak stimulus of the non-oxygenated blood; and it is this exaltation of a single vital property which preserves the animal life. Sensation and volition are quiescent. Respiration is, however, quickly excited by irritating the animal, and the call of hunger and the warmth of returning warm weather will cause a cessation of the lethargy. Hibernation is, however, not due to cold, since the tenrec, a nocturnal insectivorous mammal, passes three of the hottest months in the year in that condition; and the hedgehog, the dormouse, and the bat hibernate regularly every twenty-four hours. The influence of cold is due only to its tendency to produce sleep, to which state of the body hibernation is closely allied, differing only in degree. Most animals lay up a store of fat under the skin, which is slowly absorbed during the lethargy.

Whether it is open to discovery to find a way of making brutes hibernate, when that state is not peculiar to them, is a question difficult to consider in view of the little that is known regarding the trance condition in any organized being. It is a wise law of Nature which provides for the animal in seasons when its food is hard to obtain, or is absent altogether; and it is perhaps akin to that merciful interposition of insensibility which relieves the human being at instants of acute suffering.

Perhaps, some day, some one will find solutions to the questions suggested above. Perhaps we shall transport not merely living brutes, but living men. Imagine a military transport ship, with the soldiers stored in tiers with the beef and pork barrels. Perhaps Poe's sarcastic prediction, that the time will come when, sick of the turmoils and troubles of life in the nineteenth century, we will step across the street to our physician, and have our animation suspended, say for a hundred years or so, waking up in a new era, will, at some future period, be realized. There was a story once of an ancient German being found frozen in the snows of the arctic regions; and, on being thawed, his life returned. Another apocryphal yarn engendered the item in the papers that a live mastodon, preserved in the ice of Siberia since primeval days, had melted out and was roaming the wilderness of that country. Will these be realized? Edmond About's desiccated man with the broken ear, and Poe's revived mummy, are fancies absurd enough; but if we ever succeed in suspending sensation and volition at will in the animals next below us in the scale of creation, it is but a step to extend the same operation to ourselves.

SCIENTIFIC AND PRACTICAL INFORMATION.

BEES IN THE UNITED STATES.

The California *Agriculturist* says: There are two million bee hives in the United States. Every hive yields, on an average, a little over twenty-two pounds of honey. The average price at which honey is sold is twenty-five cents a pound; so that, after paying their own board, the bees present us with a revenue of $8,000,000. To reckon in another way, they make a clear gift of over a pound of pure honey to every man, woman, and child in the vast domain of the United States. Over twenty-three and one third million pounds of wax are made and given to us by these industrious workers. The keeping of bees is one of the most profitable investments that our people can make of their money. The profits arising on the sale of surplus honey average from fifty to two hundred per cent on the capital invested.

CEMENT FOR TEETH.

A recipe for a new kind of cement for plugging hollow teeth is published by Ostermeier, as follows: 7 parts burnt lime and 16 parts glacial phosphoric acid are mixed together and pressed into the cavity, which has already been carefully dried.

A PHOTOGRAPHIC DIAGNOSIS.

Dr. Ultzmann, teacher at the University of Vienna, lately read a paper before the Medical Society of Lower Austria, on the "Use of Photography in Medical Studies." He mentioned, on the authority of Dr. Vogel, that an eruption of small pox had been made evident by photography twenty-four hours before it actually came out. Although no one could as yet observe anything on the skin of the patient, the negative plate showed stains on the face which perfectly resembled the variolous exanthem, and twenty-four hours afterward the eruption became clearly evident.

THE California orange crop of last season, received at San Francisco, was the largest ever produced in the State and amounted to 5,280,000, principally grown in Los Angelos county. The annual requirements of the San Francisco market are over 10,000,000, of which 5,000,000 are imported from Tahiti and Mexico.

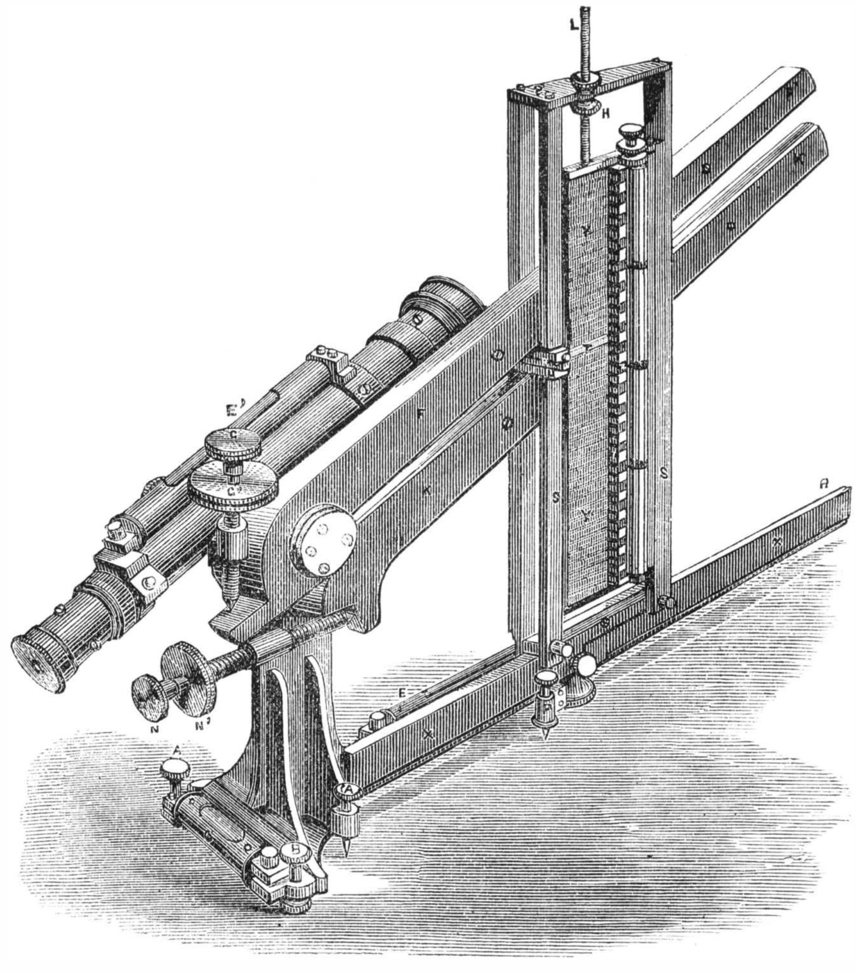
UNIVERSAL FIELD INSTRUMENT.

The instrument illustrated in our engravings, designed by Mr. R. Jahns, and manufactured by Messrs. Smith and Hänsoh, of Berlin, Germany, is intended for the solution of all problems on the field in surveying and leveling; horizontal and vertical points being fixed at one observation, and recorded on any desired scale, upon an index plate. In addition to the instrument itself, shown in Figs. 2 and 3, a plane table and signal staff are necessary. Two marks, *z* and *y*, are placed on the staff, the distance apart depending upon the scale to which the indications on the instrument are to be made.

The construction is based on the two following equations: $C : c = E : e$, and $H : h = E : e$.

The values of these letters will be understood by reference to Fig. 1. In this figure, a^1 represents the indications on the plane table of a point, *a*; *x* is the horizontal projection of a point, *y*, the position of which is the distance, H, above x^1; *c* is a length in the instrument itself; C the distance between *z* and *y* on the staff, as already mentioned. A specialty in the instrument is that the vertical portion, shown in Fig. 1 by *i b*, is, when the instrument is adjusted for the points, *z* and *y*, always parallel to that line, therefore an extension, *d*, of *i b*, corresponds to x^1 in the extension of *z h*. The hight, H, represented in the instrument by *h*, can either be read from a scale or measured off.

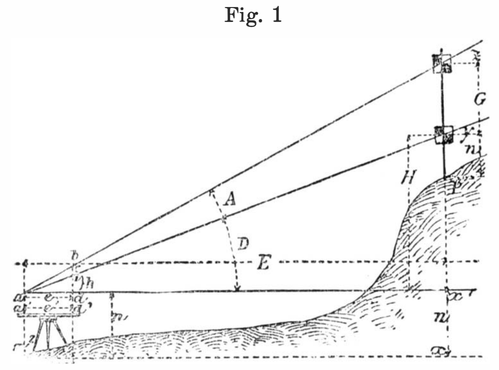
To adjust the instrument it must first be set horizontally on the plane table by means of the screws, A and B (Fig. 2), the levels, E and E^1, being used for this purpose, the small screw, A, carrying a point at the end, being run out until the point at the end enters the table, and round this the instrument can be turned. The vertical frame, S S, is then shifted to the end of the bar, X, and until the small slide, *v*, is out of contact with the inner surface of F and K. The slide, V, carries upon it, connected by a small lever, K, the constant length piece, *c*, of the instrument, and which is formed of a steel plate.



JAHN'S UNIVERSAL SURVEYING INSTRUMENT.—Fig. 2

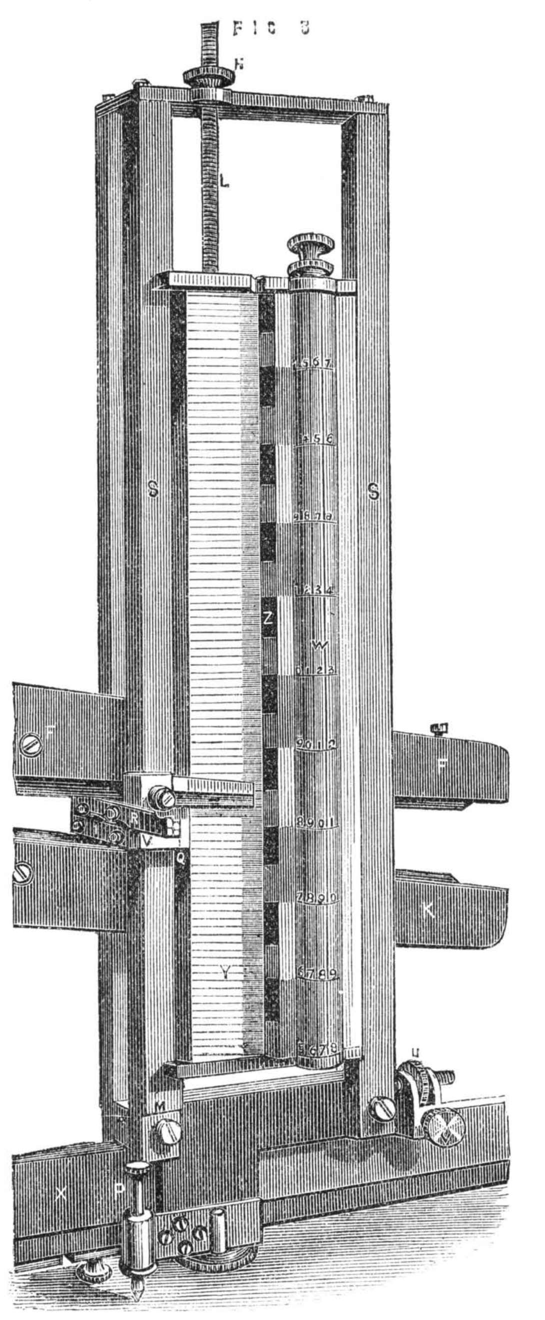
If P, Fig. 1, represents the point of which the horizontal and vertical positions are to be ascertained, the staff is placed vertically over this point. The screw, G, Fig. 2, is then turned until the guides, F and K, are quite closed, that is, until the steel edges, with which the guides are provided, are in contact. The telescope is mounted on F in such a manner that its optical axis is parallel to the steel edge. By manipulating the coarse and fine adjustment screws, N and N^1, the bars, F and K, and with them the telescope, are raised until the cross wires coincide with the point, *y*, in which case the steel straight edge forms the upper side, *a i*, of the angle, D, and the base of angle, A, Fig. 1. Before and after each observation, the horizontality of the instrument should be verified by the spirit levels. By means of the screw, G, the telescope is set to the point, *z*, and in this position the steel straight edge and the optical axis coincide with the upper side of the angle, A, Fig. 1, while the straight, K, has retained its former position. By these operations the angles, D and A, are measured

Fig. 1



The frame, S S, is then run back, until the small steel plate, *i*, and the lever, R (which is always kept against it by means of a light spring, as shown in Fig. 3), come in contact with the straight edges. Care must be taken, in order to secure accurate results, that the pieces, *i* and R, only touch the steel edges, but are not pressed against them. When in this position the frame, S S, is clamped to the guide bar, *x*, by means of the set screw, V. On reference to Fig. 3, it will be seen that the lever, R, is extended in front of the frame, S S, and a similar extension forms a part of the slide, V, and the ends of both these pieces have a line marked across them horizontally. When fixed, as before mentioned, a fine adjustment for the frame, S S, can be made by means of a micrometer, U, and by this adjustment the lines on the ends of the pieces, R and V, can be brought into coincidence. Then the upper edge of X *r* will represent the position of the point, *b*, Fig. 1, and the lower edge of *i*, that of point, *i*, in Fig. 1, corresponding to the points, *z* and *y*. The instrument may now be checked for its horizontal adjustment; and if this be found correct, the head, P, of the spring pointer may be depressed, and will make a mark on the paper upon the plane table. The hight of the point, *y*, is found by means of the vernier, *t*, on the vertical scale of S S, Fig. 3. In ascertaining the hight of a point, two cases may be considered: either the hight above a given datum line has to be ascertained, or the hight of a point above the common horizon has to be found

In the first case it is only necessary to read the hight upon the scale after each observation. To illustrate the second we will take an example. Let the hight of the fixed point be 386·75 feet; the scale on the instrument has to be adjusted as follows: The staff has to be placed over the fixed point on the ground, and the situation of this point is recorded by the instrument as described, and marked on the paper by P, the frame, S S, being fixed to the guide bar, X. The scales shown in Fig. 3 are then shifted by means of the screw, L,



until, by using the scale, Z (for fifths and tenths), the reading 6·75 appears. The revolving scale, W, is then turned until the figure 8 appears adjacent to the scale, *z*, and coinciding with the bottom line of the division on the scale corresponding with the figures 6·75. By this adjustment the instrument is set to the required scale, and hights of points recorded are read off without any calculation. The figure 3 (of the quantity 386·75) is added to the readings so long as the hights exceed 300 feet.

In ascertaining the differences in hight between two stations, it is necessary to ascertain the hight of the horizon of the instrument on the scale, Y. To do this, the steel edges of F and K are brought into contact, and these edges are adjusted horizontally by means of the spirit levels on the telescope, Fig. 2. The steel edge, F, is then lifted, and the scales on the frame, S S, are used as already explained; and when *i* is in contact with the steel edge, K, the reading on the scale gives the horizon of the axis of the instrument. In measuring differences of hight with reference to a point already given, the situation plan is attached to the plane table, and the instrument is placed on the plan in such a manner that the point, *d*, is exactly over the given point, *a*. The telescope is then set to any point of the staff, say to *y*, the frame, S S, is shifted with its point, P, over the corresponding point on the plan, the slide, V, with the piece, *i*, is set in contact with the steel edge, K, and the hight can then be read off the scale, Y Y.

Special advantages are claimed for this instrument in preparing geological surveys, as by the same observation hights and distances can be recorded; and when a sufficient number of these have been laid down, strata lines can be plotted upon the field. For making transverse sections, it also affords special facilities, as the vertical hights, y^1 y^2, are indicated on the table in horizontal distances corresponding to the real distances, thus avoiding the necessity of readings from the scale. The hights can afterwards be measured and written upon their respective lines.

If employed as an ordinary leveling instrument, no plane table is necessary, and it may be screwed upon a tripod and adjusted in the ordinary manner. The arrangement is such as has been already described, that any desired scales can be employed, the conditions regulating the employment of these scales being as follows: 1, the distance apart of the marks on the staff, and 2, the distance between the upper edge of the lever, V, and the bottom edge of the plate, *i*, when R is in such a position that the mark in front lines with the fixed mark on the slide, V. In the ratio $e : E = c : C$ the various parts may be adjusted to suit different conditions: but it is advisable, to insure accuracy, to keep C as large as possible, because the greater the angle of sight, the more certainty there is of accurate measurement. The most commonly used scales are supplied with the instrument, and the subjoined table gives the corresponding distances between the marks on the staff:

Scale.	Length of Constant c in millimeters (millimeter=0·39 inch).	Distance apart of Signal Marks on Staff in meters (meter=39·3 inches).
1: 200	15	3
1: 200	25	5
1: 500	10	5
1: 500	5	2.5
1: 1000	5	5
1: 2000	2.5	5

In changing the scales, all parts already described, which are connected with the slide, V, must be changed, and a new scale inserted in the frame, S S.

Both of the signal marks on the staff are adjustable, and are kept in the desired position by means of set screws. The degree of accuracy obtained with this instrument is stated to be quite sufficient for all practical purposes; and if the observer works with care, remarkable precision is obtained. The greatest source of error is caused by wear of the piece, *c*; but this can be corrected by making allowance for the same in the distance between the marks on the staff.

Wind Instruments.

Dr. Burg, a French physician, has published a little book in which he endeavors to controvert, by reference to his own observations and personal experience, the notion commonly entertained that the use of wind instruments is injurious to individuals characterized by pectoral weakness. He remarks "Many philanthropists, on seeing our young military musicians wield enormous wind instruments, have sorrowed over the few years the poor fellows have to live. Well, they are mistaken. All the men whose business it is to try the wind instruments made at the various factories before sending them off for sale are, without exception, free from pulmonary affections. I have known many who on entering on this calling were very delicate, and who, nevertheless, though their duty obliged them to blow for hours together, enjoyed perfect health after a certain time. I am myself an instance of this. My mother died of consumption, eight children of hers fell victims to the same disease, and only three of us survive—and we all three play wind instruments. The day is not far distant, perhaps, when physicians will have recourse to our dreaded art in order to conquer pulmonary diseases."

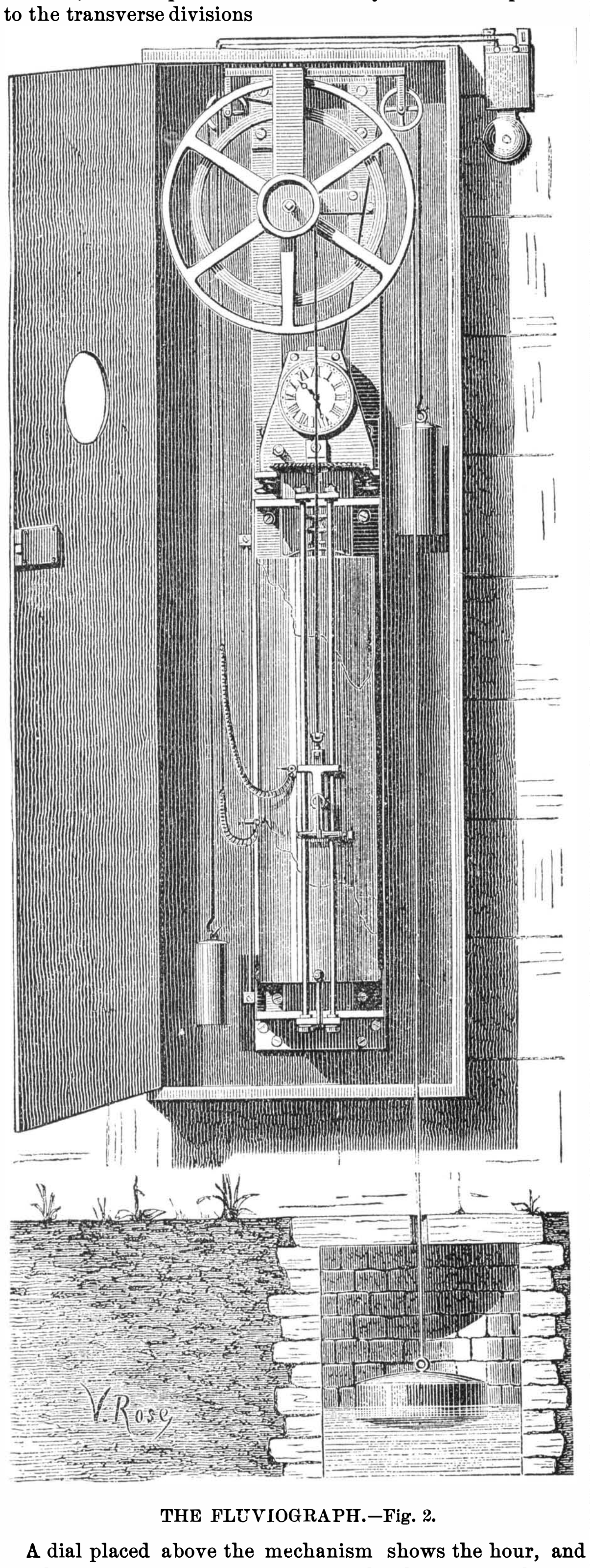
BATS are said to be inveterate enemies to mosquitoes. A gentleman in New Albany, Ind., it is said, keeps a bat in his bedroom during the season, to protect him from these pests

NEW TIDE AND RIVER GAGES.

The study of the variations of level of the ocean, and also of the rises and falls of rivers, canals, and streams, is an important adjunct of meteorological science, and is constantly followed in all countries in which regular observations of the weather and like natural phenomena have been established. We represent in the annexed engravings, for which we are indebted to *La Nature*, two new registering devices, one termed the maregraph, designed for tide measurements, the other the fluviograph, intended for similar examination of river and canal levels.

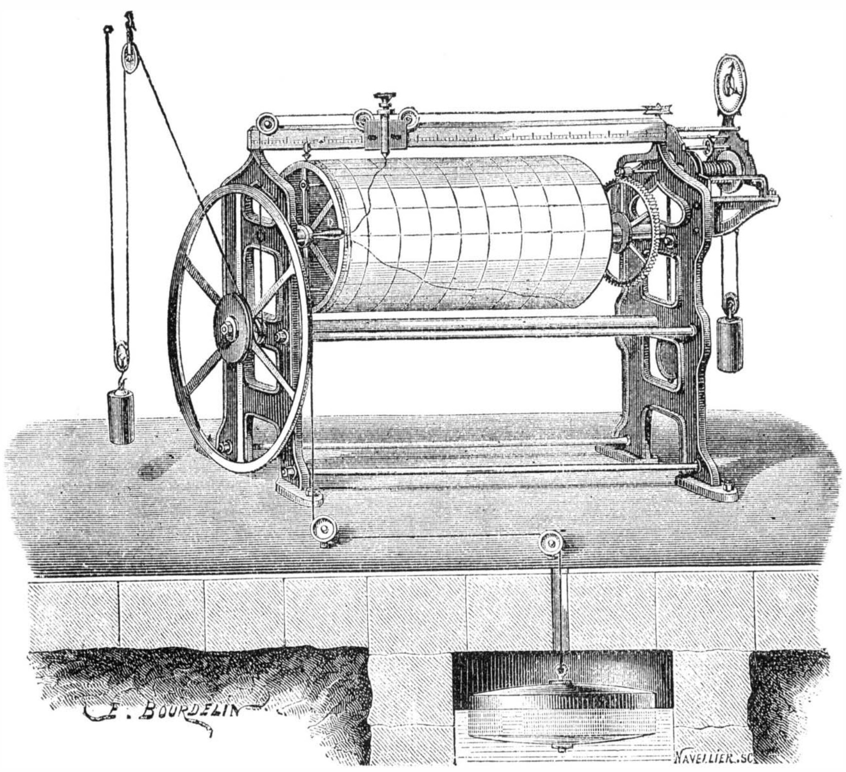
The maregraph (Fig. 1) is operated by an endless cord which connects with a float located in a suitable reservoir, into which the sea water enters. The changes of level of the water are registered on a large horizontal cylinder which is rotated by clock mechanism once in 24 hours. The cylinder is covered with a sheet of paper, changed fortnightly or monthly, and which is divided into longitudinal divisions, giving, on a reduced scale, the hights of the tides in meters and centimeters. A carriage, mounted on rollers upon a steel rule above the cylinder, carries a pencil, which is pressed against the paper by a spring. The carriage communicates by an endless cord with a small grooved wheel mounted on the shaft of the larger wheel which receives the motion of the float previously referred to.

On a third wheel, of medium diameter, is wound a cord, which is drawn by a weight in an opposite direction to that of the cord of the float. When, therefore, the float rises, the effect of the weight is to remove the shaft so as to take up the slack of the cord so that the latter is always kept taut. The pencil carriage is similarly actuated, and traces on the cylinder a mark of which the extremity is the maximum hight of the water. If the level is constant, the carriage remains motionless, and the pencil traces on the cylinder a line parallel to the transverse divisions



THE FLUVIOGRAPH.—Fig. 2.

A dial placed above the mechanism shows the hour, and at the same time serves to regulate the changing of the paper, and to indicate the moment at which the apparatus should be started on its daily motion. An electric indicator serves to give warning of any desired level being reached by the water. The indicator is movable, and is set on a special rod on the rule at the point corresponding to the hight of water to be denoted. When the carriage, on reaching that point, comes in contact with the indicator, the effect is to sound a bell.

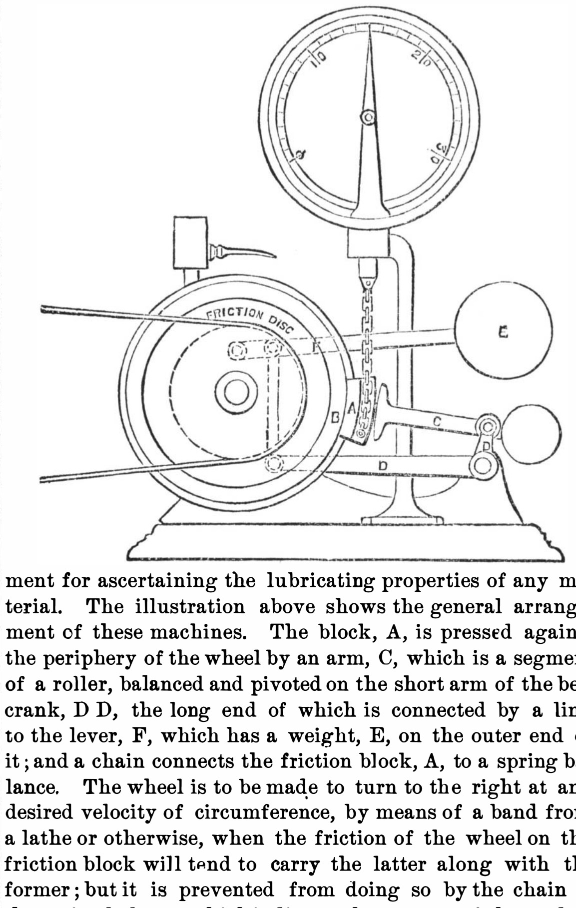


THE MAREGRAPH.—Fig. 1.

The fluviograph (Fig. 2) is more compact in form than the instrument just described, owing to the cylinder being placed horizontally. By mechanism very similar to that of the maregraph, it registers, on marked paper, variations of level of the water, which, on a canal, may be used to indicate the passages of boats through locks. It also has an electric attachment for indicating certain levels, and also may be used as a watchman's time detector, by locking the door of the case and causing the watchman to press a button which makes a mark on the paper on certain divisions corresponding to the hours shown by the clock above. This apparatus has been successfully tested. It doubtless would prove valuable as a means of showing coming floods, and giving timely warning of the same.

IMPROVED FRICTION METER.

A friction meter and oil tester has recently been invented by Mr. Napier. This is a very delicate and accurate instrument for ascertaining the lubricating properties of any material. The illustration above shows the general arrangement of these machines. The block, A, is pressed against the periphery of the wheel by an arm, C, which is a segment of a roller, balanced and pivoted on the short arm of the bell crank, D D, the long end of which is connected by a link to the lever, F, which has a weight, E, on the outer end of it; and a chain connects the friction block, A, to a spring balance. The wheel is to be made to turn to the right at any desired velocity of circumference, by means of a band from a lathe or otherwise, when the friction of the wheel on the friction block will tend to carry the latter along with the former; but it is prevented from doing so by the chain to the spring balance, which indicates the amount of the tendency of the block to move along the wheel, or, in other words, the total amount of friction on the rubbing surface.



IN the best work, slates are secured by copper nails. Iron nails dipped in boiled oil to prevent their corroding may be used. The nails should have large heads, thin and flat, so that they may not prevent the slates from lying close. Every slate should be secured with two nails; and in fastening, care should be taken not to bend or strain the slates, or they will crack and fly under sudden changes of temperature

CAPTAIN WEBB'S GREAT SWIMMING FEAT.

We have already chronicled Captain Webb's second attempt to swim across the British Channel, which was successful, being probably the greatest feat ever accomplished by a swimmer; and we publish herewith a portrait of the hero, and a chart showing the course of both attempts. The following facts are taken from *The Field:*

On the first occasion, when Webb left the water (see chart), he had been swimming 6 hours, 38 minutes, and 30 seconds, and had gone over $13\frac{1}{2}$ miles of ground, and had been carried $9\frac{3}{4}$ miles to the eastward of his course by the N. E. stream. On his successful voyage, he started $3\frac{1}{4}$ hours before high water, which gave him $1\frac{3}{4}$ hours of the S. W. stream, wherein he made $1\frac{1}{2}$ miles of westing; $5\frac{1}{8}$ hours N. E. stream caused him to make $8\frac{1}{2}$ miles easting; $7\frac{1}{2}$ hours S.W. stream took him $2\frac{1}{2}$ miles to the westward of his course, and 7 hours N.E. stream drifted him $7\frac{1}{4}$ miles to the eastward. It will thus be seen that he occupied three tides, in addition to $1\frac{3}{4}$ hours S.W. stream at starting, and about $\frac{3}{4}$ hour slack water at the finish under Calais pier, which protected him from the S.W. stream, then just beginning to ebb. His point of landing was $21\frac{1}{4}$ miles distant, and the length of ground swum over was $39\frac{1}{2}$ miles. Boyton, in his successful trip, paddled over about 29 miles of ground in 1 hour 33 minutes longer than Webb took to swim 10 miles further. As a performance of pluck and endurance, Boyton's is completely put in the shade by Webb's, though, on the score of utility, both may be placed on a par, as Boyton's suits are too expensive and require too much stowage room to come into general use, while swimmers of Webb's physique and courage will ever be *raræ aves.* Boyton took repeated rests on the occasion of his first attempt, although only 15 hours in the water, while Webb hardly rested at all, in fact never for more than a minute or two at a time, and that only while treading water to take refreshment.

CAPTAIN MATTHEW WEBB.

Captain Webb is eminently a salt water swimmer. He progressed with a slow and steady breast stroke, on an average of twenty to the minute throughout, which would make him take about twenty-six thousand strokes during the $21\frac{3}{4}$ hours. He possesses marvelous power in the legs and loins, while at the end of each stroke the soles of his feet emerge out of water. In fact, he altogether swims very high in the water, and his style would delight an Eton swimming master. The most extraordinary part of the feat is that the swimmer never complained of want of blood circulation

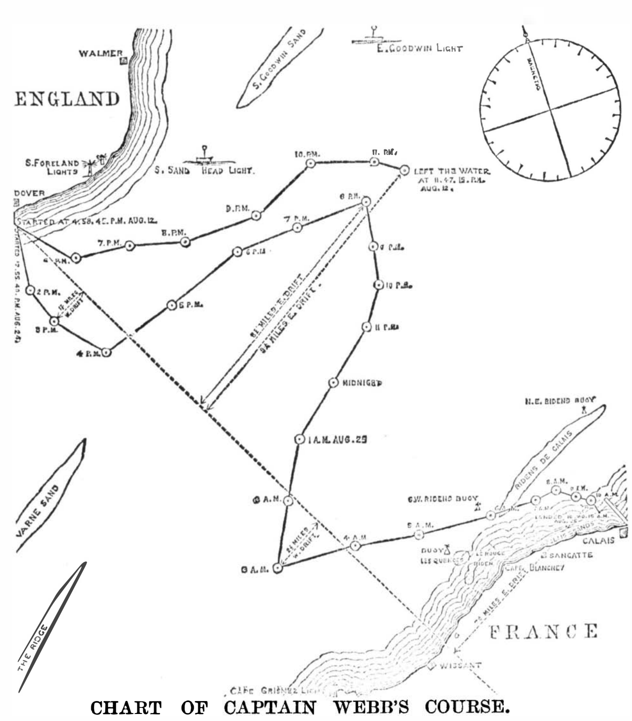


CHART OF CAPTAIN WEBB'S COURSE.

even at the last, after 21 hours immersion, but only of drowsiness from want of sleep and fatigue from prolonged ex ertion. As regards immunity from cold, we think the well-rubbed-in porpoise oil was not without good effect, as the sailors who helped him into the carriage on Calais Sands described him as feeling like a lump of cold tallow, and they themselves got lubricated with the remains of the oil. Whether his heart and physique are in any way specially adapted to stand such long immersions can only be ascertained by medical examination.

Matthew Webb was born at Irongate, Shropshire, England, on January 19, 1848, and was therefore just over twenty-seven years and seven months of age when he started. He is 5 feet 8 inches high, measures 43 inches round the chest, and weighs about 203 lbs. He learnt to swim at seven years of age. In 1870 he dived under a ship—whereon he was rated —in the Suez Canal, and cleared a foul hawser. On April 23, 1873, when serving on board the Cunard steamer Russia, he leapt overboard to save the life of a hand who had fallen from aloft while the watch was taking in second reef int opsails, the ship being then running free under all press of steam and canvas. Of course it was a long time before she could be brought head to wind and a boat lowered. However, Webb was saved with difficulty, after having been upwards of half an hour in the water, although he failed to rescue his shipmate, who was probably stunned, and sank at once. A subscription of $500 was collected for him on board, and he received three medals. When he first went to Dover to train for the present event, he successfully swam out to the N. E. Varne Buoy—more than half way across—by way of a feeler. The only things he suffered from, after his recent great feat, were an excoriated neck from constantly turning his head to protect a weak eye from the waves, and inflamed eyes from the salt.

In his training Captain Webb wisely took long and steady exercise in preference to sharp work. Being naturally a quiet and moderate liver, this came more easily to him, and very long walks, alternated with a three or four hours' swim, were the chief order of the day. In fact, when he dived, he was anything but a highly trained athlete in the usual acceptation of the term.

Correspondence.

What is the Electric Force?

To the Editor of the Scientific American:

In continuing the explanation of my views on this subject, commenced by me on page 196 of your current volume, allow me to say:

In the point of sound force, we have accurately determined the number of vibrations of matter per second necessary to the production of a certain sound; in that of light force, we have approximately estimated the number of vibrations, waves, or molecular motions per second necessary to the production of the various colors. In the point of heat force, we have determined that it exists in a certain violent molecular motion; and in the point of electric force, we have determined that it also exists in a certain molecular motion. And I may here mention, as being one of the strongest proofs, the fact that a current transmitted through a bar of iron will not disturb it, the fact that a current transmitted around it will not disturb it, and the fact that a current transmitted simultaneously through it and around it will cause it to twist in a very appreciable degree, which would not be the case unless the electric force consisted of molecular motion. If we were in possession of no other proof that the idea of a fluid flowing through an electric wire is a myth, we might easily be assured of it by the fact that molecular motion alone is the necessary condition of all other forces. This motion, beyond doubt, varies in intensity and form in different forces, but that it is the one condition of force there can be no doubt: and that the only difference between the forces is the difference between molecular actions may be accepted as a truism. To my mind the force of attraction of gravitation, and perhaps the more remarkable orbital motions of the planets, are forces to which the electric force bears no comparison. The electric force, in fact, is no more mysterious than is any other force. When one pulls a bell cord, and instantaneously a bell is rung in a distant room by the molecular transmission over or through the bell wire of the force applied at the cord, does not one realize that he is as veritably, as wonderfully, and by a similar molecular motion, transmitting that signal as though he were transmitting it by applying a battery to a telegraph wire and thus setting the atomic particles in motion? Cannot one realize that, if there are bells at different places upon a long wire, the nearest bell will ring first and the most distant last? But no one would speak of a subtle fluid as the cause of the ringing, although there is just as much subtle fluid passing over the bell wire as there is when a telegraph operator in New York makes a signal in Chicago by applying the battery to the line of wire connecting the two distant places.

As in this force, so in electricity, nothing flows through the wire. There is, in fact, the most striking analogy between the molecular transmission of electricity and the molecular transmission of all other forces. The stronger and more rigid the lever, the larger and firmer the belt, the larger the tube for water or air, the better the transmission of the forces applied. The larger the conducting wire, the more perfect the transmission of the electric force: because the larger conductor we have, the more perfect must be the molecular motion.

We are now brought to consideration of one of the most important facts bearing upon the question of molecular motion and the theory of a subtle fluid. The force of the electric current is as the square of the distance or length of the conductor. A battery is a constant generator of electric force. These are our premises, and it is not difficult to understand that if, as according to the subtle fluid theory, a wire have a certain capacity to hold that fluid, just as a tube has a certain capacity to hold a liquid, it cannot matter what the length of the wire may be. It is well known, also, that the resistance of a wire varies as the square of the diametric amount of metal. Therefore, in considering the electric force as a fluid, we are bound to consider the wire as a reservoir for that fluid. Now an immense quantity of electricity passes over a very small wire in a certain period of time; and a wire $\frac{1}{8}$ of an inch in diameter, the battery being of proper dimensions, will charge a condenser up to a certain point in one half the time that a wire of less diameter, composed of $\frac{1}{2}$ the diametric amount of metal will charge it, and in one fourth the time that a wire composed of one fourth the diametric amount of metal will charge it; but the smallest wire will charge it to its full capacity as well as the longest wire, merely requiring more time in proportion. Therefore, if a battery be attached to a wire 100 miles in length, the subtle fluid theory would, as soon as the battery should have sufficiently charged the wire, make it necessary that the strength of the electric force in the 100 miles of wire should be as great as though the wire were but a mile, or a few feet, even, in length. This statement cannot be controverted.

Very far from this, however, is the case. We may have our battery upon the wire for any length of time, and we shall find that the force of the electric current still varies as the square of the length of the wire. This, alone, utterly disproves the theory that, in transmitting a signal by telegraph, the wire is charged by a subtle fluid, and proves beyond doubt that the action of the battery is to impart a certain force to the atomic particles of the conductor, which act, each in turn, upon the next and the next, losing force in each successive action, just as we behold every day in the operation of all the forces surrounding us, as, for instance, the ripples occasioned by the dropping of a pebble into a still pond, widening and widening and decreasing in force and intensity as the square of the distance. In the molecular action, there must be a loss of force every time one atomic particle imparts the electric force to another. This we know is the case. According to the subtle fluid theory, this could not be the case.

Again, if we can prove, as in the case of light, that one transparent substance will transmit certain rays of light and not others, we prove that the transmission of the light force is due to molecular action, that the light force itself, in fact, is a certain molecular action. This will be conceded; and I suppose I need not at this point endeavor to prove that such is the case, as the facts have been set forth by students in this line of science, among them Professor Tyndall, in far weightier terms than I am able to command. The one and only deduction to be made from the results attained is that certain atomic conditions are necessary to the transmission of certain forces, and that certain substances are incapable of assuming the atomic conditions necessary to the transmission of certain forces. The same general law holds good in respect of the electric force.

Without entering into all details of the subject, it may be asserted that the very fact that one metal is a better conductor of electricity than another proves conclusively that the propagation of the electric force is dependent upon the atomic structure of the metals; that as its propagation is dependent upon this atomic structure, the propagation of the electric force is by the atomic or molecular action of the metals; and that as this is true, so the electric force is a certain molecular action. The conductivity of the metals is expressed by their resistance, the metal offering the least resistance to the propagation of the electric force being the best conductor. Thus with the resistance of silver expressed as 107, the resistance of quicksilver is 5,550, the latter metal, which is almost without tenuity of the atomic particles, being the poorer conductor, as would inevitably be the case under the molecular theory, and so would not be the case upon any other hypothesis. There are other causes, however, for the difference in the conductivity of different metals. Heat, we know, is a violent molecular motion. The electric force, being or consisting of a certain molecular action, should therefore be disturbed by the molecular action which constitutes heat; and we find that the resistance of a metal to the propagation of the electric force is increased by increase of temperature in the metal. The violence of the molecular action which is the electric force must be apparent to any one who witnesses the wonderful deflagrating effects of that force. Intense, we know, is the molecular action which constitutes heat; and it is a remarkable fact, as pointed out by Forbes, that the order of the metals as regards their conductivity for heat is the same as their order in conductivity of the electric force.

I will conclude the present article with one more argument in proof of the assertion that electricity is nothing more nor less than a certain condition of the atomic particles of matter.

The majority of the readers of the SCIENTIFIC AMERICAN have doubtless witnessed the discharge of electricity from a condenser, such as a Leyden jar, or from a battery or induction coil. They have beheld the brilliant sparks, and very many are cognizant of the fact that every spark is e particle of the metal of the discharging point heated to tha state necessary to the production of the light witnessed. The electric light is not something which has passed over or through the wire, or something partaking of the nature of many metals which may compose the wire, but it is confined in kind to the properties of the metal composing the discharging point. Thus of platinum, silver, iron, copper, o which the discharging points may be composed, each gives its own peculiar light, no matter of what metal the greater length of the conducting wire may be composed: as, for instance, we may transmit the electric force through a hundred miles of copper or iron wire, and finally, when we get the discharge, it passes through a film of platinum $\frac{1}{10000}$ of an inch in thickness: but we get the same result in the kind of light produced as though the whole of the wire were platinum. Yet the electric force is the same no matter of what the conductor may be composed; and no reasoning can account for the projection of a flaming atom of matter from the discharging points, oftentimes with force sufficient to penetrate a piece of glass several inches in thickness, beyond the theory of intense molecular action.

The simple fact that the electric light which we witness is composed of the atomic particles of the conductor, heated to the state in which we observe them, and projected or following from the mass of the conductor, from one electrode to another (atomic particles which we know never have passed through the conducting wire, but have existed at and are wearing off from the terminal alone), proves beyond doubt that nothing that we witness in electrical phenomena has passed over the conducting wire in the sense of a current; that as this force is manifested at the distant end of the conductor in the shape of projected atomic particles of matter, it is clear that the electric force is a certain intensely active condition of the molecules of matter, which activity is set up by the violent action of acids upon metals or chemicals, by heat, or by friction, and transferred from one atom to another with inconceivable rapidity; and that as no heat can exist except by combustion or by friction (unless imparted heat, which is itself sustained by combustion or friction), the voltaic arc, the most intense heat, which is not sustained by combustion but exists in all its intensity in a vacuum, can only be the result of friction; and inasmuch as the mass of the metal is not subjected to friction, the friction can only exist in a violent action of the atomic particles of the metal.

Knowledge is of two kinds, positive and negative, namely, that which we know is, and that which we know must be, because it can be nothing else. It is more by the negative than by the positive reasoning that we can determine the nature of electricity. Deschanel, recognizing the crudities of the electric fluid theories, said of the positive and negative currents: "It is conceivable that the two electricities, instead of being two kinds of matter, may be two kinds of motion, or in some other way may be opposite states of one and the same substance." The reasoning by which we establish the verity of this conception is both positive and negative, and the reasoning of analogy.

Washington, D. C. W. E. SAWYER.

Remarkable Explosion.

To the Editor of the Scientific American:

On August 28, a terrific explosion took place at the works of the Milburn Wagon Company at this place, under the following circumstances: The shop is cleared of shavings by a system of pipes and pneumatic fans. The magazine was located in the boiler room, and was about 25x10 feet, and 28 feet high. Near the top of the magazine was a 20 inch sheet iron pipe leading into the main chimney stack, and immediately under it was a second one, similar in all respects. These were used to take the fine dust out of the magazine. Six feet below them were four 12 inch pipes leading in to the furnaces, and entering under the grate bars, These had valves to them, and were mostly kept closed. The works were running at the time of the occurrence; and a fire had just been put in, and the door closed, when it "kicked," as the term is, and an explosion took place in the magazine, which completely wrecked the boiler room and magazine, tearing the roof off and blowing the wall down. Fortunately no one was injured.

This should be a warning to wood workers not to have direct communication between shaving magazines and furnaces, if fans are used, as few understand the explosive nature of the fine dust from woodworking machines.

Toledo, Ohio. TOLEDO.

[We are exceedingly obliged for this note. We have often seen miniature explosions of the kind described by our correspondent, but have very seldom seen an account of one so violent. Our correspondent is deserving of great credit for the clear explanation which he has given.—EDS.]

The Solar Chronometer.

To the Editor of the Scientific American:

It may be interesting to your American readers to know that the solar chronometer illustrated in your issue of September 11 was invented by one of their number.

In 1868 I invented the same instrument, though in a slightly different form, and applied for a patent. The claim was rejected on the ground that the invention was not new. The "equation curve," which I constructed, was identical with the one illustrated, and was constructed as follows: A meridian is assumed as the axis of abscissas, and the equator as the axis of ordinates, their intersection being the origin of the curve. The sine of the sun's longitude is the abscissa and the equation of time is the ordinate for the corresponding point of the curve. The *plus* and *minus* signs to the equation of time project the curve on opposites of the axif of abscissas; but as the ordinates for two opposite points, in two opposite quadrants of longitude, are not equal, the curve is not symmetrical, though it is nearly so. Instead of reading the time on the meridian line, as in the ordinary dial, the time is read on the curve, at a point indicated by the declination of the sun shining through the lens. The reading, being commenced at any point, is followed in retrograde order, from the right and over to the left, the curve being completed in one year. The time thus read is equated time. But all the elements that go to make up the equation of time are not considered in the construction of the curve, so the time is not strictly equated. though it is nearly so.

Moreover, the curve is not constant in its form; so that a dial, being made for one date, is not correct for a subsequent date, the error accumulating with time. This results from the fact that the equation of time depends on two elements, that have a relative motion with each other. That depending on the eccentricity of the earth's orbit runs forward in regard to longitude, while that depending on the obliquity of the earth's orbit with the earth's axis follows the line of equinox backwards in regard to longitude, these elements forming a complete revolution with regard to each other in about twenty thousand years or more. But as one of these elements has two zero points, or places where the equation of time is 0, and the other has four such points, and as in the course of one revolution each zero point of each element comes to or coincides with each zero point of the other element, we have eight oscillations of the equation of time in one of the revolutions, that is to say, in about 250 years the dial above referred to will have accumulated error to the amount of about thirty-four minutes of time.

Ferrysburg, Mich. H. C. PEARSONS.

Ancient Human Remains in Texas.

To the Editor of the Scientific American:

Some eight miles distant from this place, while digging a well at a depth of thirty-six feet, a quantity of human bones were found. They were imbedded in a yellowish dry dust, which presented the appearance of decomposed bones and flesh. On digging further down, the bed was found to be twenty feet thick, bones occurring at intervals through the whole depth. Just below this stratum, and fifty-six feet from the surface, water was found in soft quicksand. The parties, not desiring to drink water from such a well, sunk another, about eighty yards distant from the first, with precisely similar discoveries. At thirty-six feet deep were found the bones they continued for twenty feet, and then water was found in the quicksand.

A thigh bone, a breast bone (half petrified), a jaw bone (with one tooth still in it) and a foot with all the bones complete, lying in position to show that they had not been disturbed since the flesh was decomposed, were found and taken out, also fragments of broken earthenware, without inscription or pictures.

The thirty-six feet of earth first gone through were clay and sand; and the position is on a hill, estimated to be 400 or 500 feet above the sea.

Whence came this tremendous deposit, and to what age did the bones belong? By what means were they so engulfed?

Huntsville, Walker county, Texas. W. T. ROBINSON.

The Supply of Gutta Percha.

To the Editor of the Scientific American:

I wish to call your attention to an item in your issue of July 3, which states that "gutta percha and india rubber are brought hither chiefly from Brazil and Columbia." For the past eighteen years, nearly all the gutta percha coming to this country has passed through our house; and instead of its being "brought here chiefly from Brazil and Columbia," not a particle has ever come from those sources. In fact the only region of production thus far discovered is the East India Islands, in the immediate vicinity of Singapore.

Gutta percha is wholly unlike rubber, the former being non-elastic as compared with rubber; although it is very plastic, and is readily worked into a variety of forms by means of hot water or steam. The principal uses to which gutta percha has been put, of late years, is for insulating telegraph cables, and for cementing. The total consumption of the United States is now comparatively insignificant, England quite monopolizing the cable business.

India rubber, on the contrary is collected in localities all around the globe, between the tropics, the best quality being found along the Amazon river and its tributaries. Brazil annually produces about 14,000,000 lbs. and the Central American States, Africa, and the East Indies together about 15,000,000 lbs. The consumption is about equally divided between the United States and Europe.

Boston, Mass. GEORGE A. ALDEN.

Repairing the Independence Bell.

To the Editor of the Scientific American:

I think that I can suggest an improvement upon the method of Mr. Charles Smith, described in the SCIENTIFIC AMERICAN of September 11. I would follow his suggestions in cutting out the piece represented by the dotted lines. Then I would mold the bell with the side to be repaired upwards, placing under the cavity a piece of material that would not fuse at any heat that the job might require.

I would arrange a large receptacle or cavity in the sand at the mouth of the bell, for a large amount of surplus molten metal to fill. I would melt an abundant quantity of bell metal, as nearly similar in composition to that which the bell is composed of (the proportions can be ascertained by analysis). I would build on to the bell (around the cavity to be filled) with some infusible material, like plumbago, so that the metal could be cast above the surface, say half an inch or more. I would arrange material at the mouth of the bell, so as to close the channel and stop the flow of molten metal a little below the lower edge of the bell. I would fuse the metal. and heat it to a very high degree, then pour the cavity full of molten metal, keeping a steady flow out until the sides of the recess were seen to be in a molten state; then I would instantly close the channel and stop the flow, when a perfect union would be made.

The recess could be superheated with a gas blowpipe flame, and the molten metal poured into it. Then the surplus metal could be removed, and the bell peal forth as clearly as in 1776.

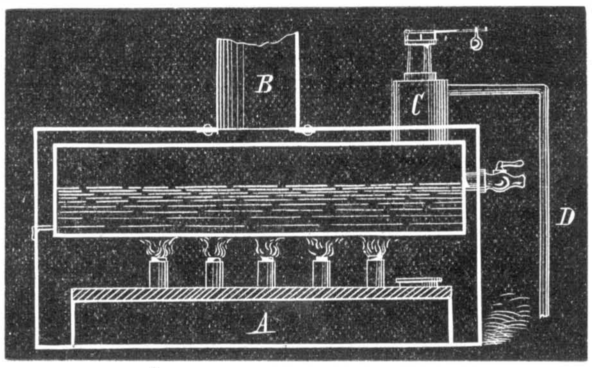
I had a piece united to a broken press in the same manner, and it is a perfect union, with all the strength of solid cast iron, as it was before the break

Beaver Falls, Pa. J. E. EMERSON.

A New Small Steam Boiler.

To the Editor of the Scientific American:

For the benefit of amateur steamboat builders, I send a drawing of a boiler that has given the utmost satisfaction, being cheap and strong:



A is a lamp, with burners enough to heat the whole length of the boiler, which is of copper. The outer cover is of tin, and half an inch space should be left all round, between the boiler and the cover, to make a draft, which will find its exit through smoke pipe, B. C is a steam drum surmounted by a safety valve, and D the steam pipe. The oil or spirits in the lamp can be protected from heat by coating the upper surface of the lamp with plaster of Paris.

For an engine 1 inch by 1 inch, the boiler should be 9 inches long. and 4 inches wide. A. M. BLUNT.

Scarborough, N. Y.

Repairing the Independence Bell.

To the Editor of the Scientific American:

There is another way to mend the independence bell, of which Mr. Charles Smith speaks in your issue of September 11

I saw in a foundery a cast iron wheel, laying on its side, the rim of which was broken in cooling; the ends were apart about ¼ inch. It was mended by placing a fire tile on the inside and on the outside of the rim, over the fracture. Sand was banked around the tiles, and a space made for pouring in hot metal; at the bottom was a small hole to allow the metal to run out. When all was ready, the pouring of hot metal through the fracture began, and continued a short time until the broken ends began to melt; the small hole at the bottom was then closed, and the fracture was filled. On examination, the joint proved good. Perhaps the bell can be repaired in the same way

Dayton, Ohio. J. H. B.

Effect of Magnetism on Watches.

To the Editor of the Scientific American:

A few weeks ago my watch, for the first time in ten years, refused to go. Up to then, it had kept correct time, and was then in good repair, having been recently cleaned. When it first began to stop I would start it by the key, and it would sometimes run a day; but finally it stopped entirely. I had it carefully examined by an expert, who, although he could find no cause, failed to make it run even for an hour.

I am running at my works a powerful magneto-electric machine for depositing copper; and having noticed that I could magnetize a piece of soft iron at a distance of at least six feet from the machine, so that it would lift and support the weight of a large nail, I became impressed with the idea that some of the steel parts of my watch had become permanently magnetized; so I made a watch repairer take it apart. Having some fine soft iron filings, I dipped the balance wheel, escapement wheel, lever, and hair spring into the filings; and each piece raised up at least one half its own weight of the filings, showing all the polar characteristics of the particles.

I have read of watches being spoiled by magnets, but had no idea that it was unsafe to go into a room containing a magnet.

The watchmaker thought he might "brush it off" for about a dollar: I let him brush on it three days as a lesson in magnetism, and then told him that nothing short of heating it red hot would demagnetize it. He put in new parts, including a new mainspring, which was also infected, and the watch now runs as well as ever.

496 Cherry street, New York city. I. B. FULLER.

Terrestrial Magnetism.

To the Editor of the Scientific American:

In an article entitled "Terrestrial Magnetism" on page 164 of our current volume, I notice a statement which may mislead, and beg leave to correct it. "That the earth is not a great magnet, but that the phenomena of the magnetic needle are due to the electric earth currents which flow at right angles to the earth's axes." These two statements are contradictory. "The earth is a great magnet, and the phenomena of the magnetic needle," etc., is the way it ought to have been put. For all our most recent knowledge tends to confirm Ampère's theory that a magnet is merely a closed circuit of electric currents acting parallel and in same direction, and not necessarily a mass of iron, nickel, or cobalt. So that the earth, being surrounded by such currents, is as much a magnet as the magnetic needle. I. B. M

Hoboken, N. J.

[For the Scientific American.]

Cotton Mathematics.

NUMBER II.

Deduction of a formula for the production, in hanks and lbs., of any weighted roller, the diameter of roller and it revolutions per minute being known.

Let D = diameter of roller in inches.

Let R = number of revolutions per minute.

Let S = decimal hank of sliver per lb.

Then: 3·1416 D = production in inches per revolution.

3·1416 D R = " " " " minute.

60 × 3·1416 D R = 188·496 D R = production in inc es per hour.

The hank measures 30,240 inches:

Hence $\frac{188{\cdot}496\ D\ R}{30{,}240} = 0{\cdot}006233\ D\ R$ = hanks and decimals of hank per hour; and for different times,

0·03739 D R = hanks per 6 hours' work.
0·04363 D R = " " 7 " "
0·04986 D R = " " 8 " "
0·05600 D R = " " 9 " "
0·06233 D R = " " 10 " "

Application of the formula:

Suppose a drawing frame, whose front roll is 1⅜ inches in diameter, makes 275 revolutions per minute: required the number of hanks produced in 8 hours of efficient work?

The 8 hour formula is 0·04986 D R.

Substituting their values for D and R, 0·04986 × 1·375 × 275 = 18·85 hanks of sliver produced in 8 hours of efficient work, and to find the number of pounds that should be produced, of ⅛ hank sliver, under conditions specified:

$$\frac{0{\cdot}04986 \times 1{\cdot}375 \times 275}{0{\cdot}125} = \frac{18\ 85}{0{\cdot}125} = 150{\cdot}8 \text{ lbs.}$$

of ⅛ hank sliver produced in 8 hours' work under conditions specified.

The formula may be used to indicate the number of revolutions required to produce any required length or weight of any desired sliver. Take for example the 8 hour formula, and suppose that:

D = 1⅜ inches (= 1·375).

S = ⅛ hank per lb. (= 0·125).

Time = 8 hours.

R to be ascertained by formula.

Length 18·85 hanks; then, by substitution, we have 0·04986 × 1·375 × R = 18·85, and 0·06855 R = 18·85, and

$$R = \frac{18{\cdot}85}{0{\cdot}06855} = 275$$ revolutions of front roll required to produce 18·85 hanks in 8 hours.

Again: Suppose the same conditions, but that 150·8 lbs. of ⅛ hank sliver are required, instead of 18·85 hanks as above; then $\frac{0{\cdot}04986 \times 1{\cdot}375 \times R}{0{\cdot}125} = 150{\cdot}8$ lbs., and 0·06855 R = 150·8 × 0·125 = 18·85, whence $R = \frac{18{\cdot}85}{0{\cdot}06855} = 275$ revolutions required.

Again: To show a convenient application of the formula, suppose that the calendar rolls of a finishing lap machine are 8 inches in diameter, and that 1,500 lbs. of lap, weighing ¾ lb. per yard, are wanted in 8 hours' work. To find the number of revolutions of calendar roll required:

The decimal hank of the lap will be (for ¾ lb. per yard) 0·001587, so that

S = 0·001587,

D = 8,

R = to be ascertained by formula.

By applying these values to the 8 hour formula, we have $\frac{0{\cdot}04986 \times 8 \times R}{0{\cdot}001587} = 1{,}500$, and 0·39888 R = 1,500 × 0·001587 = 2·3805; whence $R = \frac{2{\cdot}3805}{0{\cdot}001587} = 5{\cdot}967+$ revolutions of calendar roll required, say, 6 revolutions per minute.

Proof by another method:

1, 2—12 inches per foot	Revolutions per minute, 6—1.
1—3 feet per yard	Inches diameter of roll, 8—4.
1, 2, 14—840 yards per hank	Ratio, { 3·1416—0·4488 / 0·2244 . 0·0748
0·001587 hank per lb.	Minutes per hour, 60—1
	Hours' work, 8.

$\frac{4 \times 0{\cdot}0748 \times 8}{0{\cdot}001587} = 1{,}508$ lbs. lap, ¾ lb. per yard made in 8 hours, the roll being 8 inches in diameter, and making 6 revolutions per minute. FORWARDS.

THE largest reflecting telescope at the Paris Observatory is completed, although it will not be brought into use for two or three months. The equilibrium of the tube is perfect, and it can be directed with the utmost facility on any part of the heavens, although it weighs about six tuns.

A COMPARATIVE trial of the relative advantages of dynamite, gun cotton, and gunpowder was recently made at the railway tunnel works under Clifton Down, England, with the result of showing that dynamite is much superior to either gun cotton or gunpowder.

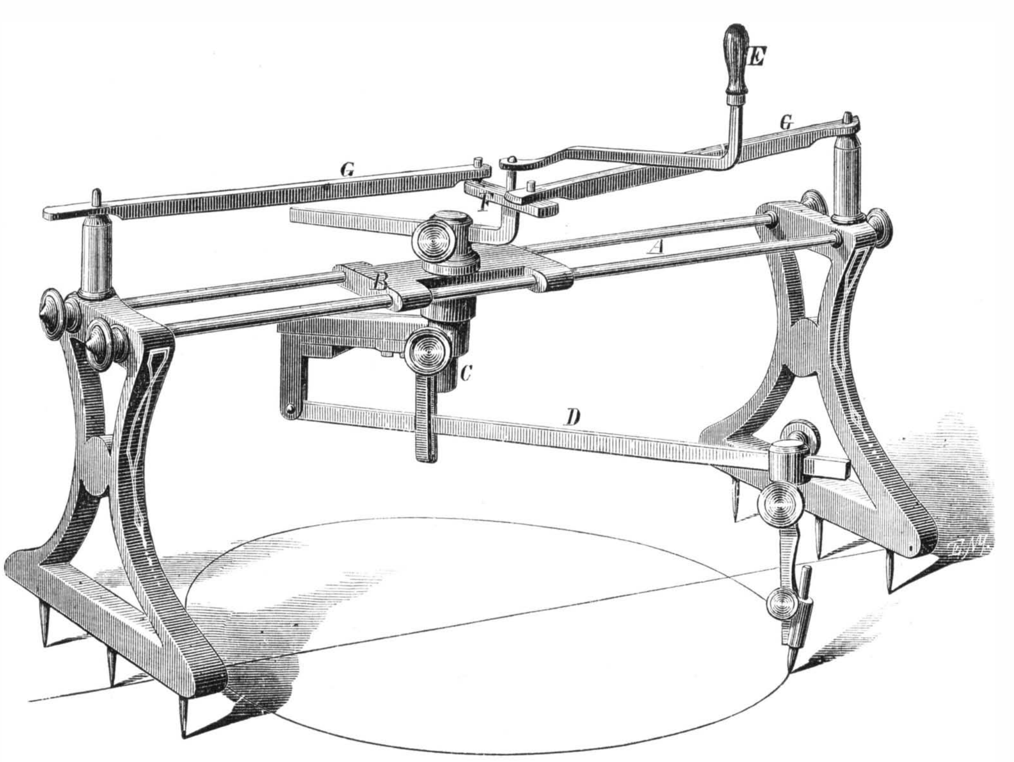
IMPROVED ELLIPSOGRAPH.

We illustrate herewith a new and useful instrument for draftsmen, by means of which any figure, from a circle to a very flat ellipse, can be accurately and quickly described. At A are parallel rods, carrying a carriage, B, through which passes the main axis, C, to which is fastened the drawing arm, D, with a head for the pencil or pen point, secured by a binding screw. The head slides to any desired point on the arm, and is likewise secured by a binding screw. The crank arm, E, passes through the head of the main axis, and also, by a set screw, may be secured in any position. The crosshead, F, fits the crank arm, and carries the parallel motion rods, G, which are secured to steady pins on the frame. There are center points by which the machine is set over any desired line upon which the ellipse is to be drawn.

It operates as follows: The center points are placed upon the minor axis; the pen point is set at the extremity of the major axis, and fastened. The arm, D, is then turned to the minor axis, or 90°, and the pen point is set at its extremity, by means of the arm and by sliding the carriage upon the parallel rods. The crank arm is then clamped. By turning the crank, the point will describe the desired ellipse. It carries the pen at right angles to the drawing bar, so that it will draw an ink line as well as a pencil line.

Samples of the work of this machine, which have been transmitted for our inspection, show that the figures are perfectly drawn.

For further particulars address Messrs. W. L. Bramhall and W. W. Johnson, 607 Seventh street, Washington, D. C.



TOULMIN'S ELLIPSOGRAPH.

IMPROVED RAILWAY TIE.

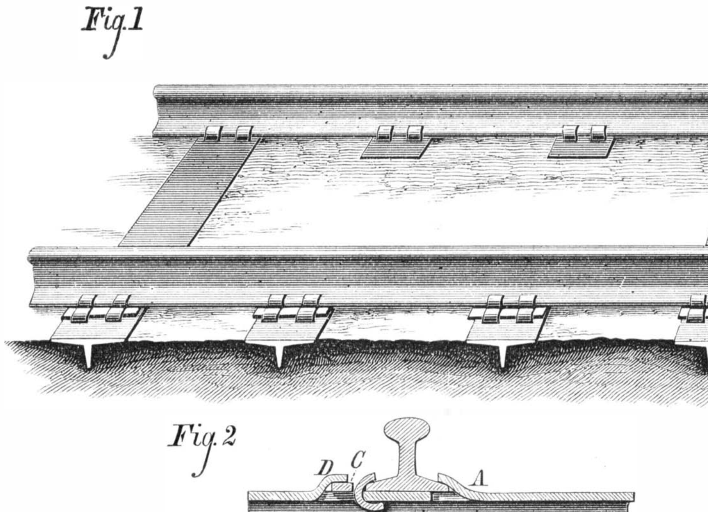
The invention illustrated herewith is a new iron railway crosstie, intended to replace the wooden tie usually employed. It is claimed to offer the advantages of permanence and indestructibility, and therefore to be much more economical than wood, the renewal of which, owing to its rapid deterioration, is a constant and large source of expense. A perspective view of the track secured in the tie is shown in Fig. 1, and a sectional view of the device is given in Fig. 2

The body of the tie is made of a rolled iron girder of T cross section. It is proposed to cut the girders as they come from the rolls, while hot, and to stamp the lugs, A, at the same handling. It will be seen from Fig. 2 that these lugs, A, overlap the inner base flange of the rail, while the outside flanges are retained by the adjustable clamps, B. The tapering plates or wedges, C, pass under, and are guided and held by, the bent lugs, D, and, by being driven inward, are tightened against clamps, B. The wedges are serrated on one edge, to prevent their tendency to work out through jolts and jars. In order to protect the ties against the weather, while still warm they are immersed in a bath of melted asphalt or other weatherproof substance.

The device shows strength, and apparently is neither difficult nor costly to manufacture. It would probably resist wear, and is as easily laid as a wooden tie.

Patented through the Scientific American Patent Agency, May 11, 1875. For further information address the inventor, Mr. Henry Reese, 209 W. Pratt street, Baltimore, Md.

Fig.1



REESE'S RAILWAY TIE

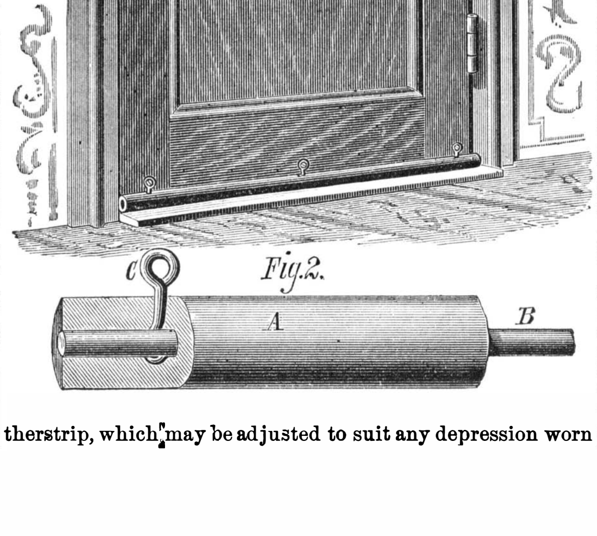
The Weather Glass.

In compliance with the repeated request of some of our meteorologically inclined correspondents, we publish below instructions for the construction of the so-called chemical barometer or weather glass. The utility of this little instrument is based upon the varying solubility of certain salts under different atmospheric conditions of pressure, humidity, and temperature, and the employment of a menstruum of such a density that the slightest increase or decrease of the same will cause the newly formed crystals to rise or sink in the liquid. The instrument generally consists of a tube, from ten or twelve inches long, and from three quarters to one inch in diameter. It is closed at the lower end, and, after the solution has been poured in, the upper end is drawn out, by means of a spirit lamp or blowpipe, until the tube is hermetically sealed. When cooled, the point is broken off in such a manner that a minute hole is left, which suffices for the necessary communication between the contents of the tube and the external atmosphere. Another arrangement consists of a large test tube with a piece of bladder or caoutchouc tied over the mouth, and a small pinhole made through this covering; this arrangement, however, is not so satisfactory as the first, as the covering does not last very long. The solution may be made as follows: Take pure nitrate of potash (saltpeter) and chloride of ammonium (sal ammoniac) each 1 part, camphor 4 parts, strong alcohol 70 parts, distilled water 50 parts. Shake the alcohol and water well together, and dissolve in it the saltpeter and sal ammoniac, then, after having reduced the camphor by triturating it in a mortar with a few drops of the dilute spirit, add it to the rest of the solution, and heat gently over a water bath until complete solution is effected and the liquid is clear. When this is accomplished, pour the solution immediately into the tube, the mouth of which may then be closed as above directed, and the whole allowed to cool very slowly.

The indications that this little instrument gives are of this nature: If the atmosphere be dry and the weather promising, the solid matter will be found resting on the bottom of the tube, the supernatant liquid being perfectly clear; but on the approach of rain or wind, the solid matter will gradually rise, and small crystals of stellar formation will be found floating in the otherwise pellucid liquid. On the approach of strong winds, flakes of feather-like form will sometimes appear on the surface of the liquid; this often occurs several hours before the actual breaking out of the storm. In cold weather the liquid is rendered milky by the multitude of white stars constantly floating in it. The instruments are pretty ornaments, and their indications are always interesting and instructive.

FLEURY'S EUREKA WEATHERSTRIP.

The invention illustrated herewith is an improved wea-



therstrip, which may be adjusted to suit any depression worn in the door sill. It consists of flexible tubing, A, Fig. 2, made of rubber, felt, or similar material, through which runs a metal rod, B, the object of which is to keep the tubing in position. Metal fastenings, C, have a hook at one end which fits around the rod, and an eye at the other end, by which they are secured by screws or other simple means to the bottom of the door, as represented in Fig. 1. The strip, by bending, may be fitted to any depression in the sill, so as entirely to fill up the opening between the sill and door when the latter is shut, thus preventing the ingress of either wind or water.

The door, by its weight, on being shut, draws the rubber against the threshold, and on opening the dragging of the rubber across the threshhold is prevented. The iron rod is made just the length of the door. The rubber tubing extends over one inch at each end, and rests against the casing.

The device is quite durable, is neat in appearance, and may be manufactured at a small cost.

Patented July 27, 1875. For further particulars relative to sale of rights or of entire patent, address the inventor, Mr. Frank Fleury, Springfield, Ill.

Ah Chu and his Salt.

B. writes as follows:

"'Where is your salt, Ah Chu?' said I. Ah Chu had invited me to dine at his mess, to celebrate a Chinese festival, and, barring the chopsticks and some national dishes, which I did not venture upon, a capital dinner it was. Ah Chu and his messmates were working on a sugar plantation below New Orleans. Ah Chu passed a bottle with a quill fitted in the cork. 'Vinegar?' said I. 'No; here is the vinegar,' said he, passing me a bottle exactly like the first. 'Me thought you asky for salt.' 'Salt it was,' said I. 'Well,' said Ah Chu, 'that is the salt me gave you first." And sure enough it was; salt dissolved in water and used in a fluid state. 'So,' says Ah Chu, 'table salt is served in China.'

"For convenience of application, and exactness with which the seasoning can be regulated, give me liquid salt."

A Model Locomotive.

An ingenious mechanical curiosity has recently been shown to us by its maker, Mr. Joseph Butcher, of 43 Center street, this city. It is a miniature locomotive and tender, containing every portion found in the full sized machine, perfectly proportioned, capable of carrying a steam pressure of 75 lbs. to the square inch, and of running at a high rate of speed. An alcohol lamp, which, by its heat, generates an alcohol steam, which, in turn, is ignited under the boiler, heats the latter, which is supplied with water by feed pumps, perfect in every valve and connection. No less than 230 separate pieces enter into the construction of the cab alone. The model is admirable in mechanical execution, and, strange to say, is its maker's first effort at mechanical work, and has occupied his leisure hours, outside his regular trade of ornamental painting, for the past three years. The engine shows remarkable skill both in design and handiwork, and evinces the great patience and native mechanical genius of its constructor, who first made the tools he used in constructing his machine.

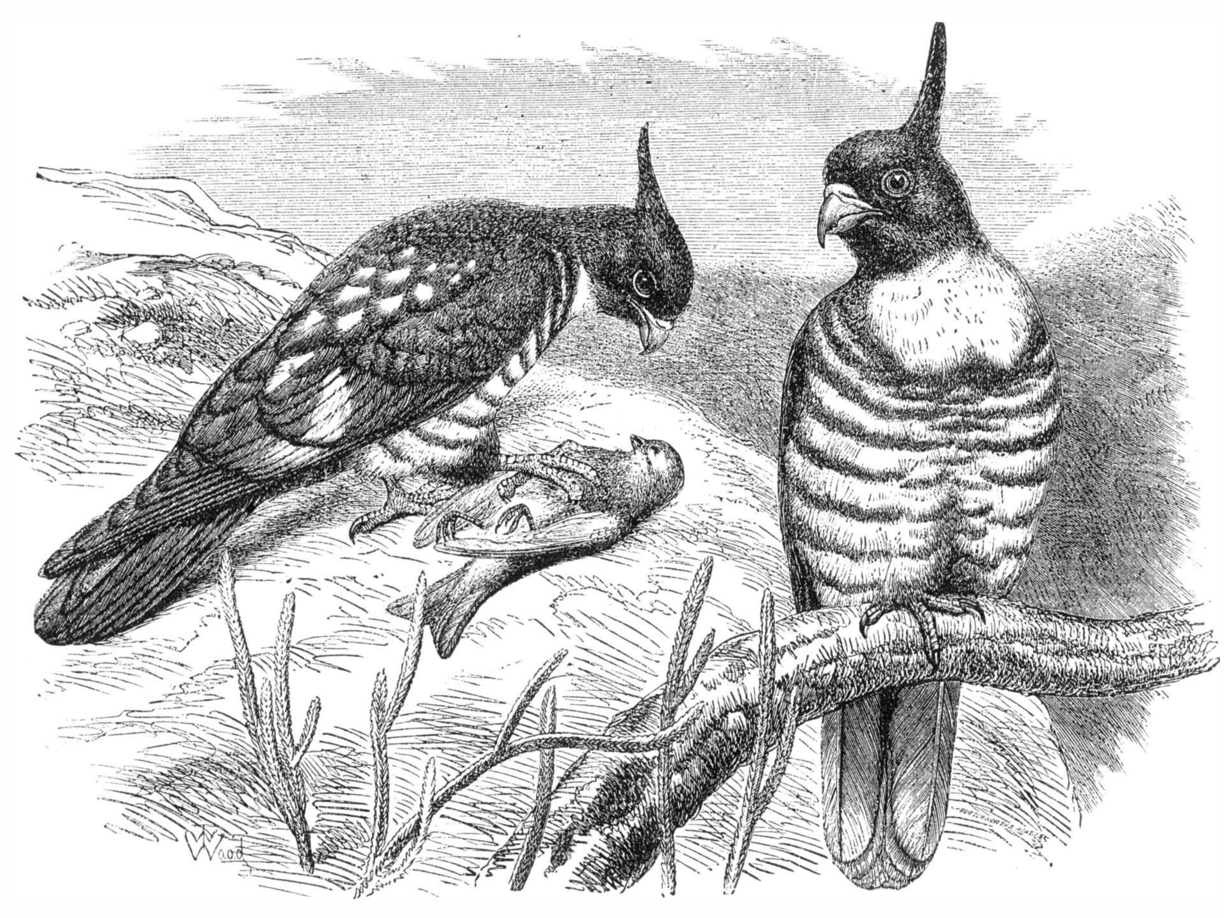
Velocity--Effects of its Increase and Arrest.

Mr. F. J. Bramwell, C. E., in a paper read at the recent meeting of the British Association, said: Gravity can put into our frames a velocity in one second amounting to 20 miles an hour without injury, therefore it is reasonable to suppose that that velocity may be taken out at the rate of two and a quarter miles per second with even less risk of injury; and if we want a proof of this, one might instance a swing at a fair. Take the case of a swing 30 feet long, rising to the horizontal at each vibration; when the swing is at the lowest point, it has a velocity of 45 feet per second, or 30 miles; one knows it will make this half vibration and will reach its highest point in less than 1¼ seconds, so that a speed of 30 miles an hour is taken out at the rate of nearly 17 miles per second instead of the two and a quarter miles of the passenger train.

Another instance of rapid reduction of velocity without injury occurs in colliery winding. The Rosebridge Colliery, in the neighborhood of Wigan, is nearly half a mile, actually 806 yards deep; the winding is done under the minute or at an average rate of thirty miles an hour; but this includes the stopping and the starting; the maximum pace is equal to 58 miles an hour, and this 58 miles an hour is brought to rest in from 180 to 200 yards. There is thus, therefore, abundant evidence that the powers of brakes may be carried yet further than they have been without fear of injury to railway passengers from the sudden checking of momentum so long as the brakes are properly applied.

THE CRESTED BLACK KITE.

The gardens of the Zoölogical Society, London, recently received specimens of a very rare Indian kite (the *baza lophotes* of Cuvier). This bird had never been seen alive in England, and even in India is so sparsely distributed that Mr. Allan Hume, in his "Rough Notes on Indian Ornithology," states that he has never procured a specimen. Though nowhere common, it appears to have an extended range, being known in Ceylon, on the east coast of India, as well as in Lower Bengal, Assam, and British Burmah. Jerdon, in his "Birds of India," states that it is certainly very rare towards the south, but that it is occasionally killed at Calcutta, and is more frequently found in the lower Eastern Himalayas. It appears to be very insectivorous in its habits, and keeps to the forests and well wooded districts, taking only short flights. In its conformation it appears more nearly allied to the honey buzzard (*pernis*), of which a crested species exists in India, than to any of the other accipitrine birds. The plumage of the bird is remarkably handsome. The upper portions, including the long slender crest, the thighs, and the under tail and wing coverts, are a glossy green black. The outer webs of the wing feathers—those that are alone visible when the wing is closed—are deep chestnut. The scapular feathers form a conspicuous but broken white wing band. The under parts of the bird are chiefly white, with five or six broad bars of deep chestnut. The crest is generally carried in a drooping position, but the bird has the power of erecting it perpendicularly. In length the crested kite varies from thirteen to fourteen inches, the extent of its wing being thirty. The weight is about eight ounces. We regret to have to announce the death of all the three specimens almost immediately after they had been sketched.



THE CRESTED BLACK KITE.

THE FLORAKIN.

The florakin or lesser bustard (*otis tetrax*) is found on the plains in many parts of India, and is common in France; in the former country it is esteemed a most delicious bird for the table The male bird, when in full plumage, is very handsome, being most beautifully marked; but the hen is much plainer, as is the case with nearly all female birds. They are to be found in pairs, and are very shy and wary, and hardly ever take to the wing if they can avoid doing so Wherever florakin are found, sand grouse (*pterocles bicinctus*), of which we gave an illustration and description on page 407, Vol. XXXII., may be seen.

The florakin resembles the large bustard (*otis tarda*) in his form and color, but is only 17 inches long. The head is reddish brown. the neck of the male being black, with a narrow white border above and below. The upper parts are mottled with the same colors, but with finer and more delicate lines. In the barren districts of Brittany (France), known as *les landes*, these birds may be seen in considerable numbers; and as the flesh is good eating, and may probably be improved by culture, it is somewhat remarkable that no attempts have been made to domesticate them.

THE FLORAKIN OR LESSER BUSTARD.

American Refined Sugar.

The exportation of American refined sugar to this side is maintained with unrelaxed energy, and consequently displaces a given quantity of stoved sugar which would be ordinarily supplied from the warehouses of the British refiners. The total imports since this new and unexpected quarter for supplies was opened have embraced 7,000 tuns. It reflects no credit upon America, either as regards the act itself or the get-up of the article which she produces. All but the inexperienced, or not over-particular judges of quality and condition, pronounce the cut sugar as shockingly indifferent; and if it is to be viewed as a specimen of the best lump which the Yankee refiner can turn out, and their countrymen are pleased to use, we must frankly assert that we pity their taste. No first class family grocer in London—no, nor any folk in decent society—would look at the American loaf sugar as it now comes to hand; and in case our statement should be read by those who, from the nature of their retail trade, find it an article more suitable to sell than that chopped from bright English titlers, we simply ask them, as they do their friends and customers, to compare and judge for themselves. We need not be in suspense as to the verdict, for we are sure it will be in favor of the British manufacturer, who, in defiance of envious detractors, is still the refiner *par excellence*, albeit his functions in that respect have now almost entirely ceased. Unless checkmated by some deliberate or accidental means, the English market will in time be so inundated with sugar of inferior quality, from France and America, that finest loaf and other sugar will eventually become things of the past.—*London Grocer.*

[If the above statement is correct, if American refined sugars are really inferior to the English article, it behoves our refiners to call upon inventors to study out new methods of refining, by which the best products can be realized at the lowest cost.—EDS.]

THE fluidity of the Berlin iron, from which the finest and sharpest, although not strongest, castings are made, is attributed to the presence of arsenic in the iron.

The Oldest Fair in the World.

In this season of industrial fairs, when Chicago, Cincinnati, Newark, New York, and other cities, are all vieing with each other in the production of the finest exhibit of the practical results of the labors of American mechanics and inventors, it is interesting to note that, in a far distant quarter of the globe, another great fair has been in progress, which, in point of magnitude, probably equals all of the yearly expositions in the United States combined. The great fair of Nijni-Novgorod, in Russia, has quite recently closed its annual display—an exhibition which has been repeated every year for the past four centuries; and the merchants and producers of Siberia, of Persia, of China, and of Tartary have met the manufacturers of Western Russia, exchanged their raw produce for the manufactured goods of St. Petersburgh, Moscow, and the west, and separated for another twelve month. The Fair, in fact, is a vast market, a temporary city, which began with the interchange of commodities between barbarians four hundred years ago at a location some eighty miles distant from Nijni Novgorod. After an existence of two centuries, during which period it absorbed into itself minor markets until it became the principal exchange of the empire, the fair was removed to its present site. Under the rule of Peter the Great, the government assumed its direction, which authority is still retained.

Unlike the colossal and magnificent structures of iron and stone which we erect as the receptacles for our exhibited productions, the buildings of Nijni Novgorod bear a close resemblance to the labyrinth of streets and houses which, together, make up a Turkish bazaar. There is a broad open market place, rectangular in form, on which are constructed twelve rows of buildings, each some two stories in hight, having broad verandahs to shelter the passers from sun and rain. These form parallel streets, some of which are nearly 120 feet in width. At the ends of the principal street, which is the broadest, are the government house and the cathedral, on the sides are shops and a chapel, near which are two high towers, the raising or lowering of flags on which denote the opening or closing of the fair. One side of the rectangle containing the buildings rests on the river Volga; the other three are surrounded by a horseshoe - shaped moat, kept filled with water at an elevation of some eighteen feet above the river, as a precaution against fire. The edifices are built on iron stanchions in the majority of cases, and all that can be removed are taken away at the close of the fair. A large number of buildings, however, remain, and with remarkable strength withstand the great yearly inundation of the river, which submerges the whole locality, leaving only the tallest structures projecting above the waters, like a miniature Venice. It is a strange contrast; a busy town of 150,000 inhabitants, replete with goods of every description, from American wagons to Persian rugs, existing for about six weeks; and then, a few months later, nothing but a dreary waste of water fills its place. Although the number of visitors at any one time may not exceed 150,000, it is estimated that fully a million people come and go while the fair is in progress, and the value of goods which have actually changed hands during the fair just closed is computed at $120,000,000.

The governor of the province supervises the management, aided by a committee chosen by the participants in the fair. The committee controls all government property, renting the same at a low rate. There are some curious regulation as regards exhibitors, or rather sellers—for people come to sell then and there for cash—which are worth noting. For instance, each row of buildings is devoted to some especial kind of goods, and merchants, thus compelled to crowd together, are encouraged to compete with each other. To prevent monopolies and over-speculation, no merchant is permitted to hire more than three consecutive shops, nor can he occupy more than one shop unless they adjoin each other. No imposts or duties are levied, and the shops are usually let to the first comer, the government asking no other gain than the small rents, which together amount to but about $120,000 a year. At the last fair. for this sum 6,086 shops were rented

The contents of the markets are, of course, wonderfully heterogeneous. Machines bearing to us well known names of American firms are side by side with the curious products of Indian and Persian looms. There are furs and skins from Siberia, teas brought overland from China, cutlery from Sheffield, flax, wheat, the importations of the great houses of Moscow and St. Petersburg, and Russian iron, besides thousands of articles representing the chief industries of every nation on earth. There are usually immense amounts of iron, stored on a sandy island in the middle of the river Oka, about three quarters of a mile long, which is not only covered with water at certain seasons, but which changes its shape every year. It is said that the quantity of iron collected here, in bars and sheets, aggregates 90,000 tuns, valued at over $10,000,000. In quality it is said to be better than Lowmoor, and equal to the best Swedish. A tramway runs the whole length of the island.

It is difficult to believe that not only are all these vast stores filled and emptied in six weeks, but that the storehouses themselves are removed and that their sills are covered in spring by ten or twelve feet of water. On the occasion of the recent visit of the Duke of Edinburgh to the fair, the iron owners gave an entertainment in his honor, in a huge pavilion constructed entirely of their stock. The structure was in the form of a turreted palace. The turrets were built of bar iron (the bars being laid crosswise over each other, with the ends projecting) and surmounted by battlements, which were represented by iron buckets. The body of the castle was 100 feet long by 50 feet wide, and was made of sheet iron. Iron buckets and baskets, turned over, made very handsome ornaments around the arches of the doors and windows. The whole structure was completed in three days and three nights.

Common Sense in the Sick Room.

In a lecture delivered at the Bellevue Hospital Medical College, in this city, by A. B. Crosby, M. D., he says: There are certain elements of hygiene which it is very important that we should observe—whether the sick room contains a surgical or medical case—if we would reasonably expect to obtain the best possible results from treatment. In the first place the

TEMPERATURE

should ordinarily range from 65° to 70° Fah., and this should not be a mere matter of guess work, but should be ascertained by the thermometer. If the temperature is permitted to average much higher than this,all febrile disturbances will very likely be aggravated; and if the average is much lower, the patient in ordinary cases runs some risk of getting a chill, although very many times he may remain with safety in a room having a lower temperature, providing he is furnished with a plentiful supply of blankets.

FURNITURE OF THE ROOM.

The room which is selected for a sick room should be as far removed as possible from those ordinarily occupied by the family, in order that the patient may have the benefit of perfect quiet. It should be large, airy, and well lighted, and, if possible, should have a sunny exposure.

The wall of the sick room is a pretty important matter to the patient. If it is covered with one of those dreadfully variegated papers, which, alas! are regarded as ornamental, it will be found, especially if the patient is suffering from any disease in which there is abnormal exaltation of the brain, that it is a source of great annoyance, and may even be positively injurious. For, as his eyes run over these pictures, he will fancy that he sees images of various kinds, such as angels and demons alternating; indeed these figures will assume every conceivable form, and he becomes thoroughly worried in the attempt to disentangle the confusion.

The paper covering the wall should have a uniform, neutral tint, such as a light green, a delicate buff, or a very delicate slate color, a light green, perhaps, is as agreeable to the eyes as any color that can be selected, and it rests the eyes with a refreshing monotony. Such a uniform tint tends to healthy stupidity, and this leads to repose. The floor of the apartment should engage your attention.

The model sick room should never be carpeted, but ordinarily should have a hard wood floor, and this should be oiled and varnished. Upon such a floor may be spread as many pieces of carpeting, rugs, and mats as are desirable. These may be placed in front of the bed, over the parts which the nurse traverses while performing his or her duties at the doors, etc. Each morning, these can be quietly slid along the floor, taken out, and be thoroughly shaken and aired. After they are removed, the floor can be wiped off with a damp cloth or soft brush, and when dry, the rugs, etc., may be replaced.

The windows should also engage your attention. These should be so arranged as to admit abundance of light. Light is a normal stimulus to the human body, and we have no good health without it; you cannot grow healthy cabbages in a dark cellar, nor can you any more easily cure invalids without the influence of sunlight. There are some acute diseases, during the progress of which it may be necessary to temper the light, but it should never be entirely shut out, for if you do you remove from the body one of its important natural stimuli.

The windows should never be surrounded by tapestry or decorations of any kind that are made of woolen stuff. A plain white shade is all that is requisite to temper the light and cut off outside objects from the patient's view, and the window frame should be free from lambrequins, hangings, etc., which may become impregnated with the germs of disease

VENTILATION.

A healthy person requires two thousand cubic feet of breathing space, and the sick person under the same circumstances should have at least three or four thousand cubic feet. Then,again, the sick man should have the air changed twice as frequently as the man in health.

Ventilation requires the introduction and diffusion of an abundance of pure air at short intervals, and a corresponding removal of the air vitiated by respiration. The move ment of air in the sick room should be imperceptible.

If the sick room is ventilated by a fireplace, we should always open a window at the top. If the room, on the contrary, is heated by a register, a window should always be raised at the bottom, since the hot air rises to the top of the room, creates a plenum, and so forces the air out at the bottom. There are three points to be observed in regard to the sick room.

Note, first, whether there is any perceptible odor, on entering the apartment from the open air; if so, ventilation is imperfect.

Make sure, in the second place, that there is a free inlet and outlet for the air.

And, thirdly, place an open mouthed bottle by the side of the bed at night. In the morning, before there is any opening of doors or windows, or any movements about the room, pour a little clear lime water into the bottle and shake it. If the air in the bottle is pure, the lime water will remain clear; but if otherwise, it will become milky in appearance, showing carbonic acid in the air, which has united with the lime, forming a white precipitate of the carbonate of lime.

PREPARATION OF GRUEL.

A man, simply because he is sick, is not to be starved, nor, on the other hand, can a man who is sick, as a rule, take such articles of food as a well man would be likely to take.

It may be doubtful whether a man, when first taken sick, should take a large quantity of food, but one of the articles which he may have is Indian gruel, if not made too strong. If, however, you give permission that the patient may have gruel to take, unless you give special directions as to how it shall be made, you will very commonly find that the nurse has prepared a fair specimen of Indian pudding, and has been administering that for gruel.

In making Indian gruel there should be no more than a dessert or table spoonful of the meal to a quart of water; and this should be boiled for a long time, keeping the quantity of water good throughout the entire boiling process.

Prepared in this manner, it may be made decidedly salt, and then administered to the patient during the first few days of his sickness.

USE OF MILK.

There is one article of diet which all persons may take under all conditions, and that is milk.

There are those who say they cannot take milk, that it makes them bilious, etc.; but that is not true. A person who is sick may take milk with the greatest possible advantage, because it contains, in a form easy of assimilation, all the elements essential for maintaining nutrition. It is the natural aliment of the young animal, and certainly answers a good purpose for the old animal, provided it is used properly. New milk, I do not hesitate to say, may be taken,as far as disease is concerned, in any and every condition. Perhaps it will require the addition of lime water, if marked acidity of the stomach is present; and perhaps a little gentian may be requisite to stimulate the stomach somewhat; and it may be necessary to give it in small quantities and repeat it often; but ice cold milk can be put into a very irritable stomach, if given in small quantities and at short intervals, with the happiest effects. We have now come to believe, contrary to the teaching of our fathers, that cold water,even ice cold water, is a most beneficial drink, and therefore permit our patients to have it as often as they may wish, provided too much is taken at one time.

Now tea, which is a wholesome beverage, and, withal, contributes somewhat to scandal, is very comforting, especially to a sick woman, and may be given without harm, if it is sufficiently diluted with milk. When made very weak —just strong enough to give a flavor—well supplied with milk, and, perhaps, a little sugar, it gives the patient a trifle of nourishment in a very palatable form.

BEEF TEA.

If, however, you will make beef tea according to the directions I now give you, it will be found to be a most serviceable article among the dietetics of the sick room.

Take a pound of the very best beef that can be obtained in the market—the butcher will tell you that any kind of a piece answers to make beef tea of, but that is not true—cut it into small pieces the size of the end of the thumb, place it in a pint basin, cover with cold water, and then place the dish upon the back part of the range or stove, where the water will gradually get warmer and warmer, but will not reach the boiling point. Let it stand and simmer in this manner two hours. Then bring it forward, and boil over a quick fire twenty minutes, and immediately after pour the fluid from the beef, at the same time allowing the little particles which become detached to flow off with it. Now, if there is any fat in the tea, it is well that it should be removed, for the reason that the bile and pancreatic secretion may be unable to emulsify it, and it may do more harm than good. If you wish to be very precise upon this point, the tea can be set aside, and when perfectly cold all the fat can be removed from the surface in a flake; or the fat may be taken up by dropping a piece of flannel upon it as it floats upon the surface of the warm tea.

It is not a good plan to strain the liquor, because this process will remove more or less of the little particles of beef, which are very essential to the value of the tea. It may now be salted, and given hot or cold, as the patient may wish; and it may be given as soon as the pulse indicates any diminution in the force of the heart's action. What becomes of this article of diet when taken into the stomach? The advocates of the worthlessness and non-essentiality of beef tea would answer that it makes but little difference. I believe, however,that it is mostly taken up by the gastric veins,and,at all events,that it is exceedingly palatable and nutritious,and does do something more than simply warm the stomach and make the patient happy for a short time.

In case the patient's stomach is very irritable, so that large quantities of any substance cannot be borne, you may resort to beef extract for nourishment.

The proper method of making this article is to take a pound of the best beef, cut it into small pieces, and place it in a good sized open mouthed bottle—a pickle jar is perhaps as convenient as any. Cork the bottle loosely, and then set it into a kettle of water, which is to be kept boiling for two hours. If the bottle is now removed, it will be found that it contains a considerable quantity of fluid, which may be turned off, and the beef subjected to slight pressure to remove still more.

In this fluid we have a concentrated article of nourishment, and it may be given, after it has been seasoned, either pure or diluted, according to the condition of the stomach. Beef extract is not nearly so palatable an article of food as rich beef tea, made in the manner described.

Electro-Harmonic System of Multiple Transmission.

During the past two weeks, Mr. Elisha Gray of Chicago, Ill., has been exhibiting his electro-harmonic apparatus in the Western Union Building, in this city. More than a year since we published an article descriptive of this curious discovery, so far as it had been developed at that time. Since then Mr. Gray has devoted the greater part of his time to the perfection of the apparatus, and has already succeeded in producing some very remarkable results. Mr. Gray's earlier experiments disclosed the fact that composite tones were as easily transmitted over a wire as single notes, and from this discovery he developed a system of multiple transmission, founded on this principle. The apparatus was tested experimentally on a wire between Boston and New York, on September 11, with very satisfactory results. Four separate communications were simultaneously transmitted from Boston, and copied from four sounders by a like number of receiving operators in New York. In the main the signals were perfectly received on all the instruments, the only apparent defect being a tendency to shorten them somewhat, a difficulty which can doubtless be overcome by a suitable modification of the transmitting apparatus.

The principle of the apparatus is a very simple one. The depression of each key sets a self-vibrating electrotome in operation, which is adjusted or tuned to vibrate at a certain rate, differing from that of any of the others, when under the influence of the electro-magnet controlled by its corresponding key. These several sets of electrical vibrations are transmitted through the circuit without interfering with each other, in the same manner that almost any number of different sets of sound waves may pass through the air without mingling. At the receiving station, each instrument is so adjusted as to respond to its own special sets of waves or vibrations without regard to others. By breaking and closing the circuit upon the transmitting electrotome, so as to form telegraphic signals, these are transmitted and taken up by the corresponding receiving apparatus.

It is not easy to fix a limit to the number of different communications that may be carried on over the same wire simultaneously, either in the same or opposite directions. The marked success which attended the operation of the principle through two hundred and forty miles of line, on September 11, seems to promise results in the future of the greatest value.—*Journal of the Telegraph.*

The Harmonic-Electric Telegraph.

The harmonic-electric telegraph invention (now commonly known as the telephone) of Mr. Elisha Gray, of Cleveland, is undoubtedly destined to prove a very useful and important one. On Friday of last week we saw four despatches transmitted simultaneously from Boston to this city, on one of the Western Union wires. It is believed, and with good reason, that at least sixteen messages can by this invention be transmitted simultaneously over a single wire. Mr. Gray has made a discovery and invention which will be likely eventually to revolutionize the present Morse telegraph system.—*The Telegrapher.*

THE recent storm in the Gulf of Mexico was the fiercest known in that vicinity for several years. At Galveston, Texas, it raged with great violence for three days, and the damage to property has been estimated as high as $5,000,000. At Indianola, Texas, it is stated, 300 lives were lost.

THE FAIR OF THE AMERICAN INSTITUTE.

NEW ELECTRIC ENGINE.

A new electric engine, adapted to pumping water through a house or to any other light domestic work, is located among the housekeeping articles, and is well worth careful examination. Its construction is novel in many respects, One set of electric magnets is disposed in the direction of their length about an interior rotating cylinder or wheel. The other magnets are arranged in the interior of the stationary case, so that the construction is that of a number of horseshoe magnets, each having one stationary and one movable leg. The long faces of the magnets are serrated to the depth of $\frac{1}{8}$ inch, the indentations of the wheel magnets fitting into those of the case magnets. This, the inventor tells us, has been found, while increasing the area of the faces in contact twofold, largely at the same time to augment the power. The coils are wound lengthwise about the bars, and the yoke of the horseshoe is made directly beyond the outside coil, instead of at the further extremities of the bars, as is usually the case; so that a large portion of the metal core protrudes beyond the yoke. This arrangement, we are informed, has also been found to increase the power as high as 100 per cent. In a future issue we shall describe another electric machine exhibited by Mr. Charles A. Hussey and we shall probably refer to the machine under discussion in detail, and with reference to the new principles claimed to be involved, noting here only the facts given us. Of these the most remarkable are the large capacity of the machine (which contains a 5 inch magnet wheel and weighs but 15 pounds), 8,000 foot pounds per minute, and the statement that a 4-cup battery, costing for materials expended $1.12, in connection with this apparatus drove a Howe sewing machine at 500 stitches per minute for 60 hours successively.

Builders, owners, and tenants of city houses will doubtless view with interest a

NEW SYSTEM OF PLASTERING

which is claimed to prevent the sudden and disastrous downfall of ceilings, so frequently occasioned by defects in the water pipes and consequent leakage or overflow. The invention consists of replacing the scratch coat and brown coat used in ordinary work by the combination of fibro-ligneous sheets with a cement composed of lime, sand, and plaster. The sheets are of a fabric resembling coarse bagging which is secured to the lathing, and the cement is supplied in the ordinary way. A hard finish coating completes the work.

A NEW FORM OF HAIR HEADER

is exhibited, which is an improvement on the similar apparatus shown at last year's fair. It consists of a vertical oscillating metal plate, the lower edge of which is provided with a rubber facing. Beneath is a horizontal vibrating plate having a rubber surface directly under the edge of the vertical plate. The tangled combings of long hair are placed between these moving portions; and by the rubber, engaging, when rubbed along contrary to the grain of or to the direction of the asperities on the hair, the "knotted and combined locks" are caused to part and separate. This hair header is called "magnetic," for no reason that we can perceive other than that given by the old lady who admired the noun "Mesopotamia," "it was such a nice, comforting word."

AN AID FOR GOING UP STAIRS.

Here is something for the denizen of the aerial flat, an invention supposed to bounce him up from one stair to another until he reaches the top of the flight, before he knows it. Each stair has a hinged lid and under each lid are some strong coiled springs. The inventor fails to say anything about the effect of his springs when a person runs down the steps. The idea suggests itself that an inexperienced user might try to go down two steps at a time, in which case his momentum would probably compress the spring sufficiently to jump him back three steps, and thus, by a kind of algebraic addition, he would find himself slowly retrograding in in spite of his efforts to advance. There is food for sombre reflection in those spring stairs.

A NEW HYDRAULIC MOTOR

for sewing machines is exhibited, which is easily attached to the table of the apparatus and which is driven by the ordinary head of water in the service pipes. It consists simply of a winged wheel placed horizontally and enclosed in a case. Motion is governed by the treadle, and speed, of course, regulated by the water cock.

ANOTHER NOVELTY IN MOTORS

is a peculiar compression engine, driven by hot air, now in operation in the machine department. It consists of two cylinders, one for power, under which the fire is built, the other simply for compression. The latter has a water jacket, and both cylinders have pistons, or more properly, plungers. The piston of the compression cylinder passes through packing at the top of the same, but below fits loosely in the bore, so that the air compressed is at liberty to pass up around the piston, and to enter a connecting passage, which leads it into the power cylinder, where it is heated and expanded, and so lifts the piston. As the two pistons are set on cranks 180° apart, the down stroke of the power piston corresponds to the up stroke of the compression piston, so that the air, which just before has been expanded, is now returned to be recompressed and again used. Thus the air is merely shifted from one cylinder to the other, and its cooling or heating is quickly accomplished through its being exposed to the action of the cold water or the fire in thin annular sheets. The machine (1 horse power), we are told, burns very little fuel, one scuttleful answering for an entire day. The expenditure of oil is also very small. This seems to be a very simple apparatus, and one well adapted for a large number of light uses. It is almost entirely free from the disagreeable noise usually incident to caloric engines.

We notice a new

MACHINE FOR POLISHING MOLDINGS,

which seems to perform very good work. It has an adjustable table, carrying horizontal rubber rollers, which grasp the strip of molding and present it to the action of a reciprocating polisher. This last is a composition of fine emery, which is made in a plastic state and applied to a piece of molding similar to that to be polished. The result when the composition is hard is a perfect matrix, into which every indentation or projection of the molding fits. The cast is then mounted in a box and rubbed to and fro on the molding, as the latter, as already explained, is carried beneath it. The advantage gained is the increased sharpness and accuracy of the edges, and the thorough polishing of the whole work, a proceeding of some difficulty by the ordinary use of sand paper.

A new convenience for housekeepers is a combination

KITCHEN SAFE,

in which places are provided for a multiplicity of articles which generally go astray about the kitchen. Besides, it offers to the cook the same advantages as the prescription counter does to the druggist. There are drawers for the sugar, spices, and similar staple ingredients, a hinged dough board in the front, a convenient receptacle for flour or meal in the top (with a hopper below, fitted with a valve so that exactly as much flour as is needed may be measured off), a sifting arrangement, and plenty of extra closet room for the thousand little things needed in culinary operations. A

NEW ANTI-FRICTION METAL

has appeared, which, we suppose, is intended to rival the material which raised such a breeze among the fair officials last year. It differs, however, in that, instead of being inserted in the bearings, the bearings themselves are made of it. No machinery fitted with the substance is running as yet at the fair. The basis, according to the circulars, is black lead, which is another point of difference from its older competitor into the composition of which black lead enters very slightly, and in many cases not at all.

[From the Engineering and Mining Journal.]

Extra Large Lap-Welded Tubes and Enameled Water Pipes.

At a recent visit to the National Tube Works Company at McKeesport, Pa., we witnessed the operation of making lap-welded tubes of such a size and quality as to call for notice. The company makes these seamless tubes or pipes of any size up to *fourteen inches diameter*. And as every length is tested by hydraulic pressure before leaving the works, their strength and quality is fully guaranteed. They have been found admirably adapted to carrying water for the hydraulic mines of California, Nevada, and other Western States, and for waterworks which do not require larger mains than 14 inches. The company has just completed an order for the Virginia City and Gold Hill Water Company, of Nevada, of seven miles of 10 inch pipe, the most extensive order for a large size that, we believe, has ever been given in this country. These seamless pipes, even without coating, are more durable and are also less expensive than the riveted pipes; but the company applies a patent enamel to them that, it is claimed, makes them almost indestructible, and, indeed, the company is willing to guarantee their durability for any length of time. The appended reports by Dr. S. Dana Hayes, Massachusetts States Assayer and Chemist, and Professor Otto Wuth, of Pittsburgh, Pa., fully establish the claims of this pipe to durability. We commend it not only to our gas and water companies, but also to our mine owners and others who have to use or convey impure water, such, for example, as in many anthracite mines. These large pipes would make excellent screen shafts for our coal breakers, and the enamel would doubtless be of great advantage for coating the exposed iron work about the mines.

In bringing the matter to the consideration of "those whom it may concern," we believe we are doing consumers as well as manufacturers a service.

REPORTS.

"I have recently made a series of tests of your enameled pipe, for the purpose of ascertaining its value as a service pipe for conveying water and other fluids, and now submit the following brief report of the results obtained:—

"Portions of the enameled covering itself were first removed from several pieces and submitted to chemical analyses, to determine the presence of deleterious substances; but the results of these analyses are entirely negative, as there is nothing of this kind present. The pipe is made of wrought iron, covered, inside and outside, with an elastic, enamel-like material that does not contain any unwholesome or objectionable ingredients.

"Its durability was then tested by exposing different pieces of the pipe to the solvent action of hard, soft, and sea waters, alcohol, and other fluids for many days, and finally those fluids were boiled in the pipe for several hours in each case—the object of this boiling being to obtain, as nearly as possible, in a comparatively short time, the effect produced in the pipe by long continued usage. These tests have been very complete, and I am quite surprised at the durability and power of resistance of the enamel covering, determined in this way. It has not failed in any trial with natural waters in my laboratory, and it has withstood the action of boiling corrosive fluids for a longer time than specimens of other water pipes now in common use.

"I commenced this investigation with some doubts about your enameled pipe, but the severe tests which I have employed prove that it is perfectly harmless and possesses great durability, these being the properties of most importance in water pipe. S. DANA HAYES,
State Assayer and Chemist, Massachusetts."

"I have made a complete series of tests in order to ascertain the quality of your patent enameled pipe, and found that the enamel, covering perfectly both the inside and the outside of the wrought iron pipe, is not in the least affected by the action of alkalies, acids, salts of any composition, alcohol—in facts, any liquids which in practice are apt to be conveyed through the pipe. The enamel itself contains no deleterious substance whatever, and even if it did it would not make any difference, as not a trace of it will become soluble. Pipe so enameled is especially adapted for water and gas. O. WUTH."

Yankee Electrical Spread Eagleism.

"At the annual meeting of the British Association for the Advancement of Science, held at Bristol, on the 25th of August last, Sir John Hawkshaw, F. R. S., the newly elected President of the Association, as usual, delivered an address. In the course of this address he took occasion to review the history of the invention and progress of the electric telegraph. This portion of his speech is as perfect a specimen of the insular egotism for which his countrymen are noted as we have seen for some time. He completely ignores, in this connection, the discoveries and inventions made by Americans, merely incidentally referring, in a foot note, to the date of the first patent of Professor Morse, issued in October, 1837. With this exception no mention is made of any American; and so far as can be learned from his address, nothing has ever been done in this country for the development of electrical science or of the telegraph.

In view of the fact that the first practical telegraph line of any extent was built and operated in this country by Mr. Harrison Gray Dyar, in 1826, on Long Island, in this State, over which dispatches were actually transmitted, and that most of the more important telegraphic inventions and improvements have been made here, and by Americans, this omission is discreditable either to the speaker's fairness or to his intelligence. While we have no disposition to withhold from the many eminent electricians and telegraphic inventors of Great Britain the credit which is due them, we are certainly not willing to allow such a slight as that which President Hawkshaw has shown to go unnoticed or unrebuked.

It is in this country that most of the useful improvements and new adaptations of the telegraph have been made, and these have been gradually adopted in Europe until most of their telegraphs are worked upon American systems.

The comparatively slow and inefficient needle telegraph of William Fothergill Cooke, not "Wheatstone and Cooke," as President Hawkshaw has it, has been generally superseded, even in England, by the Morse system, and this is supplemented to some extent by the printing telegraph of Professor Hughes, an American, which is also very extensively used on the continent of Europe. The duplex system of Mr. Stearns, an American, is also being generally adopted on the English and Continental lines. The automatic system of Professor Wheatstone, which is highly praised, is known to be as much behind the American automatic system of Mr. Little, in successful operation in this country, as is the needle telegraph behind the Morse and printing telegraphs. The fire alarm telegraph system is the invention of Messrs. Farmer and Channing, both Americans; the quadruplex has been made practical by Americans; all the printing telegraph instruments which have proved of any value are the exclusive inventions of Americans; the quotation telegraph systems; the automatic fire telegraph system, by which instant notice is given of the commencement of fires, which has proved of great importance and value, is the invention of an American; the district telegraph system, by which messages can be summoned, policemen called, etc., has been invented and perfected by Americans; and the harmonic electric system, by which not merely four, but there is every reason to believe at least sixteen communications can be simultaneously transmitted through a single wire, is the invention of Mr. Elisha Gray, of Chicago, also an American.

Some of the first electricians of the world are also Americans. Professor Henry, of the Smithsonian Institute at Washington, an American, invented the intensity electro-magnet, by which the transmission of telegraphic signals on long circuits became practicable. Messrs. Farmer, Channing, House, Page, the latter the inventor of the so-called Ruhmkorff coil, and many others eminent for ability as electricians, are Americans; but these are coolly ignored by the orator, who has never heard of any achievements in electrical science except those of certain British scientists whom he names, save by a few Germans, to whom he grudgingly accords some small credit.

In no other country has telegraphy acquired such perfection in actual use or been so universally adopted and used by the people as in the United States and Canadas. More actual business is transmitted daily on a single circuit by two operators in this country than by four operators on two circuits on the English lines. Business is dribbled over the English lines slowly by means of needle telegraphs or by Morse registers, the use of which is universal there but exceptional here; and the automatic telegraph of Wheatstone gives a speed of seventy to eighty words per minute in actual business against 1,200 to 1,500 words per minute by the American automatic system. Only in cable telegraphy can any practical superiority be shown on the part of British electricians and telegraphers, and this arises from the fact that in the United States we have had no long submarine cables to operate. We consider it quite probable, however, that if the speed of transmission is hereafter materially increased over such lines it will be through American inventions, and had the cable telegraphs of the world centered in New York, as they have in London, we believe that our electricians would, before this time, have devised some method of transmitting through long submarine cables more than seventeen words per minute."—*The Telegrapher.*

If Sir John's address savors of egotism, nothing of the sort can be charged upon the *The Telegrapher*. The native modesty of the Yankee is proverbial, and the above prettily illustrates his method of practice.

DECISIONS OF THE COURTS.

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

PATENT CANNED GREEN CORN.—J. WINSLOW JONES *et al. vs.* G. LEWIS MERRILL AND OSCAR F. SCULE.—SAME *vs.* JOHN H. NOYES *et al.*—SAME *vs.* W. B. OSTRANDER *et al.*

Motions for preliminary injunctions to restrain alleged infringements of etters patent granted to John W. Jones, April 8, 1862, and May 13, 1862, for certain inventions of Isaac Winslow, relating to a new and useful improvement whereby corn in its green state is preserved in hermetically sealed cans. The first of the patents was for the product; the second, for the process

[In equity.—Before WALLACE, J.]

Held:—An adjudication in favor of a patent at final hearing, and after full consideration of elaborate proofs touching the validity of the patent, must be held controlling upon an application for a preliminary injunction, unless cogent evidence is presented in addition to that which was found insufficient upon the final hearing.

While the fact that the defendant has obtained a patent for his process is not controlling in proceedings for an injunction, it is entitled to some weight.

The process covered by the patent of John W. Jones, assignee of Isaac Winslow, May 13, 1862, for preserving corn in its green state, involves three distinct features, each of which is essential to the result: First, separating the kernels from the cob; second, placing them in their natural juices in cans; third, sealing the cans hermetically and subjecting them to heat by water or steam until the kernels are thoroughly cooked.

This patent would not be infringed by a process in which the corn, whether on the ear or removed therefrom, is thoroughly cooked by the direct application of steam before it is canned.

Where it appeared that the defendants subjected their corn to the direct action of steam, or otherwise "cooked" it, before canning it, but heated it again in a steam bath after canning, a preliminary injunction under the Winslow patent was denied, although grave doubts were entertained as to whether that part of the defendants' process which was adopted prior to the canning was anything more than a colorable departure from the patented process.

Where defendants claimed to cook their corn in the ear thoroughly before subjecting it to heat in the sealed cans, but the printed label on their cans, prepared when they had no interest to warp the facts, stated that the corn was "cut from the cob while fresh and sealed at once, and then prepared by an entirely new process," etc.: Held, that in proceedings for an injunction the defendants must be concluded by the statement they thus published to the world.

Where complainants were chargeable with knowledge of defendants' acts, but permitted them to continue their manufacture, and in response to an inquiry as to whether they regard defendants' process to be an infringement, returned an answer that led defendants believe that they did not, an injunction was refused.

It is a general principle of equity ju isprudence that the court will not lend its extraordinary aid, by way of preliminary injunction, to any claimant who has encouraged or acquiesced in an infringement of his right, or unreasonably delayed in prosecuting for its violation.

Compensation for damages accrued and protection from future damages is all such a complainant is entitled to. This provided for by a bond.

W. H. Bright, W. H. Clifford, and *E. W. Fox*, for complainants.
Smith, Markham, & Smith, for Merrill & Soule.
Tower & Joslyn, for Noyes *et al.*
Sedgwick, Kennedy & Tracy, for Ostrander *et al.*

Recent American and Foreign Patents.

Improved Tram Stick.

John R. Byer, Attica, Mich., assignor to himself and Arthur H. Fish, same place.—The object is to improve the means for "tramming" the spindles and stones of grinding mills, and the device consists in a tram stick having an adjustable lever, to the end of which lever the "quill" is attached, and to the other end of which lever is an adjusting screw.

Improved Hose Coupling.

Mark M. Lewis, New York city, assignor to himself and Albert C. Aubery, same place.—This is a hinged two-part tubular coupling, provided with flanges, grove, and rabbet, to enable it to be used independently, or with a middle-ribbed inner coupling.

Improved Railroad Gate.

John H. Eberhart, Sumter, S. C.—This invention consists of a pair of sliding gates meeting together at the middle of the way, which are coupled on each side by a bell crank and rods. There is a slide to be moved by the locomotive to open the gate when the locomotive approaches it, and to be closed by the rear car when the train passes away.

Improved Printing Press.

Calvert B. Cottrell, Westerly, R. I.—This relates to a graduated cam and segmental lever, which take the cylinder while in full speed from the bed, which is also in full speed, and stop it, while the bed continues its motion at full speed. They stop the cylinder, while the bed runs on, and without losing any time whatever on account of the stopping of the cylinder. Air springs are provided whose cylinders are on each end of the bed, while their stationary pistons are in corresponding positions on each end of the frame. These springs take up the momentum that is transferred thereto by the bed at each stoppage, and then retransfer the same at the start of the bed on its return in the opposite direction, thus allowing but little lost motion, and enabling the machine to be run much faster than usual, and with much less than the ordinary motive power.

Improved Car Starter.

Anthony A. Jones, Utica, N. Y., assignor to himself and Julius F Chesebrough, same place.—This invention relates to the mode of connecting the foot rod which projects up through the platform of the car with the pawl, rod, and lever which operate the ratchet wheel mounted on the front axle. When the driver applies his foot to the plate on the rod, the horizontal arm of an elbow lever is depressed, thereby causing another rod to carry one or the other of the pawls into engagement with the ratchet. Simultaneously with this engagement, other devices act so that the pressure is thenceforth applied directly to the lever so long as it continues.

Improved Suspension Book Rack.

Frederick F. Hill, Essex, Conn.—This is an improved folding rack for books and ornaments, to be hung against a wall, so constructed that the shelves may be adjusted and secured at any desired distance apart.

Improved Wet and Dry Ore Crusher.

Henry Bolthoff, Central City, Col. Ter., assignor to himself and Charles F. Hendrie, same place.—A hollow cylinder revolves upon truck wheels placed in a frame. The motive power is applied to one of the truck wheel shafts, driving the mill by friction of the truck wheels on the periphery of the two heads, which are connected together by staves. The heads have a flange on the outer rim, and are protected from wear on the inner side by liners. For wet crushing, these staves are made watertight by the insertion of proper packing between them and at the ends, each stave having projecting ribs to help hold the packing and stiffen the stave. Through the center of the cylinder, which is open, is placed a hollow pipe. Through this is fed the ore and water, the pipe having openings for the discharge of the same into the outside of the cylinder. Balls of cast iron are placed inside, and by the motion of the cylinder the ore and balls are brought into contact, and the crushing is done by concussion and abrasion; and when the ore is sufficiently fine to float, it rises to the top of the water and passes out in the form of pulp through registers on either side near the center into hoppers fastened to the stands; thence it passes in pipes to the amalgamating coppers, as used with stamps. For dry crushing, of course the ore, instead of discharging at the centers, discharges around the periphery through interstices between each stave, which are made much narrower than the wet mill stave, to give more discharging capacity, and are so shaped on the inside as to form corrugations, thus preventing packing of ore and balls, and thus aiding free discharge.

Improved Traveling Can.

Antoine Alexis Gervais, Paris, France, assignor to A. Gervais & Co., same place.—This relates to field cans in which are a chamber, having a fire grate or basket, an air channel, and a draft flue.

Improved Corn Sheller.

Hiram C. Creekmore and John W. McMillan, Salado, Tex.—This is a combination, with an inclined box, open on one side, of a cylinder or roller, to which saws and strips or bars are applied as means whereby the husks are stripped from the ears of corn, and the kernels removed as the ear passes through the box.

Improved Buckle Loop.

Frederick A. Neider, Madison, Ind.—This relates to an improved loop and buckle for carriage back stays and curtains, and consists of a flanged buckle-fastening plate tacked to the curtain or back stay, in connection with a sliding box fastened by the flanges and held in position by the buckles.

Improved Ventilator Cap.

Henry A. Gouge, New York city.—The base of the cap is secured to the upper end of the ventilator flue. The body of the cap is made of the same shape as the lower part, but larger, and is so arranged that its lower part may overlap the upper end of the lower part. The part is connected with, and supported from, the base part by bars. To the bars are secured the deflector, which is made in the form of two low pyramids, placed base to base. To the upper edge of the base part is attached the edge of a plate, which projects downward and outward until in line with the lower edge of the body, at which point it is bent inward and upward at an acute angle, thus forming an angular cornice around the top of the base. It is claimed that, no matter from what direction the wind blows, it not only cannot enter the flue, but actually induces an upward draft through the flue.

Improved Detachable Link for Chains.

Charles H. Gillingham and Albert L. Gillingham, Griggsville, Ill.—This detachable link for spur wheel chains will enable links to be quickly attached and detached, to lengthen and shorten the chain or to replace a broken or worn link with a new one. The invention consists in the body and a crosshead key, secured to each other detachably by a pin.

Improved Waterproofing Compound for Leather.

James Clunan, Brooklyn, N. Y.—This is a compound of paraffin, tallow, and resin, which are melted together, and with which the leather is impregnated.

Improved Traverse Motion.

Charles L. Noe, Bergen Point, N. J.—A master wheel, with two half circular cog rims in different planes, is arranged in combination with a train for turning a screw for working a traverse guide. In the train there are two pinions for transmitting the motion from the master wheel alternately in different directions, one taking it from one of the cog rims and the other taking it from the other rim. One of these pinions transmits the motion direct, while the other transmits it through the first pinion, so that one causes the screw to turn one way and the other turns it the other way, this producing a continuous traverse of the guide forward and backward. The invention is applicable for bobbin winders for sewing machines, reels for fishing rods, and other spool or bobbin winding apparatus.

Improved Sad Iron.

Henry R. Robbins, Baltimore, Md.—This invention consists in a simple and ingenious device for the attachment of a handle to a sad iron, whereby it can be readily and easily detached from one iron and attached to another, thus making one handle answer for a number of irons.

Improved Steam Rock Drill.

Joseph C. Githens, New York city.—In describing this invention, on page 122 of our current volume, the following description of an essential part of the apparatus was omitted, owing to an error in the printed copy of the letters patent: The valve-shifting piston is made with hollow ends, a solid center and side ports, and is provided with a sliding band, made with ports at a greater distance apart longitudinally than the small holes or ports in combination with the cap of the steam chest, the sliding valve, the ports opening into the cylinder, and the piston.

Improved Screw Propeller.

Lewis C. Cary and George F. Cary, Portland, Me.—This is a combination of a hollow watertight protecting rim with the blades of a propeller. The protecting rim is constructed of a flat band, an oval band, and the stiffening rim. The object of the bands is to make the ring watertight and buoyant.

Improved Sleeve Button.

Jacob G. Missimer, Trenton, N. J.—The shank is bent at right angles to form a foot. In the outer side of the foot is formed a wide dovetailed groove, to receive a bar, which is made twice the length of the foot. The end of the bar and the foot are pushed through the button hole, which allows the shank to pass into the said button hole. The bar is then pushed forward and locked by a spring catch. To detach the button, a finger is inserted beneath the cuff, and the bar is pushed back, and the foot and bar are drawn out of the button hole.

Improved Gang Plow.

David A. Manuel, Napa, Cal.—The crank axle of the rear supporting wheel swings in a sleeve of the main beam. Both supporting wheels are applied by their crank axles in such a manner to the main beam that they run parallel to the line of draft. Two plows are firmly attached by clips to the main beam between the supporting wheels, and are adjustable thereon to different widths. A thimble is swiveled to an extension of the rear crank arm, and travels in forward or backward direction on a screw sleeve, producing thereby the raising or lowering of the rear wheel by the swinging of the crank axle in the socket sleeve of the main beam, and the setting of the plows to any required depth. A hand lever moves the rear shaft, and lowers or raises thereby the crank axle and wheels, so as to regulate the working of the plows. The direction of the draft beam may, by adjusting nuts and brace, be changed slightly from the line of draft, and thereby the plows thrown to or from the land, as desired. The pole is secured into a tongue socket of the draft beam, and set at the front end to such hight that the weight is taken off from the horses' necks.

Improved Cultivator Frame.

William M. Coston, Quitman, Mo.—This cultivator frame is so constructed that the seat support can be turned over forward, leaving the rear part of the frame wholly unobstructed, so that the machine can be used as a riding or walking cultivator, as desired.

Improved Electro-Magnetic Engine.

Charles A. Hussey, New York city.—This is an improved electro-magnetic engine for running sewing machines and other light machinery, by which the induction currents of the magnets and sparks at the commutator are entirely avoided, and a more perfect utilization of the battery current is produced. The essential features are the stationary magnets having radial arms with T-shaped ends, arranged in alternating position, so that the pole ends of one face the intermediate space between the pole ends of the other; the outer stationary magnets having widening pole ends of T shape at right angles to the arms; the central revolving magnet provided with widening pole ends of double T shape at right angles to the radial arms of the same, and the stationary and revolving magnets having radial arms and widening pole ends whose face width is somewhat larger than the distance between two adjoining pole extremities, so as to lap on the pole ends across the intermediate space.

Improved Paper Pulp Engine.

Alvin Gardner, Windsor, Canada.—A box of six sides has a tapering recess or well formed in its middle part, into which is fitted a tapering ring. In grooves in the face of the tapering ring are secured knives, which are set at an angle. In the cavity of the tapering ring is placed a beveled wheel, to the face of which are attached other inclined knives. To the top of the wheel is attached a scraper, by which the pulp is pushed outward toward the walls of the box. In using the engine, the wheel is raised, the rags to be cut are placed beneath it in the cavity of the ring, and the wheel is lowered upon them. As the wheel is revolved the rags are cut by the knives, the inclination of the said knives preventing the cut from being made short, and tending to produce a pulp with a longer fiber. The inclination of the arms tends to draw the pulp down through the wheel. The scraper enables the engine to be run more slowly, while at the same time producing a proper circulation of the pulp.

Improved Bilge Water Valve for Ships.

Joseph W. Hughes, Newburyport, Mass.—Stops are arranged be tween the timbers to hold the water in the bilge, and self-closing valves are applied to the stops to open and let the water in freely when the ship's sides rise, and close and retain it when they fall.

Improved Shutter Worker.

Jacob D. Hughson, Prairie City, Ill.—The invention consists of an elbow lever pivoted on the window sill inside of the lower sash, with its second joint arranged below the stop and above the sill, and connected by a link with a T-shaped lever. Said lever at one end is pivoted to the sill, and at the other is connected to the lower end of the blind, all in such manner that the blind can be opened and closed readily by merely swinging the first mentioned lever forward and backward. There are stops on a stop plate combined with this lever, so as to hold it for fastening the blind open or closed.

Fertilizer Distributer, Planter, and Cultivator.

Bolivar Scofield, Cartersville, Ga.—To the sand board and sway bar, between the frames, is secured a box, from which two spouts lead down nearly to the ground, the forward spout being intended to conduct the fertilizer to the ground, and the rear spout to conduct the seed to the ground. The front and rear sides of the box have semicircular notches formed in them to receive barrels designed to distribute guano or other fine fertilizer, and to distribute seed. Holes in the barrels may be partially covered to regulate the discharge, and the said barrels are rotated by suitable mechanism. The driver, by operating a lever with his foot, can adjust the three plows to work at any desired depth in the ground, or can raise them entirely away from the ground, as may be desired, and a harrow can be raised from the ground by and with the opening plow. The harrow removes lumps, clods, and rubbish, the opening plow opens a furrow to receive the fertilizer and seed, the fertilizer is deposited in the furrow through the spout close in the rear of the plow, the fertilizer is covered, and the furrow is partially filled by the covering plows. The seed is then deposited through the spout, and covered by a weighted plate.

Improved Bee Hive.

Samuel Hixson, West Newton, Pa.—This is a box hive having a moth trap in connection with the bee entrance. The bee entrance is on the under side of the removable trap, which is grooved on its under edge. The entrance of the moth miller is resisted by the bees, and she is driven to take refuge in one of the grooves, where she lays her eggs, and escapes from the open end of the groove. The worms that hatch from the eggs are easily kept from the bee entrance, and go the other way to gain an entrance to the hive, and, reaching the ends of the grooves, they drop off and fall to the ground.

Improved Colter Attachment.

John S. Johnson, Rockford, Ill.—This consists of devices to attach a revolving colter so that it can be readily adjusted as to hight, to the width of the furrow, and to the line of draft.

Improved Locomotive Engine.

Thomas T. V. Smith, Yarmouth, N. S.—This is a modification of the present ordinary locomotive, so as to admit the use of a wider fire box, to enable broad gage boilers with wide fire boxes to be readily and cheaply altered to the narrow gage, and to admit the use of large locomotives on much narrower gages and cheaper railroads than is now practicable. It is proposed to do away with the ordinary truck in front, supporting the engine by the driving wheels, which are placed so far forward as to clear the fire box, and to introduce a second outside frame running back to the rear of the tender, resting in front on the inner frame, and working upon it with a truck center. The whole is, in fact, a composite carriage, o. which the engine forms the front truck and the tender the hind truck. One feature in the invention is that the overhanging weight of the fire box rests on the outside frame, being free to work horizontally, to allow for the lateral play in passing curves.

Improved Mechanical Movement.

Philip Bellinger, Paoli, Ind.—The invention consists of alternately acting handle levers and treadles, which are applied to a double crank shaft with balance wheel, and also to a second crank shaft turning in pivoted bearings, with an equalizing attachment. The object is to change rotary reciprocating into rotary motion.

Improved Raftsman's Boot Calk.

Rufus D. Guilford, St. Charles, Mich.—This calk is formed from rectangular pieces of sheet steel, struck up in suitable dies, whereby its corners are bent down to form spurs. The calk is secured to a boot or shoe sole by means of a screw.

Improved Rubber Drawers for Invalids.

Maria Bradley, New York city, N. Y.—This invention consists in rubber drawers for invalids, formed of a body open at the sides, and a tube formed integral with the drawers. The tube is made of such a length that it can be led from the invalid to a vessel placed at the side or beneath the bed, to receive the urine as it flows out through said tube.

Improved Stop Motion for Steam Engines.

Thomas Evans, South Manchester, Conn.—This consists of an auxiliary steam cylinder, connected with the main steam pipe, and provided with a weighted valve, and a piston whose rod is connected with the cross head and an air valve of the condenser for interrupting the action of the main steam cylinder on the opening of the cylinder valve.

Improved Packing for Stuffing Boxes.

Richard Greenalch, Greenbush, assignor to himself and William Buchanan, Yonkers, N. Y.—This invention consists of rubber steam packing cut in long pieces shaped transversely to pack around the rod and fill the space between the rod and the box nicely, so that they receive the pressure of the gland in their lengthwise direction instead of crosswise, as commonly arranged.

Improved Chain Pump.

William Webres, Evansville, Ind.—This fits to the barrel, and is also readily repaired by unscrewing the swivel connection with the chain. It is made of rubber and attached to a central bolt, to be held between a disk of the same and a binding swivel screwing thereon, the bolt and swivel turning readily in a swivel at the other end of the bucket. The pump barrel has a longitudinal water drop groove.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

W. T. A. will find a description of rosin oil on p. 266, vol. 31.—L. H. R. and G. B. T. will find formulas for safety valves on p. 330, vol. 32.—H. J. C. will find a rule for ascertaining the increase of temperature of air by compression on p. 133, vol. 33.—A. E. B. can silver looking glass by the process given on p. 234, vol. 30.—L. M. P. will find directions for waterproofing paper on p. 146, vol. 31.—A. M. will find a recipe for a fine boot blacking on p. 283, vol. 31.—M. P. will find directions for bronzing brass castings on p. 283, vol. 31.—C. C. H. will find directions for annealing lamp chimneys on p. 42, vol. 26.—C. H. F. will find directions for photographing on wood in *Science Record* for 1874, pp. 187, 188.—B. C. will find full directions for molding rubber on p. 283, vol. 29.—H. P. D. will find directions for making a polishing starch on p. 203, vol. 31.—G. M. P. can repair rubber hose by the method described on p. 203, vol. 30.—G. A. P. can japan small iron articles by the process described on p. 208, vol. 26.—W. R. McF. can rid his house of ants by the process given on p. 319, vol. 32.—A. B. S. & S. will find that a gold lacquer for brass is described on p. 362, vol. 30.—A. G. A. will find a recipe for marine glue on p. 43, vol. 32. Fish glue is described on p. 408, vol. 24.—B. F. will find directions for gilding picture frames on p. 347, vol. 31.—R. B. R. will find a formula for ascertaining the power of a windmill on p. 241, vol. 32.—E. R., A. E. H., and E. R. will find directions for preserving natural flowers on p. 266, vol. 31.—E. C. L. Jr. will find a description of the process of cutting gears on screw-cutting lathes on p. 187, vol. 29.—W. S. H. will find directions for putting gold lacquer on tin on p. 139, vol. 32.

(1) G. B. R. asks: If the electricity generated in a Rhumkorff coil were changed into electro-motive force, would there be a greater amount than was developed in the battery used to run the coil? A. There would not.

(2) F. G. asks: 1. In a copper and zinc battery, should a wire be attached to each of the plates, and the ends of the wires be connected; or should the wire leading from the copper plate be connected to the zinc by the binding screw? A. A wire should be connected to the copper and another to the zinc. 2. How is the circuit made? A. The circuit is made by connecting the two wires together. 3. When 1 part oil of vitriol to 10 or 12 parts water is used, how long is it before such battery is ready for use? A. The battery will be ready for use as soon as it is set up. 4. If the zinc weighs 1 lb., how much should the copper plate weigh? A. A thin sheet of copper will answer. 5. Can the copper plate in a battery be used a second time? A. Yes.

(3) F. G. S. asks: How long will a well tempered compass needle retain magnetism? A. It would depend upon the quality of the steel and the care with which it was used. It is impossible to state the time without knowledge of the facts.

(4) S. W. says: My battery jars are covered with a coating that breaks off and crumbles easily. It is white in the gravity batteries, and blue in the Daniell. What are the cause and the remedy? A. The white deposit is sulphate of zinc; cause of its formation is that the solution is saturated. Remedy, dilute the solution with water. By painting or greasing the top of the jar, the tendency to creep over will be removed.

(5) A. E. P. asks: 1. I propose laying a telegraph line, ½ a mile long, with No. 23 wire. How many cells of Callaud's battery would it require to run it, the wire in the magnet being No. 21? A. Twelve. 2. Would it be better for that distance to use finer wire on the magnets? A. Yes. 3. What size would be best, and how much should be on each magnet, there being only two sounders in the circuit? A. Use 500 turns of No. 28.

(6) A. W. C. asks: What is the process of deodorizing alcohol? A. Spirit of wine, brandy, or alcohol distilled over soap lose their empyreumatic odors and tastes completely. At about 215° Fah. the soap retains neither alcohol nor wood spirit. The soap employed should contain no potassa; it must be a hard or soda soap, and ought to be completely free from fatty acids or fluids, otherwise it may render the product rancid and impure. Common soap made from olein and soda has been satisfied all the conditions in practice. If this soap be employed, it will be better to add a little soda during the first distillation. Thirty-three pounds of soap is enough for 100 gallons of empyreumatic brandy. Attwood's patent alcohol is deodorized by distillation over permanganate of potash.

(7) J. A. asks: 1. How much (length or weight) fine wire is absolutely necessary for a machine to give a shock that can be sustained comfortably, say 200°? A. From 1 to 3 lbs. 2. Is it necessary to have two thicknesses of wire? A. Yes.

(8) L. K. Y. asks: How is wood naphtha made? A. See p. 138, vol. 33.

1. In what way is perchloride of iron made? A. Dissolve pure protoxide of iron in dilute muriatic acid, and crystallize the salt out by evaporation of the solvent. 2. How can I make nitrate of iron? A. Dissolve pure iron or its oxides in nitric acid until it will dissolve no more; filter the solution and evaporate to dryness over a water bath. The residue should be redissolved in hot water and the solution again filtered and evaporated as before, in order to remove any basic salt that may have formed, and as much of the superfluous nitric acid as possible.

What do you mean by a primary coil and a secondary coil? A. See p. 115, vol. 33.

(9) W. E. E. asks: What cement or putty is best to use on a chamfered slate joint which is exposed to the sun's heat, cold, etc.? A. The form you have adopted for the joint is not very favorable for retaining the packing; a better form would be that of a plain butt joint, and this would be still better if provided with a firm blade between to receive the packing of each slab alone, independent of the adjacent one. We know of no cement that will answer your purpose so well as one formed in great part of asbestos. Of course the composition of the best of these, such as have been proved of value in practice, is not divulged by their proprietors. We understand, however, that they are furnished as articles of commerce.

(10) H. C. B. says: We have a dispute as follows: I affirm that to make an inside chaser from a hub to chase a right hand inside thread correctly, a left hand hub must be used, or, in other words, a right hand hub will make a left hand inside chaser. I do not affirm that the thread cannot be cut with either; but, that the thread may have the correct pitch, the left hand hub must be used. Am I right or wrong? A. Right. For complete explanation, see No. IV. of "Practical Mechanism."

(11) I. H. M. Jr. asks: How can I print from a plate of bichromated glue (acted on by a photographic negative) on common paper, with printer's ink? A. Coat evenly a glass plate with a strong solution of gelatin in water, and when dry, flow over this a filtered solution of bichromate of potassa in water. Expose this to strong sunlight for a short time. Repeat this operation—with gelatin and potash bichromate, as before—several times until a good background of insoluble gelatin bichromate is obtained. Then prepare the plate in a darkened room as at first, and expose under the negative as in solar printing; an exposure, with a good light, for from fifteen to twenty minutes is usually sufficient. On removing the negative, place the bichromate plate immediately in a large quantity of clean cold water in a dark place, and allow it to remain immersed several hours. The water should be changed in the mean time, in order that all the unchanged gelatin bichromate should be completely dissolved. The film may then be removed from the glass plate, dried, and mounted on a slab of lead or zinc for printing.

(12) A. B. C. asks: How can I toughen steel tools, such as gravers, etc, to make them retain a good sharp edge for cutting gold and other metals? A. If you use any of the best grades of tool steel, and leave them hardened right out, without drawing the temper at all, your gravers will stand and cut well.

(13) F. H. of Berlin, Germany, asks: Which electromagnets will be the strongest of these two: One has one coil of thick wire, and the other has two or more coils of thin wire wound around it. The sizes of the magnets as well as the weight of the copper in the wires are supposed to be the same in both cases, as well as the current used for magnetizing. A. Probably the single coil of thick wire. It would depend, however, upon the resistance of the wire and battery. When the resistance of the wire and battery are equal, the maximum magnetic effect is secured.

(14) L. N. B. asks: 1. How can I nickel plate bars of iron 3x1½ inches? A. Various solutions for nickel plating have been suggested, but perhaps one of the best, at least one highly recommended, is that containing the double salt of nickel and ammonium. This is prepared by dissolving 1 part by weight of sulphate of ammonia and 2·13 parts sulphate of nickel, in sufficient water to make a saturated solution, a little more water being added afterwards to prevent any tendency to crystallize. Considerable trouble is usually experienced by the amateur in his efforts to obtain a good deposit. The principal difficulty, however, consists in the management of the operation, and the necessity of employing a proper anode, which is rather hard to obtain. The anode should present a surface in excess, if anything, of that of the object to be coated, and the battery power must be carefully regulated to the work required. Unless this is done the deposit is apt to contain gas, which is always evolved in greater or less quantities with the deposition of nickel, and this is liable to make the deposit porous or flaky. A good plan is to use two or three Grove or Bunsen in series, until a slight coating is obtained, after which a single Smee cell, of proportions depending on the size of the object to be coated, should be used to complete the operation. It is well, also, to keep the solution alkaline by adding a little ammonia from time to time. 2. What battery is the best for such purposes? A. The Smee.

(15) V. C. asks: How must I proceed to repair the soldered parts of double-barreled guns, using no tools but the copper bit? A. Clean the parts to be soldered, and apply to them muriatic acid which has been killed with zinc. Warm the parts, and solder in the usual way with fine solder.

(16) G. A. says: In your paper on the slide valve, by Joshua Rose, he leads me to infer that an engine, when just beginning to take steam, should have its exhaust port about two thirds open. In looking at our valve and the ports in steam chest, I find that ours is not more than one fourth open. The engine makes a groaning noise when loaded or partly so. What had I better do to ease it a little? Would it be best to lengthen the valve? A. Your valve should be lengthened. At least ¼ inch more lap should be added to each end: this involves the necessity of a new eccentric to increase the valve travel, which should not be less in your case than 3½ inches.

(17) L. says: I have a lathe, the spindle of which revolves in a very soft and fusible alloy. As the bearing has worn out of true, I wish to cast a new one. What is a good alloy? A. You cannot do better than use the best grade of Babbitt metal; or mix and use the following: Zinc 17 parts, copper 1 part, antimony 1½ parts.

(18) H. S. asks: What is the pressure of water per foot of current of a river 10 feet deep, moving at 5 miles per hour? A. The pressure will vary with the depth, and may be best ascertained by making a piece of board a foot square, and suspending it like a swinging sign in the river current. A cord attached to opposite points of its surface and to a spring balance will practically answer your query.

(19) G. H. W. asks: Please give me the proper size of propeller, engine, and boiler for a boat 36 feet long, 6 feet wide, drawing 1½ or 2 feet of water. I want the boat to go at a speed of 16 miles an hour. A. Most builders would hesitate to guarantee such a speed for so small a boat, at least without the inducement of an extraordinary price.

(20) E. P. says: In your issue of August 28 you say: "Ice boats very frequently travel faster than the wind that drives them." I, with several other engineers, would be glad if you would give us the facts or philosophy on which this statement is founded. In our view, it is plain that, if a boat moves faster than the air around it, its sails must displace the air in front of them. Now where does it get the force to do this? The proposition that a moving body which gets and retains its force and motion only from the moving air can do this, involving as it does the corollary that the pressure of the air in front of the sails is greater than the pressure behind them, appears to us to be an absurd idea which we cannot for a moment believe that you would entertain. A. This ice boat question has been frequently discussed in our columns, and explanations given with diagrams showing the lines of the forces and why the boat moves faster than the wind. Our esteemed correspondents are referred thereto. Consult, for one example, page 170, vol. 28. But if any of them are unable by a study of the theory to satisfy themselves of the fact, we advise them to construct an ice boat this winter and try the experiment practically. They will find that, with a properly constructed machine, skilfully steered, in a wind moving say thirty miles an hour, they can travel from forty to fifty miles an hour, or more, according to the state of the ice. If prevented from experimenting, let them read the New York daily papers which in winter contain frequent accounts of ice boat regattas on the Hudson river, giving the velocity of the wind and the increased speed of the boats over the wind.

(21) J. M. G. asks: How can we Texas farmers destroy the countless swarms of rabbits which nearly destroy our growing crops of wheat, and make sad havoc among our garden stuff? A. Enclose a space with wire netting, leaving room for the rabbits to enter, and bait it with carrots. In the winter, large numbers can be attracted to a spot by this means.

(22) J. E. P. asks: Do you know of any preparation to cover a rough laid brick wall with in place of mastic? A. To stucco a rough brick wall, make a mortar consisting of 1 part lime to 2 parts sand; add water and work it up thoroughly. But to make reliable work, the lime and sand must be of the best, and properly prepared before being mixed. Take a good fresh stone lime; slake it just sufficient to make a fine dry powder and not a paste. Throw this powder against a ¼ inch mesh wire screen; what passes through is fit for use, the remainder should be rejected. The sand must be of the sharpest, screened to a uniformity of size, and washed thoroughly clean of all mud and dirt. Clean the wall of all loose dirt, mortar, etc., with a stiff broom. Then apply the mortar in two coats; the first a rough coat to bring the wall to a fair surface, and the second a finishing coat. Put on the second coat before the first is entirely dry. Also, put in a little cream water color, to as to set with the stucco. The wall should be protected at top by a projecting roof.

(23) J. V. H. says: I find that the lead pipe carrying off water from my bath and washstands is becoming clogged up. Can you tell me of a remedy? A. Pour a little strong ammonia down the pipe.

(24) F. L. says: 1. I have an engine 3 x 6 inches, and intend to run a propeller 30 inches in diameter. What size of boiler would be suitable? A. A tubular boiler 28 inches diameter by 4 feet high would probably be large enough. 2. I have an awning for a boat. How can I make it waterproof? A. Cover it first with a solution of soap, then with a solution of alum.

(25) E. G. A. says: I am continually seeing statements to the effect that, during a thunderstorm, the electricity passed down the lightning rod, escaping into the ground. Is not the reverse the case? Does not the electricity pass from the earth up the rod and neutralize the electricity of the cloud overhead? If not, why not put a ball on the upper end of the rod and point the lower, for has not experiment demonstrated that electricity will flow off a point with more rapidity than off a round surface, and the reverse in passing on? If this be not the case, what is the necessity of placing balls on the posts of an electrical machine and points on the ends of the spokes of an electrical wheel? A. It is conventionally assumed that the current always passes from positively to negatively electrified bodies, so that what we call its direction depends altogether upon which is the positive and which the negative body. As a matter of fact, the atmosphere is usually positive relatively to the earth; but it is evident that the action of the clouds upon each other, under the influence of different currents of air, may result in charging them with opposite electricities. When the conditions are favorable, they then act inductively on the earth, the positive cloud inducing a negative charge in the portion directly under its influence, and the negative cloud a positive charge. If a rod is present or the degree of electrification is sufficiently great, a discharge takes place from the earth to the cloud in one case, and *vice versa*

in the other. It is not correct, therefore, to say that the discharge is always in the same direction when referring to any one rod. Points receive and give off charges more readily than surfaces do. It is in consequence of this fact that round surfaces are used with the electrical machine, and points with lightning rods, the object being an accumulation of electricity in one case and its dissipation in the other.

(26) J. W. S. asks: How can I render pasteboard uninflammable? A. Soak your pasteboard in a solution of tungstate of soda, and dry in the sun.

(27) E. G. A. asks: 1. Have there ever been any experiments made to ascertain the relative size of the atoms of various substances? Respecting the constitution, shape, size, and absolute weight of elementary atoms, chemists know nothing; but they have proved that the atoms of hydrogen are lighter than those of any other element, and they have discovered how many times heavier each elementary atom is than an atom of hydrogen. Thus, we know how many times heavier an atom of carbon is than an atom of hydrogen; and the so-called atomic weight of carbon is a statement of its atomic ratio. 2. Do all atoms weigh the same, or do they vary in different substances? For example, does one atom of aluminum weigh the same as one atom of platinum? A. They vary; hydrogen being 1, aluminum is 27·48, and platinum 197·88.

What do the best authorities decide is the cause of gravitation? A. It is an inherent property of every particle of matter in the universe to attract every other particle, with a force directly proportioned to the mass of the attracting particle, and inversely to the square of the distance between them. A satisfactory hypothesis has never been offered in explanation of the cause of this universal attractability of matter.

(28) B. asks: Can earth and calcareous sand, containing from 10 to 30 per cent of sulphur, be separated by any other method than the Sicilian kiln or *calcaroni*? If so, where can I find the process? A. Consult Wagner's "Chemical Technology," pp. 194 to 199. See also p. 296, vol. 31 of the SCIENTIFIC AMERICAN.

(29) S. L. L. says: I have been trying to obtain oxygen gas from water by means of sulphuric acid and chloride of lime. I knew that the sulphuric acid would unite with the lime, setting free the chlorine, which, uniting with the hydrogen of the water, would, I thought, permit the oxygen to pass through a capillary tube, and be shown by the application of flame. I saw the gas rise in the tube: but it would not affect the flame when a match was applied. What was the reason? A. Your reaction simply gives you sulphate of lime and chlorine water. Under the existing circumstances, the chlorine does not attack the hydrogen.

(30) G. L. asks: What is oxphosphate of iron? A. There is no such substance.

What is the process of condensing milk? A. See p. 343, vol. 30.

(31) C. P. W. says: I. What is the green substance that is formed when unbrowned coffee is put into the white of an egg? A. It is a compound resembling tannate of gelatin. 2. In Youmans' "Chemistry," it is stated that tea arrests transformation; in a work entitled "Foods," it is stated that tea hastens transformation. Which is correct? A. The best series of experiments on this point are by Julius Lehmann, who found that the use of tea and coffee as articles of diet appeared to exercise an important influence in retarding the waste of the tissues of the body.

(32) T. F. H. says: I have a set of silver articles with black wooden handles which have turned brown in color by being buried in a damp bank vault. What can I use to stain the handles black and restore the polish? The wood is very hard, I presume ebony. A. Dip the handles in a boiling solution of weak caustic alkali, to dissolve all the grease; dry, and apply a solution of nitrate of silver. It will be necessary, often, to apply two or more coats of the nitrate of silver.

(33) J. E. asks: Is there any perceptible shrinkage in gas in consequence of the gasometer pit leaking and being renewed with water? In other words, does fresh water require to be saturated to a certain degree with gas before the gas holder will rise, a portion of gas being absorbed every time more water is added? A. There will be a slight absorption of the gas by the water. The two principal ingredients of coal gas are hydrogen and marsh gas, and 1 cubic inch of water absorbs 0·0015 cubic inch of hydrogen, and 0·035 cubic inch of marsh gas. There will be no stoppage in the rising of the gas holder on account of this slight absorption.

(34) A. S. asks: What will remove mud spots from heavy black silk? A. The safest plan is to wash carefully with good soap.

(35) G. A. F. asks: 1. Is cow or horse manure better for lettuce, beets, cucumbers, etc., and why? A. The latter, as it is more highly nitrogenized. 2. In what kind of soil should musk melons be raised? A. A rich sandy soil.

I recently purchased a fine specimen of calamine, purporting to come from Arizona. Does that territory contain that mineral? A. If so, it must be in a new locality as yet unknown to mineralogists in the East.

(36) C. L. asks: What are the methods of obtaining the silicious and aluminous ethers? I believe they were discovered some few years ago (6 or 7) by Mr. Theophile Zchweskofski. A. Dibasic silicate of ethyl ($2C_4H_5O, SiO_2)_2$ is formed by adding alcohol gradually to chloride of silicon. A powerful reaction occurs: hydrochloric acid is evolved in abundance, and a colorless liquid is obtained, which, when submitted to distillation, at first evolves hydrochloric acid; but the boiling point rises rapidly until it reaches 330° Fah., at which temperature pure dibasic silicate of ethyl distils over. It is a limpid liquid, of a pleasant ethereal odor, and a hot taste resembling that of pepper. It is combustible, and burns with a flame of dazzling whiteness, depositing pulverulent silica. The composition of this body is remarkable, 4 volumes of vapor being produced from the compound, $C_{16}H_{20}Si_2O_8$: favoring the hypothesis of the tetratomic character of silicon, with an atomic weight of Si = 28. This ether is not miscible with water, but is decomposed by it, with the separation of gelatinous hydrate of silica. Silicic ether (C_4H_5O, SiO_2) is a second ether, containing only half the quantity of oxide of ethyl that is present in the foregoing compound. It may be procured by acting upon alcohol of specific gravity 0·833 with chloride of silicon, and distilling. The dibasic silicate is formed at the same time, and the first portions of the distillate consist entirely of this compound; but by degrees the boiling point becomes higher, and when it reaches 660° Fah. the pure monosilicate passes over. The dibasic silicate of ethyl is, in fact, transformed into the monobasic silicate by the action of the water present in the dilute alcohol, occasioning the decomposition of the dibasic silicate into the monosilicate, while alcohol is set free. If more water be added, a viscous compound is obtained, which, according to Ebelman, contains a third ether, with twice as much silicic acid as the foregoing one. Aluminic ether or aluminum ethyl, Dr. Cossa states, can be prepared by causing aluminum to act upon stannethyl. For further particulars of processes, consult Wurtz' *Dictionnaire du Chemie*, vol. 1, p. 1,352.

(37) J. E. L. says: I have an article of pearlash containing 14 per cent of phosphate of potash. What will be the most economical process for separating it from the carbonate? I desire to get a perfectly pure carbonate, and to utilize the phosphate. A. It cannot be done cheaply. It would be necessary to convert one of these soluble bodies into an insoluble, and then reconvert it into the original condition.

(38) H. R. P. asks: What effect does chocolate have on the system? A. Chocolate, when properly prepared, is considered by physicians as a very wholesome and nutricious substance.

(39) J. H. M. asks: Can ammonia be distilled or obtained from common sea weed? A. Ammonia can be obtained by distillation, in closed vessels, of organic matters containing nitrogen. A large amount is obtained from the refuse product of the distillation of coal for the manufacture of gas. Among the products are water and a considerable quantity of carbonate and hydrosulphate of ammonia; the ammoniacal salts become dissolved in the water, and constitute the ammoniacal liquor of the gas works: this liquor is saturated with sulphuric or hydrochloric acid, and thus the sulphate or muriate of ammonia of commerce is procured.

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

G. W. H.—No. 1 is impure limestone. No. 2 is argillaceous shale colored by red oxide of iron (the blue portions by carbonate of copper in traces). In some pieces the amount of iron is considerable. No. 3 is the same but with less iron.—J. M. H.—You had better consult the druggist from whom you obtained the pills.—J. R.—No. 1 is sulphide of lead with silex. It has been fused previously. Of No. 2 the part insoluble in acid is silex: the remainder is composed principally of iron with some alumina. No. 3 is quartz and sulphide of iron. No. 4 did not arrive. No. 5 is sulphide of iron partly altered to oxide.—B. F.—No. 1 is chlorite rock. No. 2 is quartz rock. No. 3 is steatite rock with quartz vein. No. 4 is talcose schist. No. 5 is talcose schist with talc. No. 5 is quartz with chlorite and decomposed micaceous schist. No. 7 is quartz rock. No. 8 did not arrive. No. 9 is a jaspery quartz. No. 10 is quartz rock with traces of iron and manganese. Although some of these specimens have the appearance of gold bearing rocks, the fact could be ascertained only by assay on a considerable quantity of ore.—G. P. L. R.—No. 1 is decomposed granite. No. 2 is white porcelain clay.—A. W. D.—It is hornblende, containing silica, alumina, lime, magnesia, and iron, but is not of value.—J. B.—It is milk quartz and is not valuable.—A. J. G.—Gold is not present.—G. H. C.—It is pyrites.—P. H. L. and J. I.—It is iron pyrites, of little value.—C. R. T.—It owes its peculiar character to a large percentage of red oxide of iron.—A. T. H.—It is a variety of granite rock, and may be used in building.

COMMUNICATIONS RECEIVED.

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

On Cotton Mathematics. By H. V. M.
On a Power Manual. By A. S. R.
On Astronomical Calculations. By S. D. S.
On Heating Churches. By J. I. S.
On Wagon Wheels. By P. K. W., and by G. A. G. Jr.
On the Keely Motor. By F. W. Jr.
On Electric Force. By F. S. P.

Also inquiries and answers from the following:

J. B. N.—J. B.—E. L. E.—W. R. H.—G. E.—I. E. S.

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 inquiries analogous to the following are sent: "Who sells the best washing machine? Whose is the best cross-cut saw? Why do not makers of magic lanterns advertise in the SCIENTIFIC AMERICAN? Is there a really fireproof and burglar-proof iron safe? What does a Rhumkorff coil, capable of giving a 12-inch spark, cost?" All such personal inquiries 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.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending

September 7, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air engine, A. K. Rider	167,568
Alarm, burglar, W. A. Parker	167,559
Amalgamator, C. H. Aaron	167,486
Auger. earth, W. Low	167,455
Barrel bung, W. E. White	167,419
Barrels, lining oil, A. Rieder	167,569
Battery, galvanic, B. F. Dawson	167,510
Bell, door, F. G. Daniels	167,508
Billiard table, C. Joergens	167,540
Billiard table cushion, H. W. Collender	167,501
Blasting, cartridge case for, P. A. Oliver	167,465
Boats, hinged mast for, Davenport & Porter	167,439
Boiler, cast iron sectional, J. F. Daniels	167,438
Boiler plates, punching, J. Morgan	167,461
Boiler, steam, J. H. Wilkinson	167,595
Boiler. water tube. J. D. Pierce	167,562
Bolt and rivet machine, J. C. Getz	167,522
Book, copy, E. F. Goodman	167,447
Boot, H. Hall	167,450
Bottle stopper, F. Haury	167,530
Boxes, machine for trimming, A. Stearns	167,583
Burial case, D. W. Hunt	167,451
Burner, vapor, C. H. Prentiss	167,471
Butter mold, P. Shaw	167,476
Butter worker, P. Shaw	167,475
Can opener, W. D. Skidmore	167,577
Car coupling, E. Lewis	167,454
Car coupling, A. Smith	167,477
Car platform, G. M. Brill	167,385
Car replacer, O. J. Williams	167,421
Car starter, Hastings & Naves	167,528
Car. street. J. Stephenson	167,585
Car trucks, R. McNulty	167,405. 167,406
Carbureter, D. L. Westcott	167,592
Carriage, child's, H. C. Moody	167,459
Cartridge case for blasting, P. A. Oliver	167,465
Cattle stall, Marsh & Bell	167,551
Check rower, L. J. Odell	167,557
Chuck, planing, G. V. Seaver	167,572
Churn, J. F. Coe	167,500
Churn dasher, Bright & De Guire	167,493
Churn dasher, G. W. Eichholtz	167,512
Cistern cut-off, T. B. Harrison	167,526
Clasp, dress supporter, E. A. Bliss	167,428
Cloth-scouring machine, C. Franke	167,396
Coats. apparatus for shaping, C. Franke	167,394
Cock, stop, C. Franke	167,397
Cock, stop, C. F. Murdock	167,463
Coffee, glazing roasted, Bell & Conrad	167,383
Coffin screw, W. M. Smith	167,578
Compass, mariner's, G. Iles	167,452
Cooker, feed, Fisher & Wickkiser	167,516
Cork for stoppers. preparing, C. H. Frash	167,521
Corn dropper, check row, J. W. Fawkes	167,514
Corn-shelling implement, J. M. Wilson	167,579
Cotton sweep, M. Call	167,494
Cultivator, M. McNitt	167,458
Dental plates. D. M. Lamb (r)	6,333, 6,334
Derrick, B. Freeman	167,398
Desk, reading and writing, E. W. Stiles	167,586
Die stock, V. J. Reece	167,472
Door check, W. Vanderventer	167,590
Drill, ratchet, H. C. English	167,392
Easel, parlor, E. G. Chormann	167,432
Eaves trough hanger, J. P. Abbott	167,422
Egg stand and boiler, Woods & Sherwood (r)	6,632
Eggs, batter of, W. O. Stoddard	167,587
Elevators, automatic brake for, H. Pearce	167,560
Engine, direct acting, J. R. Paddack	167,408
Engine, rotary, L. Adams	167,489
Engine, steam, H. Davey	167,509
Engraving machine, R. W. Johnson	167,542
Eraser, india rubber. R. Lockwood	167,455
Fence post, G. W. Hatch	167,529
File, Carr & Wilcox	167,495
Filter, submerged, J. W. Lefferts	167,546
Fire kindler, D. Frankfoder	167,520
Fire place grate, J. Bawden	167,426
Fire plug. J. A. Stacey	167,582
Fruit dryer, Lowman and Creps	167,549
Fruit jar, J. H. Cowl	167,437
Furnace, F. P. Dimpfel	167,441
Furnace, H. M. Smith	167,579
Furnace, locomotive boiler, W. F. Grassler	167,448
Furnaces, feeding air to, W. J. O'Neal	167,467
Gas, making heating, J. M. Ayer	167,491
Gas light globe, T. Trudeau	167,417
Gas main dip pipe, P. Munzinger	167,555
Gas regulator, J. Adams	167,488
Gas stove, J. J. West (r)	6,636
Gate, Redmond and Rhodes	167,567
Gems, setting, H. G. Mackinney	167,457
Glass monument, A. Pfeiffer	167,470
Glazier's diamonds, P. Sinsz	167,575
Grain-cleaning machine, G. E. Throop (r)	6,629
Grate bar. E. N. Schmitz	167,571
Grindstones, forming artificial, G. Hart	167,527
Gunpowder, manufacture of, H. Courteille	167,503
Harness saddle, J. F. Knox	167,544
Harrow, J. B. Greene	167,449
Harvester, A. J. Cook	167,387
Harvester, J. S. Fowler	167,519
Hat and cap, Isidor and Hein	167,538
Hat-pressing machine, M. A. Cuming	167,506
Hat-stretching machine, R. Eickemeyer	167,391
Hats, stiffening, R. Eickemeyer	167,513
Heating buildings, C. Franke	167,395
Hinge, A. H. Isham	167,537
Hinge, D. Skidmore	167,576
Hook, snap, H. C. Goodrich	167,399
Horse power, O. O. Storle (r)	6,631
Ice cutting machine, J. Schater	167,413
Ironing apparatus, H. E. Smith	167,580
Keys, machine for making split, W. H. Fox	167,445
Knit goods, etc., uniting, H. A. Blanchard	167,492
Knitting stockings, etc., Polle and Keisker	167,563
Lamps, funnel for filling, H. H. V. Lilley	167,548
Land roller. E. H. Adams	167,380
Lantern, pocket, J. Stevens	167,479
Lightning rod, W. H. Spang	167,415
Link, W. A. Ingalls	167,453
Locomotive boiler furnace, W. F. Grassler	167,448
Locomotives, reversing gear for. J. Ord	167,468
Loom for weaving matting, S. Kuh	167.535
Loom shuttle binder, J. H. Moore	167,460
Loom stop motion, B. F. Arnold	167,381
Looms, take up pawl for, S. S. Walker	167,418
Marking pot, W. H. Rodden	167,473
Masts for boats, hinged, Davenport and Porter	167,439
Metallic vessel. E. T. Covell	167,504
Mill, grinding, G. Selsor	167,573
Mirror, toilet. H. Palmieri	167,558
Miter, level, and plumb, combined, J. Murray	167,556
Muff, head, I. B. Kleinert	167,543
Music leaf turner, F. G. Johnson	167,541
Nail cutting machine, W. Wickersham	167,420
Napkin holder, C. Rowland	167,411
Neck tie, A. P. Damon	167,507
Nozzles, joint for hydraulic, J. J. Crawford	167,505
Nut lock, J. G. Perry	167,469
Oar lock, G. H. Hurd	167,536
Organ reed boards, A. W. Wilcox (r)	6,697, 6,638
Ovals, machine for cutting, J. E. Howard *et al.*	167,534
Pantaloons former, C. Franke	167,393
Paper bag holder, G. H. Cleveland	167,434
Paper collar and cuff machine, E. Wilder	167,484
Paper making cylinder, S. Sellers	167,574
Pavement, Abbott and Cranford	167,423
Peat machine, C. H. Williams	167,596
Penholder, D. M. Somers	167,581
Photographs, coloring, W. W. Williams	167,485
Pianoforte, G. C. Manner	167,403
Planing chuck, G. V. Seaver	167,572
Planter, corn, E. E. Matthews	167,552
Planter, cotton, J. B. Onan	167,466
Plow, side hill, R. I. Knapp	167,402
Plow, sulky, E. W. Russell	167,474
Portfolio stand, D. J. Steen	167,584
Power regulator, spring, O. Collier	167,435
Propeller for vessels, F. Jacob	167,539
Propelling machine, J. J. Flack	167,517
Propelling mechanism, L. W. McKenney	167,553
Pump, force, F. W. Clarke	167,433
Pump valve. T. Maguire	167,550
Pumps, strainer for, L. Blass	167,437
Purifier, flour and middlings, A. M. Comstock	167,502
Railroad rail joint, S. H. Witmer	167,985
Railroad switch, C. C. Coats	167,499
Railway, elevated, W. Harrison	167,401
Railway signal, detonating, F. Hickman	167,532
Rake, horse hay, Downing & Van Campen	167,390
Rake, horse hay, J. Hollingsworth	167,533
Rattan, treating, C. Newman	167.409
Refrigerator, H. H. Barnes	167,425
Refrigerator, H. G. Gleyre	167,446
Register, hot air, E. A. Tuttle	167,480, 167,481
Rein holder, Porter, Hawes, & Page	167,564
Respirator and inhaler, J. Carrick	167,496
Roller & harrow, A. P. Allen	167,490
Sad iron heater, G. W. Cottingham	167,389
Salt, deposits from tubes in, W. C. Halliday	167,524
Sash pulley, J. Smith	167,478
Saw mill head block, Dilger & Dunn	167,511
Sawing machine, Pease & Whitacre	167,561
Scaffold, L. W. Swafford	167,588
Seal metallic, F. C. Hamilton	167,525
Separator, grain, L. C. Royer	167,570
Sewers and sinks, emptying, R. Boeklen	167,384
Sewers, manhole cover for. D. H. Fernald	167,444
Sewing cabinet, A. Tostevin	167,589
Sewing machine, W. G. Beckwith	167,382
Sewing machine, W. L. Fish	167,515
Sewing machine plaiter, W. Walker (r)	6,635
Sheet metal, corrugating, W. B. & O. P. Scaife	167,412
Shoe pegs, making, F. D. Ballou	167,424
Shoemakers, cutter wheel, etc., J. W. Carver	167,430
Soldering machine, L. P. Merriam	167,554
Sole channeling machine, L. Goddu	167,523
Sofa, T. Ramsden	167,565
Spinning ring, W. Jenckes (r)	6,628
Spoke socket, A. Clist	167,498
Spoke tenoning machine, C. W. Latham	167,547
Square, W. H. Walker	167,482
Stove, gas, J. J. West (r)	6,636
Stove heating, M. C. C. Church	167,497
Stove, heating, Raymond & Campbell	167,566
Stove heating, T. White	167,594
Stove polishing machine, P. H. Walsh	167,591
Table, ironing, Hughes and Lockard	167,535
Table slide, extension, Maxwell & Peaster	167,404
Tar from seaweed, obtaining, W. H. Ruddick	167,410
Thill coupling, F. Chapman	167,431
Ticket case, I. White	167,593
Ticket reel, A. Stephenson	167,416
Tile, illuminating, T. Hyatt (r)	6,630
Trap, fly, R. Nutting	167,464
Trap, hog, W. Deatherage	167,440
Tunneling machine, O. B. Dowd	167,442
Umbrella tip cup, F. S. Brown	167,429
Undergarment, S. T. Converse	167,436
Valve, balanced, G. Mossop	167,462
Wagon, dumping, P. & J. Heilman, Jr	167,531
Wagon seat, S. B. Conover	167,388
Wagon spring, M. Feigel	167,443
Washing machine, D. Warnock	167,483
Watch regulator, R. S. Mershon	167,407
Wells, shutting off water from, J. P. Gordon	167,400
Wheat steamer and equalizer, Sims & Hosick	167,414
Whip socket, H. Fowler	167.518
Windmill, S. M. Abbott	167,487
Window screen, J. E. Chase	167,386

DESIGNS PATENTED.

8,594 and 8,595.—CARPETS.—T. Barclay, Lowell, Mass.
8,596.—PLATED BAND.—R. Christesen, W. Meriden, Conn.
8,597.—COFFEE MILLS.—J. Girard, New Britain, Conn.
8,598.—CARPETS.—H. F. Goetze, Boston, Mass.
8,599 to 8,603.—CARPETS.—E. Guiraud, New York city.
8,604.—MATCH SAFES.—T. B. Harkins, Bristol, Pa.
8,605.—GASELIER.—C. Herter, New York city.
8,606.—CARPETS.—J. E. Hill *et al.*, Philadelphia, Pa.
8,607.—CARPETS.—A. Lilley, Lowell, Mass.
8,608 and 8,609.—CARPETS.—D. McNair, Lowell, Mass.
8,610 to 8,635.—CARPETS.—J. M. Christie, Kidderminster England.
8,636.—FABRICS.—E. C. Clark, Rockville, Conn.
8,637 to 8,642.—CARPETS.—C. W. Swapp, Lowell, Mass.
8,643.—SHAWLS.—H. Berg, Philadelphia, Pa.

8,644.—TYPES.—H. Ihlenburg, Philadelphia, Pa.
8,645.—BOA.—G. H. Prindle, Philadelphia, Pa.
8,646.—TRIMMING.—G. H. Prindle, Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
September 8 to 14, 1875.

5,147.—J. Hall, Toronto, Ont. Revolving reel bake ovens. Sept. 8, 1875.
5,148.—G. H. Jones, Rose, N. Y., U. S. Mold for casting turbines. Sept. 8, 1875.
5,149.—R. Wheeler, Bell Ewart, Ont. Extension stove leg. Sept. 8, 1875.
5,150.—P. S. Laurent et al., Sherbrooke, P. Q. Stove heater. Sept. 8, 1875.
5,151.—W. A. McClintock, Pittsfield, Ill., U. S. Seed drill. Sept. 8, 1875.
5,152.—C. Hood, Hartford, Conn., U. S. Combined ladder and wash bench. Sept. 8, 1875.
5,153.—C. Boeckh, Toronto, Ont. Fiber and bristle combing machine. Sept. 8, 1875.
5,154.—J. H. Sheldon, Chicago, Ill., U. S. Illuminating gas. Sept. 8, 1875.
5,155.—G. H. Thompson, Oneida, Ont., et al. Device to prevent horses from jumping over fences. Sept. 10, 1875.
5,156.—J. D. Mann, Kentville, N. S. Snow plow. Sept. 10, 1875.
5,157.—J. Guest, Jr., Merrickville, Ont. Churn power. Sept. 10, 1875.
5,158.—R. Gilchrist, Louisville, Ky., U. S. Extension ladder. Sept. 10, 1875.
5,159.—J. Edgar, New York city, U. S. Coal shovel. Sept. 10, 1875.
5,160.—J. W. Mann, Woodhouse, Ont. Seed sower. Sept. 10, 1875.
5,161.—F. M. Gardner, Hornellsville, N. Y., U. S. Lifting attachment for shovels and forks. Sept. 10, 1875.
5,162.—C. B. Long, Worcester, Mass., U. S. Machine for crimping leather. Sept. 10, 1875.
5,163.—W. D. Ewart, Chicago, Ill., U. S. Drive chain. Sept. 10, 1875.
5,164.—L. Glynn, Cambridgeport, Mass., U. S. Pipe wrench. Sept. 10, 1875.
5,165.—H. W. White, Oskaloosa, Iowa, U. S. Guitar head. Sept. 10, 1875.
5,166, 5,167.—H. W. White, Oskaloosa, Iowa, U. S. Chin rests for violins. Sept. 10, 1875.
5,168.—A. Manbré, Penge, England. Process of extracting sugar, etc. Sept. 10, 1875.
5,169.—J. Commins, Charleston, S. C., U. S. Composition for kindling fires. Sept. 10, 1875.
5,170.—A. F. Skidmore et al., Litchfield, Minn., U. S. Machine for cutting hoops. Sept. 10, 1875.
5,171.—I. C. Richardson, Nashua, N. H., U. S. Steam heating apparatus. Sept. 10, 1875.
5,172.—E. B. White, Arkona, Ont. Barrel and circular box. Sept. 10, 1875.
5,173.—H. Wanby, Toronto, Ont. Stone pipe stone mold. Sept. 13, 1875.
5,174.—E. Biddle, Carlin, Nevada, U. S. Hydraulic jack. Sept. 14, 1875.
5,175.—J. Rice, Black Brook, N. B. Roller hoisting apparatus. Sept. 14, 1875.
5,176.—J. Regan, Ottawa, Ont. Framings and molds to make wells, drains, etc. Sept. 14, 1875.
5,177.—J. B. Clark, Plantsville, Conn., U. S. Dies for heading and squaring bolts. Sept. 14, 1875.

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WANTED—Foreman for Blacksmith Shop. A competent man can obtain steady employment by addressing the undersigned. None need apply but such as have had experience, and can furnish satisfactory references as to character and ability. WARDER, MITCHELL & CO., Manufacturers of Champion Reapers and Mowers, Springfield, Ohio.

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Save 25 PER CENT. in FUEL.
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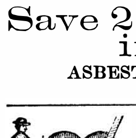

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STEAM ENGINES, STEAM BOILERS.
SAW, FLOUR AND GRIST MILLS.
MILL GEARING MADE
Without Patterns.
SHAFTING, PULLEYS AND HANGERS
A Specialty.
POOLE & HUNT.
SEND FOR CIRCULARS. BALTIMORE, MD.

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MOUNT VERNON, OHIO,
MANUFACTURERS OF FIRST CLASS STATIONARY ENGINES, 8 to 100 H. P., PORTABLE ENGINES, CIRCULAR SAW MILLS, STEAM BOILERS, ROTARY BOILERS, MILL AND FACTORY MACHINERY, &c., BUILD GRIST MILLS, guaranteeing 80 BARRELS FLOUR WITH ONE TON BEST COAL, or **50 Barrels Flour with One Cord Best Wood**; also, Engines to run on 3 lbs. coal per hour per indicated horse power. ☞ Send for circulars.

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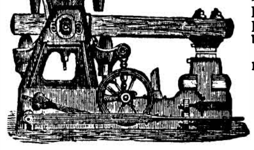

has larger capacity, is more durable, takes up less room, does more and better work with less expense for power and repairs than any other Hammer in use. Guaranteed as recommended. **BRADLEY Manufacturing Company,** SYRACUSE, N. Y.

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Reduced Prices.

Set Iron Dogs, ⅜ to 2 in	$	5.60
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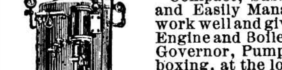

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RANDOLPH'S DITCHER AND EXCAVATOR: Simple, strong, and adapted to all soils reasonably free from stumps or large stones. Will do the labor of 100 men, *steadily*, at the cost of ten. Machines of all sizes, cutting from three inches wide, three feet deep, to 36 inches wide, four feet deep. Extra sizes made to order. Circulars, &c., sent on application to RANDOLPH BRO'S, 111 Broadway, New York.

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For Locomotive and Stationary Boilers.
FRIEDMANN'S PATENT.
Over 15,000 Now in Use Here and in Europe
Throws more and hotter water, with less steam, than any others. It has two Waterways, fixed Nozzles, and no movable parts to get out of order.
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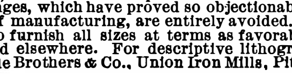

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