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The Cere Viaduct.

The viaduct which we illustrate this week crosses the Valley of the Cere, near Ribeyres, and is situate on the line of railway between Figeas and Aurillac, which forms a portion of the central network of the Paris and Orleans Railway, France. The viaduct, which carries the rails at a hight of 181 feet 6 inches above the water level, consists of five spans of lattice girders supported by masonry abutments and by piers formed of clusters of cast-iron columns rising from bases of masonry. The three central spans are of 164 feet each and of the two other spans, that on the one side is 145 feet, and the other 139 feet. The length of each abutment is 118 feet, the total length of the viaduct being 1,012 feet. The width of the viaduct between the rails is 14 feet 9 inches, and it carries a single line of rails. Each of the piers consists of a cluster of eight cast-iron columns united by cross bracings, and fixed to the top of a brickwork base of elliptical shape. Each pier measures 16 feet 5 inches by 8 feet 2½ inches from center to center of columns at the level of the capping, and the columns are disposed at such an inclination that their center lines, if produced upwards, would all meet at a point at 123 feet 1½ inches above the level of the rails. The side columns of each pier have thus a batter in the direction of the line of the viaduct of 1 in 30, and the end columns a transverse batter of 1 in 15, and as all the piers are of the same size at the top, the dimensions of each at the bottom vary with the hight. The brickwork bases of the piers have also their sides built at such inclinations that they form portions of a cone, the apex of which would be at the point of junction of the center lines of the columns before mentioned. The foundations of the viaduct were commenced in June, 1863, the erection of the girders in May, 1865, and by the following October a connection had been formed between the two abutments.

When complete the superstructure was tested by a load of 4,000 kilog. per meter, or about 8,000 lbs. per yard run; and under this test the central piers were compressed 3 millimeters, or about an eighth of an inch. At the same time the central span was deflected 15 millimeters, or three fifths of an inch, and the two spans on each side of it 12 millimeters, or nearly half an inch.

Its total cost was $171,000 in gold. Each of the main piers contains 71 tuns 13 cwt. of cast iron and 51 tuns 10 cwt. of wrought iron, and the cost per yard in hight of the iron portion of the pier was about $400.

The viaduct was constructed under the direction of M. Déglin, engineer-in-chief of the Ponts et Chaussées, and of Mr. Bortoux, acting engineer. The design was by M. Wilhelm Nordling, engineer-in-chief of the northern part of the Reseau-Central.

VIADUCT ON THE PARIS AND ORLEANS RAILWAY, FRANCE.

Railway Economy.

There seems to be a great difference of opinion among railway managers as to the meaning of economy as relating to the roads they operate. By far the greater number apparently holding that it is in cheapness of first cost, without regard to service to be rendered. This has been *the* fault, not only in the working, but in the construction of American railways.

Originally, owing to the scarcity of capital and the necessity of rushing the enterprise through to completion, the roads were hastily graded, insufficiently ballasted, and laid with any iron that could by any possibility be considered as at all suitable, and which cost the least sum per net tun. So, in rolling stock, wheels which have so much to do with the safe transmission of the passengers and freight, were not purchased because of the quality of material used in their composition and the care bestowed upon their casting; but the only question asked was, "What is your price?"

It is no wonder that under such circumstances as these American railways have made themselves illustrious as one of Grim Death's most efficient allies. We believe that an examination of the causes of casualties on rail roads will show that of every hundred, ninety-nine have arisen from either a defective wheel, or axle, or rail.

The expenditure of one or two cents a pound more for axles, of three or four dollars additional per wheel, and a few dollars per tun extra for rails, would, we firmly believe, do more to reduce the list of accidents on railways than any other course of action their managers could pursue. Railway supply manufacturers are not slow to discover that it is cheapness, not quality, that secures orders.

Pity 'tis that railway managers have not been as quick to understand that the "penny wise" are frequently the "pound foolish;" that the best is always the cheapest in the long run; that that policy which

shall secure to them the most complete road-bed and the most thoroughly reliable equipment, is the one which will also enable them to reduce cost of track repairs per mile, cost of car repairs per ton per mile, and loss and damage to goods and passengers to a mere nothing, compared with what they would be under the reverse rule. Safety and speed can both be increased, and with these comes, what all are striving for, larger traffic. Surely, it seems to us, it is not very difficult to see that when a wheel which would cost $22 would prevent an accident involving the payment of thousands of dollars of damage caused by a wheel whose price was $18, it is better to pay the $22. Yet managers buy the $18 one, and trust to good fortune to protect them from ill-consequences.

The public, who risk life and property on railways each and every day, have a most unmistakable interest in these things, and an undoubted right—we had almost said duty—to declare through their representatives, that it shall be a crime, properly punishable, for railway managers to decrease safety in order to secure cheapness.

We are glad to know that some of these gentlemen can see their own and the public's interest without any forcing, prominent among whom is the superintendent of a road some sixty-four miles long, running through a difficult country, all grades, and tunnels, and trestle-work, and yet the record of whose accidents will compare *most* favorably with many better located roads, and his secret is, testing the materials he uses in his track and on his motive power and car equipment, testing them thoroughly, and then purchasing that which shows best service, whether its first cost is greater than the others or not.

If managers generally were as wise, we should soon have the pleasure of reporting a decreased mortality and a lessened damage account on railways.—*Railroad and Travellers' Journal.*

[For the Scientific American.]

ON TIN.

BY PROFESSOR CHARLES A. JOY.

Tin is one of the metals known to the ancients, although it does not occur native, and requires some metallurgic knowlege for its preparation. It is mentioned by the earliest writers, and was called by Homer "the easily worked metal." The Greek name for it was *cassiteros*, and this in turn is derived from the still older Sanscrit word *castira*. By studying the derivation of the name we arrive at the conclusion that the metal was well known in the East, and probably was introduced to the Western nations from that quarter of the globe. Later in our history it was discovered by the Phœnicians in what they called Cassiterides and we know as Cornwall.

The Romans called the metal "white lead," and the Celts *stean* or *ystaen*, from which we derive "tin." Stannum was first used for argentiferous lead, then for white metals, and, finally, in the fourth century, for tin. The Latin name which is used in pharmacy, and affords us our symbol, Sn., is therefore of comparatively recent origin. In ancient times the uses of tin were chiefly for bronze and for mirrors. The famous mirrors of Brundusium were alloys of copper and tin, and were afterwards replaced by silver. Even in the Middle Ages there was a very limited use of the metal, and it is a curious fact that no specimens of antique tin have come down to us. The alchemistic name of tin was Jupiter, and many were the attempts made to convert it into gold. The chief ore of tin is the oxide or tin stone, from which it is easily separated by coal. The easy working of the ore accounts for the knowledge possessed of it by the ancients. There is a tin pyrites, or compound of sulphur, copper, and tin, and a silicate. The metal has also been found associated with tantalum, tungsten, and columbium, in certain rare minerals, and, in Bolivia and the Ural mountains, is said to occur native. Traces of tin have been discovered in mineral waters, to which, however, it imparts no poisonous properties. We do not find that it plays any conspicuous part in the animal or vegetable kingdom. America otherwise so rich in metals has hitherto produced very small quantities of tin. There are rumors of its occurrence in large quantities in Missouri, also in California, in Durango, Mexico, and in New Hampshire, but these localities have not been sufficiently worked to produce much impression on the market. The production of tin in Europe in 1865 amounted to 19,140,000 lbs., the value of which was about $4,740,000 gold; of this 18,590,000 lbs. came from Great Britain. It is said that the mines in Cornwall, which, according to some authorities, have been worked for 3,000 years, are gradually giving out, but the statistics of the annual production do not confirm this rumor. There is naturally more demand for tin than formerly, and this may have occasioned the rumor of the falling off in the Cornish mines.

The mode of extracting metallic tin from the ores is fully described on page 79, current volume.

The properties of tin have been well understood for many centuries. It is rare, indeed, to take up a metal our knowledge of which has been so slightly increased, as is the case with tin. The literature of any other metal, especially of the rare metals, is very copious for the last twenty years, but under the head of tin we find very little that is new. It is true that the number of its compounds has been materially increased until there are about two hundred and fifty of them described in the text-books and journals. To some portions of an able lecture recently delivered by Professor Stone, at the Cooper Union, we add a few scattered facts obtained from recent publications.

Tin has a well-known white color, with a yellow tinge and a high metallic luster. At 212° Fah. its ductility is so far increased that it can be drawn into wire. At ordinary temperatures it is not very ductile. The malleability of the metal is one of the chief occasions of its usefulness, as it is in the form of foil that it has such extensive application. An ingenious method for the manufacture of tin foil was invented by Mr. Crookes, of New York city, it consists in hammering plates of tin by placing them on top of each other. As fast as a given sheet becomes large and unwieldy, it is cut off and laid on top, and in the course of time one hundred sheets are piled one on the other, like so many quires of paper. They do not adhere together, and the workmen can, in this way, produce very thin foil. Much of the work can be done by machinery, but as the inspectors of tobacco require a foil of a particular thinness, the exact point can only be ascertained by the fingers. It requires a very expert workman to decide when the foil has reached the exact fineness to suit the officers, and no machine can take his place. Metallic tin imparts a characteristic odor to the moist hand, it also has what is called the tin cry when it is bent. This property affords a means for testing bars of tin to distinguish them from solder. Plumbers are in the habit of holding the ingots to their ears and giving them a bend. They can thus separate bars of tin, lead, and solder from each other. Cadmium is the only metal that resembles tin in this respect. Although tin melts at so low a point as 442° Fah., it is not sensibly volatilized. It requires a high heat to convert it into a vapor. The metal slowly tarnishes in the air, and is rapidly oxidized at a red heat. It readily combines with mercury, producing the well-known amalgam used in the manufacture of mirrors. For this purpose four parts of tin and one of mercury are usually taken. A sheet of tin foil is laid on a stone slab and spread out uniformly by a roll of flannel; the glass is skillfully pushed over it, and is afterward drained and pressed.

Another compound of tin with mercury and sulphur is known as mosaic gold, and is extensively employed as a substitute for gold leaf in the manufacture of cheap picture frames and for bronzing wood. Twelve parts of tin and six parts of mercury are put into a mortar and stirred; this is mixed with seven parts of flowers of sulphur and six parts of sal ammoniac, and the whole heated in a matrass.

Tin, such as is used for kitchen utensils, is often mixed with eighteen per cent lead, and hence could give rise to lead poisoning if incautiously handled.

Speculum metal for mirrors and reflecting telescopes is an alloy of one part of tin and two parts of copper; it is of steel-white color, extremely hard, brittle, and susceptible of high polish. It is difficult to unite tin and copper owing to the different densities of the metals. There are a large number of alloys of which tin is a valuable constituent. Britannia metal consists of equal parts of brass, tin, antimony, and bismuth.

Pewter, four parts of tin and one of lead.

Common spoons, queen's metal, nine parts of tin, one of antimony, one of bismuth, and one of lead.

Rose metal, which is used for safety plugs, and melts at a very low temperature, is composed of two parts of bismuth, one of tin, and one of lead. Plumbers' solder is made up of equal parts of tin and lead; fine solder of two parts of tin and one of lead.

Bell metal is variously constituted; it is sometimes composed of seventy-eight parts of copper and twenty-two parts of tin. Gun metal has less tin. Bronze less tin with three or four per cent zinc. It is an interesting fact that bronze cooled slowly, is brittle, and, suddenly, is malleable, exhibiting a property just the opposite of steel.

Tin is used by calico printers and dyers for making "spirit mordants" and "stannate salts," and imparts crimson hues and azure colors to various materials. This application has been seriously interfered with by the new industry in aniline, where the colors are of a greater variety and the mordants are albumen instead of metallic salts. There was a period in our history when we imported nearly all of the white metal and Britannia ware for the various utensils of the table and kitchen. Now we manufacture most of our table service and also work up great quantities of tin ware. In beauty of design and perfection of workmanship our plated ware is equal to any manufactured in England or France, and we have no longer occasion to send to Europe for such articles. During the year ending June 30, 1869, the total importation of tin amounted to $10,300,000 upon which a very heavy duty was levied by the government to the great injury of many branches of manufacture where the article is largely employed. Tin ware is used by all classes—the poor as well as the rich—and ought to be encumbered as little as possible with duties and taxes.

How to use waste scraps profitably has long attracted the attention of metallurgists, and various methods have been employed. In New York city the scraps are put into circular iron baskets and subjected to great heat. The tin runs off and is collected in a suitable receptacle. The iron remaining after the removal of the tin, is not wasted, but is employed in various metallurgical operations. Sometimes the tin is economized by converting it into stannate of soda used as a mordant in dyeing. There are numerous ways of accomplishing the separation of the tin from the iron and subsequently combining it with the soda. One of them is to digest the scraps in a proper mixture of soda lye and sulphur. Crystals of sulphate of soda or glauber salts are a secondary product, and collect on the sides of the vessel. After filtration, the liquid is evaporated to dryness, and affords cakes of stannate of soda. Sometimes twelve to fifteen per cent of the stannate is obtained in this way from the scraps.

A fine green color is obtained by combining the stannate with a salt of copper, and a pink color for porcelain by fusing together stannic acid, quartz, bichromate of potash, and some chalk. The poisonous properties of lead have been so often fatally tested that many efforts have been made to substitute tin tubing in its place. The cost of the material has hitherto been a serious drawback, but the invention of a method of producing lead-incased tin pipe has obviated much of this difficulty, and encouraged the hope that tin pipe can be generally substituted for lead. The use of tin and its salts, as reducing agents, is one of the most recent additions to our knowledge of its properties, and there are numerous applications for the 250 compounds of the metal, an account of which we omit from want of space and may recur to hereafter.

[For the Scientific American.]

THE CENTURY PLANT.

BY JOHN RAMSAY GORDON.

The *Agave*, or *Caretas*, is one of the genus of plants known to botanists as the *Amaryllidaceæ*. The American aloe and century plant are names by which it is commonly known.

This plant grows abundantly in tropical climates, particularly in South America and the West Indies; it is called the caretas in the French colonies and in some of the other adjacent islands. The name, agave, is derived from a Greek word signifying glorious, which, I suppose, was given to it on account of its gorgeous appearance when in bloom, combined with its majestic growth; and, it seems, indeed, an appropriate one.

Though not aware of the origin of its French name, I believe it is mentioned by the celebrated writer, Pierre L'Abbat, in his description of the Antilles. Century plant is, I think, an incorrect name for it; of this I shall say more hereafter.

The agave, or tree aloe, in its entire appearance resembles very much the medicinal or shrub aloe; but, unlike the latter, it sends out but one stalk, and each leaf is rolled up lengthwise in itself when small; it is of a dark green color when in its youth, that hue changing to an olive shade with the decay of the plant.

The leaves of it are of a blade-like form, all growing from one base, near the ground; from the center of them there projects a stalk, which attains a hight of twenty feet, and sometimes more; this stalks grows perpendicularly, and is tolerably straight; from the stalk, there grow branches, which resemble the arms of the old style of saloon candlestick. These branches bear flowers on attaining maturity, and afterwards seed pods appear on them. Though the entire plant is of a pulpy nature, it is nevertheless strong and durable. Some persons have asserted that it attains the great age of one hundred years, hence its name of century plant; but, I think, that this is hardly possible, as its roots are seldom firmly fixed in the soil where it grows, which in general is of a rocky nature. The stalk and branches become ligneous, or woody, before decay. The leaves are composed of a quantity of fibers or threads arranged longitudinally, which are covered and united by a greenish pulp, and the whole is inclosed by a substance resembling parchment. These blades are extremely sharp at their ends, and, at their edges, are provided with a series of small acute thorns, extending from the heart of the plant to the point of the blades.

When the agave is in bloom, the appearance of it is rather imposing, and the perfume which it emits is equal in effect to the night blooming cereus or any other essence of the toilet, and birds and insects gather about it in numbers to suck the nectar from its flowers. There are daily to be seen, also, innumerable swarms of bees gathering their food. One species of the trochilus, or humming-bird, known in the West Indies as the doctor bird, frequents, too, the localities where the aloe is to be found; and I have seen it with its plumage of brilliant hue, fluttering its tiny wings, and, while suspended in air, sipping its luscious draft of nectar.

I have before remarked that it has been stated that the plant attains the age of one hundred years; were it possible that this could be, I can safely affirm that the poor century plant would not stand one day after some jolly follower of Neptune had set his eye upon it.

Sailors! What will they not conceive? One Sabbath evening—the sailor's vacation—I watched a number of men who had provided themselves with axes, making an attempt to secure one of these plants, which they could not accomplish without cutting its surrounding leaves; and, as I was desirous of knowing what use they would make of it, I approached and questioned them. One of the men informed me that they made razor strops of the stalk, and that it furnished tolerably good ones too. It was cut into lengths of three feet in order to be portable, and at leisure it would be cut into the desired form of razor strops.

The name, caretas, applied to this plant by the French colonists, is very familiar to me as it is that which is employ- in the island of St. Thomas whence I hail.

It seems to me that the caretas could be rendered very serviceable in several ways; and I think that it would furnish very good rope, as the fiber which exists in the leaves of the plant, when spun, makes strong cord; in fact, it is employed by the South American Indians for this purpose, though not to any great extent on account of the want of machinery necessary for the manufacture of it. I believe that it is also converted into medicine by the natives of South America and the West Indies.

Louisiana State Fair.

The fourth grand State Fair of the Mechanics and Agricultural Fair Association of Louisiana, will be held at New Orleans, in April of this year, commencing Saturday, the 23d, and continuing nine days. The Fair will be held on the extensive grounds of the Association in the above city, and a greatly enlarged list of premiums is offered. Visitors and exhibitors are invited from every section of the country. It is announced that railroads, steamships, and other transportation lines, will carry exhibitors and their wares at half price. The Secretary of the Association is Mr. Luther Homes, who may be addressed by parties wishing further information.

ON A NEW METHOD OF STRAIGHTENING HIGH CHIMNEYS.

Condensed and adapted from "Zeitschrift für Bauwesen."

It is a well-known fact that high chimneys, however carefully built, often lose their original straightness soon after their erection, and assume an inclined position or a curved shape. This frequently takes place to such an extent that the stability of the chimney is endangered so that it becomes necessary to straighten it. This is generally done by making an incision, or several, in the chimney on the side opposite to that to which the chimney is inclined. This operation is performed by means of large saws. Recently, however, a very high chimney erected by Messrs. Wesenfeld & Co. in their chemical establishment at Barmen (Prussia) was straightened successfully by a different method.

This chimney is 331 feet high. Its exterior shape is octagonal, with a clearance of 8 feet throughout its whole length. This gives it an interior sectional area of 53 square feet. The socle is quadratic in section, 30 feet wide and 40 feet high. The upper, or pyramidal part of the chimney is octagonal, 291 feet high. The exterior diameter of the latter is 17 feet at the base of the pyramidal part. This diameter is reduced 2¼ inches on every ten feet upwards. The masonry is 7 bricks thick in the basement, 5 at the base of the pyramidal part, and 2 at the top.

For the sake of comparison we here add the following table:

TABLE CONTAINING THE MOST IMPORTANT DIMENSIONS OF SOME REMARKABLE CHIMNEYS (br.=length of brick)

Number.	Height, including foundation. y	Height, excluding foundation.	Exterior diameter. below. d	Exterior diameter. above.	Thickness of masonry. below.	Thickness of masonry. above.	Decrease of diameter on every 10 feet of hight.	Relation of the hight to the diameter of base. $\frac{h}{g}$	Locality
	ft.	ft.	ft.	ft.			Inches.		
1	434	441	31	12 3-8	5 ft.	1 1-2 br.	5·09	14·12	Port Dundas, near Glasgow (Scotland).
2	345	430	30 1-3	13 1-8	3 1-2 br.	1 1-2 br.	7·49	10·67	St. Rollox, near Glasgow (Scotland).
3	331	330	29	11 1-2	6 ft.	1 1-2 ft.	2·47	18·33	Chemical factory at Barmen (Prussia).
4	271	271	18 1-2	10 1-4	6-1-2 ft.	1 1-4 ft.	6·36	11·33	Cast steel Works at Bochum (Prussia).
5	221	221	17 1-2	7 1-2	4 ft.	7 in.	3·4	14·82	Dye Works, Hagen (Prussia).
6	175	175	20	7 1-4	3-1-2 br.	8-4 in.	5·53	12·43	Pontnewydd Chemical Works (England)
7	155	161	17 1-2	7	4-5 br.	1 br.	9·07	8·44	Alois Iron Works (France).
8	152	150	16 1-2	6 1-2	3 br.	10 in.	7·91	9·14	Hepburn's Tannery on the Tyne (England).
9	144	132	16	6	3-4 ft.	10 in.	6·08	11·93	Dye Works, Barmen (Prussia).
10	133	126	11 1-2	4 1-2	4 1-2 br.	1 br.	8·0	9·0	"Einer Graben", chemical Works, Barmen (Prussia).
11	125	136	9 1-2	4	3-1-2 ft.	1 br.	5·90	11·59	Kienegarn Factory, Barmen (Prussia).
12	153	136	15	6	4 br.	1 br.	4·54	13·86	Dye Works Ochde, near Barmen (Prussia).
13	156	131	11 1-2	4 1-2	3 ft.	10 in.	5·45	12·43	St. Ouen, near Paris (France).
14							8·31	8·14	White's Factory (England).
15							4·82	10·81	Rolling Mill, Hagen (Prussia).

In looking over the table it might appear strange that the proportions of the hight to the diameter of the base has been taken so very high in the construction of the chimney No. 3, which is the subject of the present paper. For, by comparing this proportion to those used in the construction of any of the other chimneys mentioned, it becomes evident that this high proportion has been chosen against all previous experience and practice. The explanation of this is found in the circumstance that this chimney was to have, according to the original design, a hight of 260 feet only, which by a later resolution was changed to 331 feet. As the construction had then been commenced, and was proceeding in a very satisfactory manner, it was considered best and sufficiently safe to increase the hight without altering the dimensions of the base. The consequence, of course, was that every square foot of a section through the masonry of the lower part of the chimney was subjected to a very high, and indeed, abnormal pressure.

An exact calculation has shown that one square foot of masonry in the lowest part of the chimney proper carries a weight of 21,335 lbs. or 149 lbs. per square inch.

For comparison the highest pressure existing in the chimney No. 4 (see table) erected at the Bochum cast steel works, was calculated and found to be 18,429 lbs. per square foot, or 128 lbs. per square inch. The difference amounts to 21 lbs. per square inch, or little below 1½ atmospheres, which constitutes the excess of pressure in the masonry of the chimney at Barmen over that of the Bochum chimney.

The chimney at Barmen (the straightening of which we propose to describe hereafter) was built with the greatest possible care. A good underground was available, consisting of a stratum of hard and coarse gravel. The foundation and the socle were built in the summer of 1866, the pyramidal part in the summer of 1867. The foundation was made of large, flat quarry stones with terrace mortar (1 lime, 1 river sand, 1 terrace, which is a kind of puzzolana). The socle was made of brick with ordinary mortar (1 lime on 2 river-sand).

The mortar was prepared fresh every morning by the masons themselves. Cement mortar (1 cement on 2 river sand) was used on rainy days. The crown of the chimney was built with cement exclusively. The joints of the masonry were flushed up with cement, and gradually as constructions proceeded.

The three masons who did the whole work daily changed their positions on the chimney so as to equalize any unevenness in the masonry that might be caused by imperceptible differences in the manipulations of the different individuals. At distances of fifty feet single layers of brick work were painted black outside to afterward facilitate an estimate of the hight of any point of the chimney above ground. The chimney was built from the inside without a scaffold, the materials being hoisted by a steam engine put up temporarily near the place of construction. The motion was transmitted by three rollers or drums. The frame which supported the upper drum was moved higher up after the completion of every three or four layers of brick, and was at the same time turned horizontally from one side of the octagon to the next one to equalize the effect of the pressure of the frame on the masonry. The holes made into the masonry to support the frame, were filled up with brick and mortar immediately after the removal of the frame to a higher level.

The construction of this chimney was thus successfully completed in October, 1867, and answered perfectly the requirements for which it was erected. It was perfectly vertical and straight.

However in the spring of 1868, remarkable for vehement and long-continued gales and storms, this chimney suddenly assumed an inclined position toward the north-east. The injurious action of the south-west wind was probably favored by the bold proportions of the structure, by the yet subsisting softness of the mortar, and by the large size and the shape of the richly ornamented chimney crown. This crown caught the wind, and thereby caused it to act as on a long lever. The chimney was thus bent, and the mortar not perfectly dry, the brickwork did not yet possess the necessary elasticity to return to its original shape.

The deflection of the chimney was considerable at the end of May, and seemed yet to increase, and threatened an overthrow.

As above mentioned, some layers of bricks in the chimney at distances of fifty feet from each other, were painted black outside. The hight of these black lines above the socle being known, these lines were, by means of a theodolite projected on a plank situated on the socle of the chimney to find the deviation from the vertical line at these different hights. It was thus ascertained that the chimney at a hight of

251 feet	was out of	line	45 inches.
210 feet	"	"	30 "
160 feet	"	"	16 "
110 feet	"	"	5 "

The socle stood perpendicular. As the deviation was still increasing, and as it would have done too serious an injury to the manufacture of the establishment to set the chimney temporarily out of use, it was necessary that immediate action should be taken in the matter. The ordinary method of straightening chimneys was at first resorted to. A hole was made through the whole thickness of the masonry on that side of the chimney which required lowering four feet above the top of the socle. Into this hole a saw was introduced with which a horizontal cut through one half of the chimney was attempted. But as the thickness of the wall was considerable and the bricks hard; and as the saw could be manipulated from one of its extremities only, the effect of sawing, after two hours' work, was scarcely perceptible.

The hole through the chimney having been made without trouble, and the difficulty experienced in sawing led to the idea to gradually remove a whole layer of bricks, replacing it by a thinner layer thus to produce the desired slit. Before, however, this operation was performed, the experiment was made with an old inclined chimney 120 feet high. When the method had there proved practicable and successful, it was concluded to treat the new chimney in the same way.

A layer of bricks was broken out by means of pointed cast-steel bars, from 1½ to 5 feet in length. The annexed figure shows a horizontal section of this layer, the inscribed numbers, 1, 2, 3, 4, etc., indicating the succession in which the different parts or divisions of the layer have gradually been removed. When the division, 1, was broken out, it was replaced by thinner bricks covered with terrace mortar. After this the two divisions, marked 2, were broken out and replaced by thinner bricks, then the two divisions, marked 3, and so on until one half of the whole layer was thus exchanged.

Flat shovels with long handles were used to lay those bricks which had to be placed near the inside of the chimney. A space of 5 inches was left each time between the newly-laid bricks and the old ones of the next division, to break out the latter with greater facility.

The width of each single division was 2 feet to 2½ feet. The masonry was sufficiently dry above not to give way when a layer of that width was removed below it. The replacing bricks were taken thicker gradually as the operation drew nearer the points, A and C (see engraving), so as to get the slit wide in the middle and gradually extenuating towards it two extremeties at A and C. As soon as the slit reached these points, the chimney began to move, and by slight oscillations slowly settled down on the new layer of bricks, and when it had reached it, remained quiet.

The act of settling by oscillations lasted from 18 to 36 hours, corresponding to the width of the slit which was different in the different cuts performed in a similar way at different hights of the same chimney. The oscillations were the greater and the livlier the higher up the cut was, which produced them.

At the highest cut, 100 feet from the top, the oscillations were such that the masons became frightened and left the place, the slit became alternately wider and narrower by ¾ of an inch. The facts before mentioned seem to prove the elasticity of the whole structure. Four cuts were made into this chimney; the

1st.	4 feet	above the socle,	greatest	width.	⅜
2d.	100 feet	"	"	"	1¼
3d.	140 feet	"	"	"	1½
4th.	191 feet	"	"	"	1¾

After the completion of these operations the chimney continued during several weeks to settle slightly in the direction opposite to its former inclination, the brickwork on that side being now subjected to a higher pressure than before.

This circumstance has to be carefully considered beforehand, or else the slits would be made too wide and produce an inclination of the chimney in the opposite direction. A severe storm which occurred on the 6th and 7th of December, 1868, and which threw over several chimneys in the neighborhood, did not affect the above. The result of the straightening operation before described is perfectly satisfactory, and the structure is now stronger and steadier than ever.

We have yet to speak of the means by which the upper parts of the chimney were made accessible to perform the upper cuts. This was done on a new and interesting plan. Standing on the lowest platform, the masons made a number of holes all on the same level, 4 feet above the platform, into the exterior wall of the chimney. They stuck iron bars into these holes and fixed boards to them so as to form another platform. Standing then on the latter, they made another one four feet higher up in the same way, and so forth. Every second platform was again removed, so that the remaining platforms were 8 feet apart. They were then joined by ladders, to make the ascent possible and easy. This method is, however, only practicable when the chimney has a considerable diameter, and when the mortar is sufficiently dry not to give way under the one-side pressure of the bars and platforms, which would make the arrangement loose and unsafe.

In December, 1868, another chimney at Duisburg was straightened by the method above described. But as the diameter of the chimney was not as large as that of the Barmen chimney, and as the mortar was yet soft, a wooden scaffold was erected around the chimney to get at the upper points which required cutting. The breaking out and replacing of the bricks could not be done there in divisions wider than 5 to 10 inches, otherwise the upper masonry not being dry, would have settled down. When the chimney was straight, a further settling towards the side of the cut was prevented by driving iron wedges covered with mortar into the slit.

We shall finally not omit to remark that it is advisable to straighten a chimney as soon as there is a decided evidence of its deviation from the vertical position. For while the mortar is not hardened, the deviation gets worse and worse, and the operation more difficult and more expensive.

Varnish for Iron.

The following is a method given by M. Weiszkopf, of producing upon iron a durable black shining varnish: Take oil of turpentine, add to it, drop by drop, and while stirring, strong sulphuric acid, until a sirupy precipitate is quite formed, and no more of it is produced on further addition of a drop of acid. The liquid is now repeatedly washed with water, every time refreshed after a good stirring, until the water does not exhibit any more acid reaction on being tested with blue litmus paper. The precipitate is next brought upon a cloth filter, and, after all the water has run off, the sirupy mass is fit for use. This thickish magma is painted over the iron with a brush; if it happens to be too stiff, it is previously diluted with some oil of turpentine. Immediately after the iron has been so painted, the paint is burnt in by a gentle heat, and, after cooling, the black surface is rubbed over with a piece of woolen stuff, dipped in, and moistened with linseed oil.

According to the author, this varnish is not a simple covering of the surface, but it is chemically combined with the metal, and does not, therefore, wear off or peel off, as other paints and varnishes do, from iron."

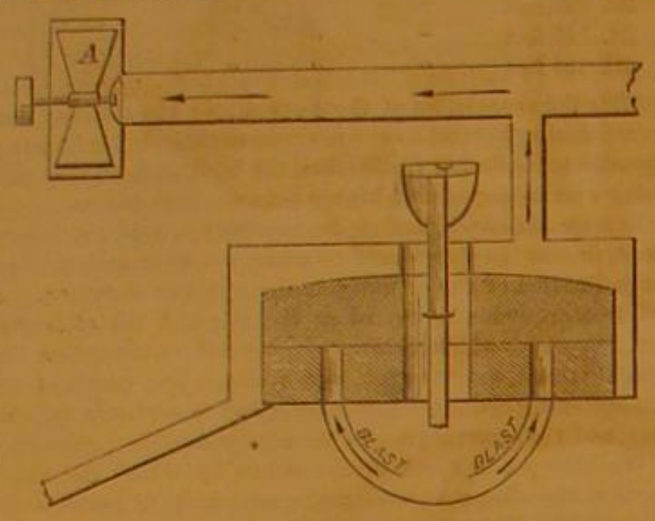
HENRY CAREY BAIRD'S CATALOGUE.—We are in receipt of the revised catalogue of practical and scientific books for 1870, published by Henry Carey Baird, 406 Walnut street, Philadelphia. A glance at the contents shows that this enterprising publisher has placed within reach of all classes technical and practical information on nearly all industrial subjects. A peculiar feature of these publications is that among them may be found those suited to men of limited education, as well as those of a higher order for the fully educated and informed. It is their practical character that has given the publications of Mr. Baird their great popularity. The present catalogue is the finest collection of this class of literature we have ever seen. Sent by mail free of postage to any address.

WORKING MILLSTONES WITH AN AIR BLAST.

Extensive litigation, relating to the use of an air blast in running millstones, have, for some time, occupied a prominent position in English courts. These litigations possess little of interest to our readers, but the patented process which has given rise to the suits, has features of considerable value.

Mr. Bovill, the plaintiff in the action of Bovill *vs.* Smith, in his specification says:

"When working millstones with a blast of air I introduce a pipe to the millstone case, from a fan or other exhausting machine, so as to carry off all the warm dusty air blown through between the stones to a chamber, as hereafter described, by which the dust in the mill is avoided, and grinding improved, and this part of my invention relates only to sucking away the plenum of dusty air forced through the stones, and not to employing a sufficient exhausting power to induce a current of air between the millstones without a blast, this having been before practiced."



Mr. Bovill, in his English patent of 1846, published an arrangement for employing exhausting power to get the desired current of air through the grinding surfaces of the millstones, and at the same time avoid the inconvenience of passing the meal through the exhausting machine, and in 1846, a Mr. Debeaune registered under the Utility Designs Act, a plan of a set of millstones arranged round a central receiver, from the top of which a fan was to carry away, by exhaustion, the stive. The inconvenience sought to be avoided by Mr. Bovill's English patent of 1846 was one supposed to attend the working of Newton's earlier patent of that year, whose drawing showed the exhausting apparatus attached to the meal spout itself, so as to draw both meal and air through the grinding surfaces, and discharge both from the pan into a receiver. Mr. Bovill proposed to draw air through the grinding surfaces by exhaustion, but to avoid passing the meal through the exhausting apparatus, while Debeaune proposed to use the exhaust only to draw away the stive from the receiver, without seeking to increase the current of air between the grinding surfaces.

The defendant in Bovill *vs.* Smith used exhausting power only to draw away the stive from the millstone cases, and to blow it either into the open air, or into a non-porous stive room.

The general method in dispute is shown in the accompanying diagram, in which the stones are shown covered in, and made as near as possible air-tight, being supplied with air from the cold blast, which, when having passed through the stones, is drawn off by the extracting fan, A, thence into a small room, and into the open air.

The method has in various ways been modified and changed in its details; and so many have had a hand in its improvement that it is little wonder extensive litigation has grown out of it. In some instances both blast and exhaust fans have been employed. The air charged with flour dust is in some instances, passed through porous cloth to arrest the flour; and in other cases it is passed into a large room in which, the air emerging through ample screens with little force, the flour settles and is economized.

The advantages claimed are that the stones are kept much cooler, and thus a higher speed may be maintained, and a larger quantity of work performed; but so far as we can learn it has never been very popular in this country, although it has been tried in several large flouring establishments.

How Dualin is Made.

Wood of soft texture (for instance, pine or poplar) is reduced to small grains, resembling sawdust, treated with diluted acids, and then boiled in a solution of soda. After having been thoroughly dried, by a quick drying process, the cellulose is mixed with—

"No. 1. Niter and nitro-glycerin; or,

"No. 2. Being first changed into nitro-cellulose, by being treated with nitric acid (48° B.) and sulphuric acid (66° B.), it is then mixed with nitro-glycerin.

"No. 3. The dried cellulose is mixed with anhydrous glycerin, until the mass becomes of the consistency of thick broth. This is gradually treated to a bath composed of a mixture of sulphuric acid (66° B.) and nitric acid (48° B.) of eight to ten times its quantity, during which process the greatest care must be taken to stir the heated mixture, and cool it. The stirring is continued for at least half an hour, after which the mixture is placed in a water bath of ten times its quantity. The acid-water being repeatedly drawn off, and replaced by pure water, the mixture is now placed in a bath of diluted soda-lye. In this, it is stirred from one to two hours, again washed in pure water, and then rendered anhydrous by means of hot water heating, and treating it with concentrated sulphuric acid and chloride of calcium. After having been rendered anhydrous, it is mixed with cellulose, prepared by process described under No. 1, 2, or 4, until a dry and not very greasy powder is obtained. The dust is sifted out, and this, if packed into cartridges, is serviceable.

"No. 4. The cellulose is charred, finely pulverized, boiled in concentrated niter-lye, and after soda has been added, is rapidly dried, and mixed with nitro-glycerin or dualin, prepared by process No. 1, 2, or 3.

"No. 5. The process of preparing nitro-starch, another ingredient of dualin, is also new. It will prevent the formation of lumps after the starch has been subjected to the acids, and also render the dried preparation less sensitive to dampness.

"*a*. Starch is thoroughly dried until it assumes a yellowish-brown color. It is then finely pulverized, and mixed with anhydrous glycerin. The mass is slowly placed in a mixture of nitric acid (48° B.) and sulphuric acid (66° B.) of ten times its quantity, during which process the greatest care must again be taken to stir the mixture, and cool it. The stirring is continued for half an hour, when the mixture is placed in a water bath. The acid-water being repeatedly drawn off, and replaced by pure water, the mixture is now placed in a bath of soda-lye, then placed in another water bath, and finally rendered anhydrous by means of hot water heating, and treating it with concentrated sulphuric acid and the chloride of calcium. It is now pressed through a fine sieve, and mixed with either dried pulverized starch that has been treated with niter-lye, or it is mixed with cellulose, prepared as above described, until a dry and not very greasy powder is obtained.

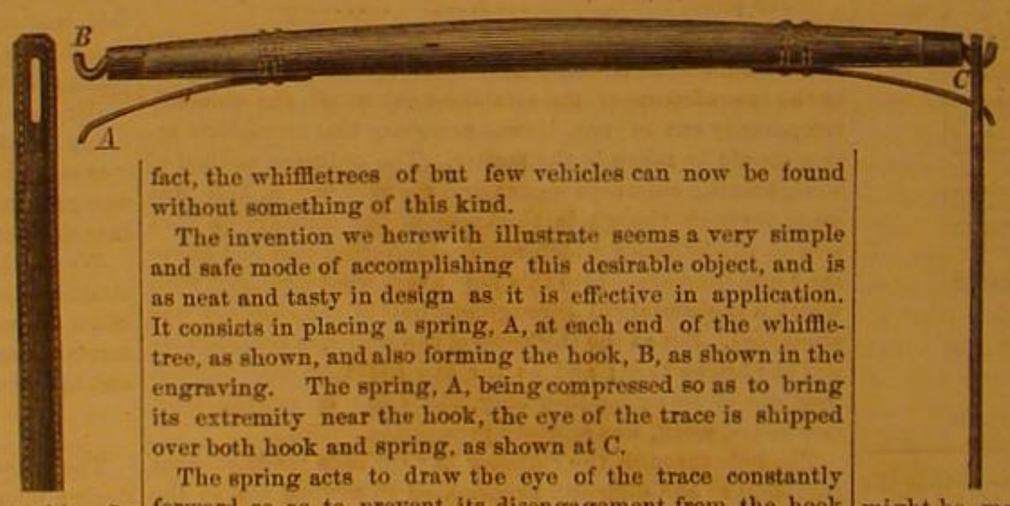
"*b*. After the starch has been dried, it is mixed with pulverized cellulose, or with the dualin-dust prepared by process No. 3. This mass is then placed in a mixture of nitric acid (48° B.) and sulphuric acid (66° B.), and for the rest, treated as described by process No. 5.

"No. 6. In an entirely analogous manner, mannite is mixed with anhydrous glycerin, and compounded with the other ingredients of dualin."

WILLIAM'S IMPROVED TRACELOCK.

The detachment of a trace from the whiffletrees of carriages is an accident which has often endangered, and not unfrequently sacrificed the lives of their occupants. When the occupants have escaped without injury, many a young and promising horse has taken fright and has been ruined for life.

Many devices designed to lock traces so that they cannot become detached, unless by design, have been made, and many of them have justly attained a wide popularity. In fact, the whiffletrees of but few vehicles can now be found without something of this kind.



The invention we herewith illustrate seems a very simple and safe mode of accomplishing this desirable object, and is as neat and tasty in design as it is effective in application. It consists in placing a spring, A, at each end of the whiffletree, as shown, and also forming the hook, B, as shown in the engraving. The spring, A, being compressed so as to bring its extremity near the hook, the eye of the trace is shipped over both hook and spring, as shown at C.

The spring acts to draw the eye of the trace constantly forward so as to prevent its disengagement from the hook except when it is compressed in the manner above described.

The device is exceedingly simple, and it will be seen is very easy to manipulate in the attachment or detachment of the traces. It deserves to become popular.

The inventor will sell either the entire patent or State rights.

Patented, through the Scientific American Patent Agency, Dec. 7, 1869, by Samuel P. Williams, of Rutland, Vt., who may be addressed for further particulars.

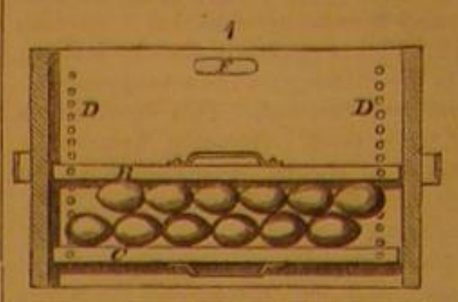
J. D. MICHAEL'S PATENT EGG BOX.

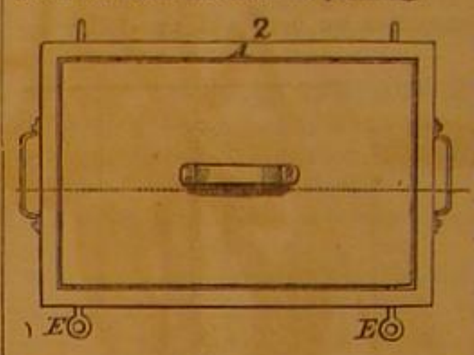
It is generally known that eggs keep much better and longer if frequently turned over, for if left lying on one side any length of time, the yolk will settle or sink until it reaches the shell; the egg is then too stale for use, and will soon be rotten. If turned over every few days, the yolk will not reach the shell so soon, and consequently the egg will keep a great deal longer.

It is a well known fact to persons conversant with natural history and the breeding of fowls, that the fowl when setting is known to turn her eggs over every day. She is taught by instinct that this is necessary. If the eggs were allowed to lie on one side during the three weeks required for hatching, the yolks would settle so that the eggs would spoil or not hatch. The heat from the fowl's body would hasten the spoiling of the eggs if they were allowed to remain in one position.

The design of this box is to provide a package for eggs, in which they can readily be turned over all together, whether the box be full or partially filled. This box would be very useful to parties who buy eggs and ship to market, also to persons who have a great many fowls, and especially useful to retailers of eggs, and in large families. An improvement has been made in the manufacture of these boxes, which will do away with the use of the rods, and make the box simpler and cheaper. For shipping purposes they can be provided with locks to prevent pilfering, while in transit.

Fig. 1 is a side view. Fig. 2 a surface or plan view of the same. The invention consists of a case or box, A, open at top and bottom, provided with boards, B C, arranged to be moved up and down and secured at any point within by running the rods, E, through the holes, D, and through holes bored in the ends of the boards, B C. Four iron eyes may be attached to each board, B C, to run the rods, E, through, and thus dispense with boring holes in the boards, B C. An additional board like B C, and two additional rods, E E, may be provided to be placed in the middle of large boxes to prevent breakage of eggs by accumulation of weight. Eggs for shipment should be packed with chaff or other packing to prevent breakage. Small boxes for local use need no packing.





These boxes would be useful for packing and shipping choice varieties of fruit in, by providing several boards to separate them into thin layers, and by making proper openings for ventilation. They may be also used for packing fruit and other articles.

This invention was patented through the Scientific American Patent Agency, Jan. 4, 1870, by J. D. Michael, No. 125 McElderry's Wharf, Baltimore, Md., who can be addressed for further information, rates of territory, etc.

The Moon as a Terrestrial Motor.

The *Railroad and Travelers' Journal* thus discourses:

"An ingenious civil engineer of Marseilles has discovered a mode of using the force of rising and falling tides as a motive power, and he thinks that this new motor can be made serviceable at a great distance from the sea. The name of the discoverer is Ferdinand Tommasi.

"The power of the moon's attraction has been used practically for a long time. The inhabitants of Long Island, while still colonists of Great Britain, ground their wheat and sawed their lumber by moon power. The ocean tide was suffered to fill mill ponds at flood, and the water so gathered was confined and used to drive undershot wheels after the tide had nearly ebbed. By this process, however, only an insignificant part of the tide power was employed. On every mile of ocean coast the power of the tide is sufficient to raise ten million tuns a distance of ten feet twice every day. The tidal power exerted in Delaware Bay alone would more than suffice to drive all the machinery now in use in the world. The chief difficulty in applying tide water as a mechanical motor is the want of strength in metals. If a cheap substance could be had of ten times the strength of steel this tide power could be gathered up and utilized. With such a metal a spiral spring, weighing a few hundred lbs. and wound up by the power of the tide, might be made to propel a railway car a hundred miles by means of a system of wheels like those which are driven by the main spring of a watch. While tidal power is in amount scarcely conceivable for its vastness, it is very slow in its vertical motion, the machinery by which it can be made directly available must therefore be of great strength and dimensions. The utilizing of the tidal motor has long been a subject of study among mechanicians and inventors, but the insufficiency of the strength of metals has been constantly in the way of a successful result. The same want is experienced in almost every branch of mechanical invention or improvement. The discovery of some chemical means by which the strength of steel could, without additional cost, be doubled, would realize the dreams even of those who seek the means of useful aerial navigation, and it would result in the application of steam-water and electro-magnetic power to very many new uses."

TO PREVENT THE ESCAPE OF GAS FROM INDIA-RUBBER TUBING.—India-rubber tubing is slightly permeable to gas. The amount which escapes through the walls of the tube is, however, very small; it may be advisable sometimes to render any escape impossible. This can be done by giving the tubing a thin coating of a varnish made by dissolving one part and a half of treacle and two parts of gum arabic in seven parts of white wine and three and a half parts of strong alcohol. The treacle and gum must first be dissolved in the beer or wine, and the alcohol must be added very slowly, constantly stirring the mixture, or the gum will be thrown down.

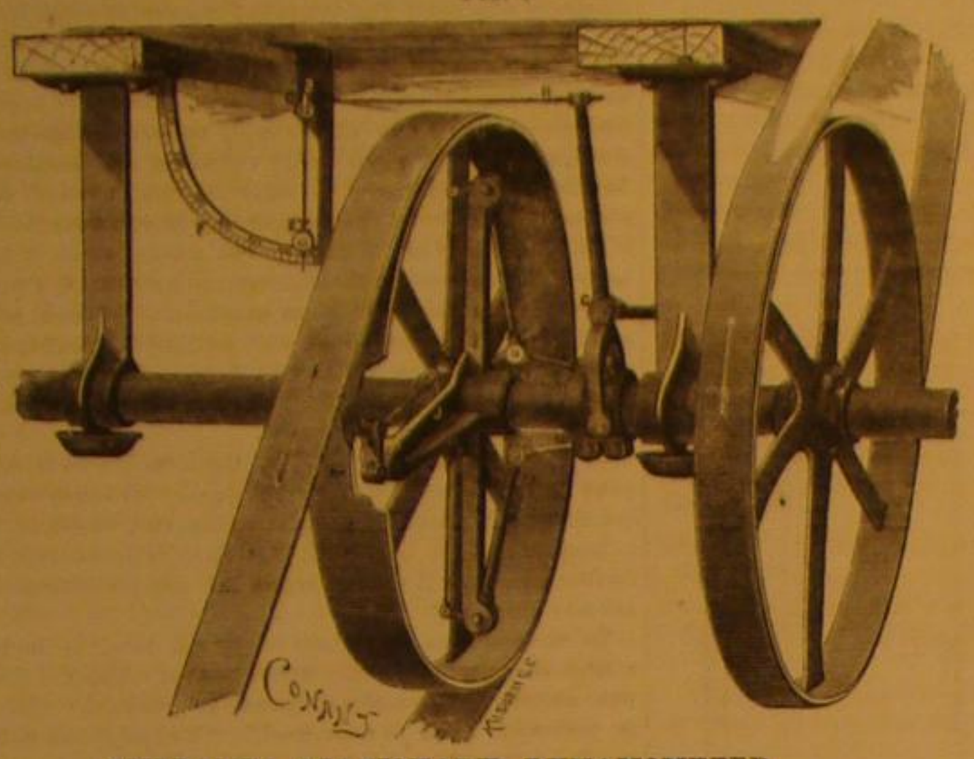
A PATENTEE, whose business had been conducted through this office, says: "I believe I have made enough from the few lines notice of my invention, printed in the SCIENTIFIC AMERICAN, to pay the cost of my patent."

The Measurement of Power---Emerson's Dynamometer.

The time when people were content to estimate the power of motors by guess is passed. If there is any one thing more than another that indicates the advance of mechanical science at the present day, it is the perfection of appliances whereby accurate knowledge of the relative performance of boilers, engines, water wheels, and motive power of all kinds can be accurately measured and determined.

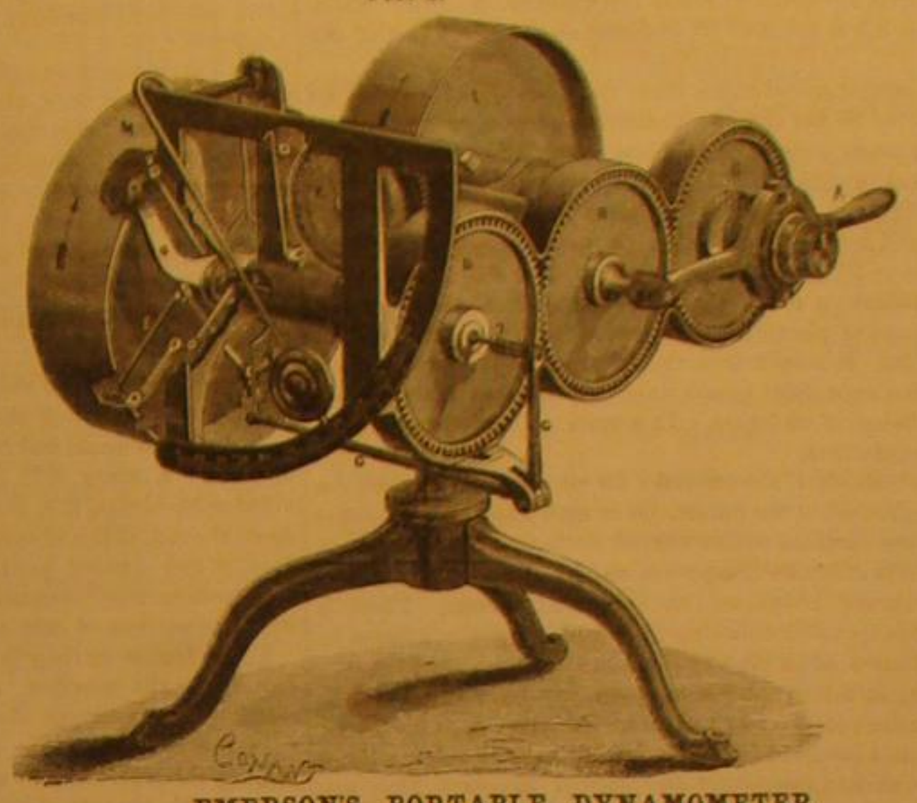
We this week give illustrations of the dynamometer invented by Mr. James Emerson, formerly of Worcester, now of Lowell, Mass. The stationary form of this instrument was illustrated and described on page 1, Vol. XX of the SCIENTIFIC AMERICAN, but the parts were not as fully shown as is desirable, and we herewith present another engraving, with a portion broken away to more fully exhibit its construction.

FIG. 1



EMERSON'S STATIONARY DYNAMOMETER.

FIG. 2.



EMERSON'S PORTABLE DYNAMOMETER.

The pulley, A, is loose upon the shaft, but is made to revolve with it by the levers connected to its rim from the spider, J, which is keyed to the shaft. These levers are connected to the pendulum E. The arrangement is that of the platform scales, made rotary. The index is graduated and the whole tested by sealed weights, the same as any other scales. It is placed permanently upon the shaft, so that the power used may be known at any time. Its introduction demonstrates what we have often stated; namely, that little reliance can be placed in the common methods of estimating the amount of power used. We are informed that in one place, where it was claimed that but four-horse power was used, the dynamometer gave sixteen. Examination proved that one half was wasted by bad arrangements. In another case, 231-horse power was claimed; the dynamometer gave 145, and it was found upon examination that the head of water had been estimated from the bottom of the "pit" to the surface of water in the flume, and that the wheel was clogged with sticks and leaves, which were removed; then the dynamometer gave 190-horse power. Engines have been found that used abundance of fuel without giving out much power. A large dynamometer, measuring 250-horse power, in use at the Wamesit Power Company's works, at Lowell, Mass., for nearly two years, is seemingly as perfect and sensitive now, as the day it was put on.

The portable form of the dynamometer is shown in Fig. 2. The power to be measured is received from the motor shaft by the pulley lettered L, transmitted through the wheels, B, and the weighing apparatus to the pulley, M, which imparts it to the machinery to be driven.

This form of instrument is made of different sizes for testing pickers, looms, spinning frames, or any kind of machinery.

It may be used where power is rented, but the stationary kind is far the best for that purpose. A tenant can always favor his power where the dynamometer is applied temporarily.

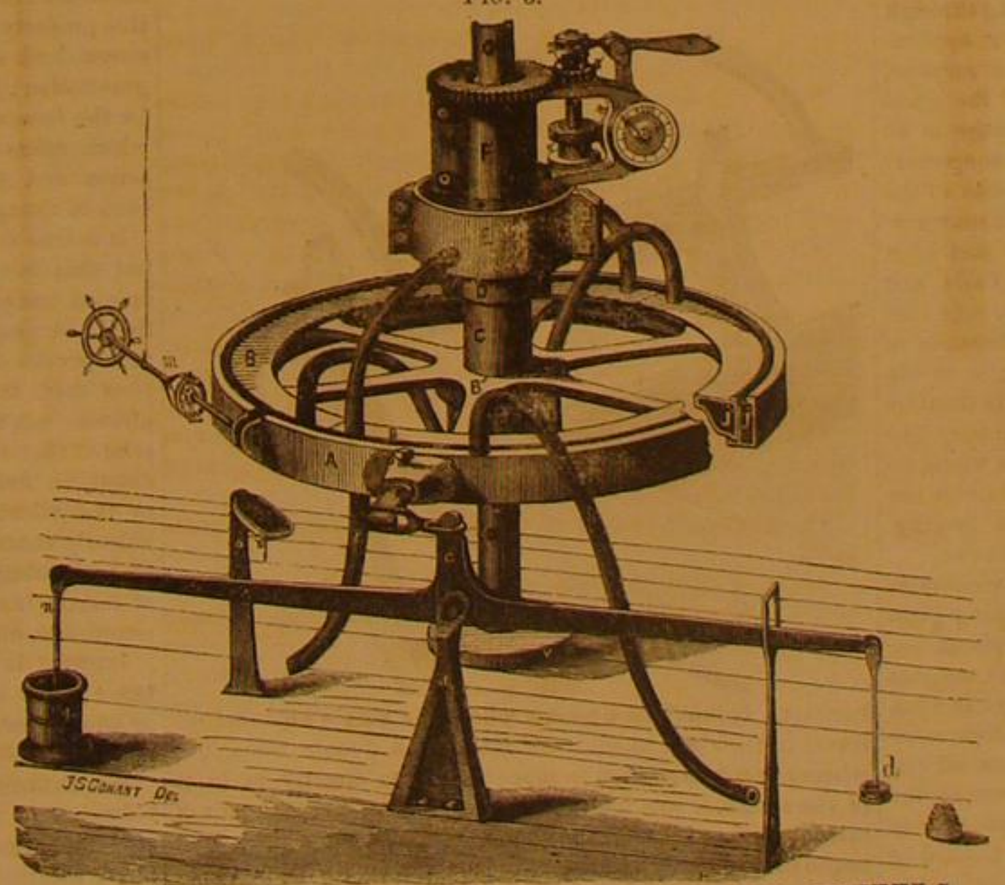
Fig. 3 is an engraving of Mr. Emerson's turbine dynamometer. The wheel, B, is secured to the shaft of the water wheel, and its speed controlled by the friction band, A, which is connected to the scale beam, as shown, the point of connection describing a circle of 13 feet. The rim of the wheel and the friction band are hollow, and are kept cool by a stream of cold water passing through them.

We are informed that in some tests made at Beloit, Mich., the scale beam was found to be readily balanced with an ounce weight, and the whole apparatus was so delicately constructed that a two-ounce weight added to the beam at *d*, equaling 2½ pounds at the point of connection with the friction band, would cause a decrease of two revolutions when the wheel was running at 130 revolutions per minute. Substantially the same instrument was used at the Lowell tests during the last summer and fall.

We are informed that in each case where two wheels, of the same kind, were tested the past season, a difference of two or more per cent was found, thus proving the necessity for each builder to have a place where his wheels can be readily tested and worked up to their best points.

The effect of the test, the past season, upon the water wheel trade, renders the fact patent that hereafter mill owners will require facts from actual test before purchasing wheels, and without doubt there will be plenty of testing the coming season; Mr. Emerson, with his dynamometer, will make arrangements by which it can be done at much less expense than heretofore; any one may have a private test, but henceforth, if a wheel is entered as a competitive wheel, the result will be published without fear or favor. Further information relating to these dynamometers, or in regard to test of water wheels, engines, or power, may be obtained of the patentee, by addressing James Emerson, Box 502, Lowell, Mass.

FIG. 3.



TESTING THE POWER OF TURBINE WATER WHEELS.

Metallic Spectra.

M. Robert Thalén has communicated to the Royal Society of Upsala, a memoir on the characteristic metallic lines of the spectrum, especially with reference to their wave-lengths. As ordinary spectroscopes do not give entirely accordant readings, varying as they do with temperature and other incidental circumstances, it is necessary in all cases to make the solar spectrum the basis of reference. Augström's "normal solar spectrum" was accordingly the normal starting-point of the author's researches; and, with this as his guide, he has succeeded in constructing a chart, which gives, in millimeters, the wave-lengths of metallic lines within about 0·0000001 of their true value. Forty-five metals have been thus investigated, and their spectra mapped. Of these, the following give lines coinciding with those in the solar spectrum: Sodium, calcium, magnesium, iron, manganese, chromium, nickel, cobalt, and titanium. The discovery of the last-named coincidence is due to M. Thalén himself.

The Japs in California---An Interesting Sketch of the Colony near Gold Hill.

Up to this time the Japanese have accommodated themselves in their household matters at considerable inconvenience; but this will soon be at an end, and in a few weeks they will be settled down as comfortably as you please, with houses of their own, each family reposing "under its own vine and fig-tree." Among their number are four carpenters, and these men are now engaged in erecting buildings for the use of the party. The houses are to be twelve in number, dimensions thirty-six by thirty, each containing four rooms, and built after the real Japanese fashion, with low, pitched roofs, the eaves extending far over the sills, and forming a balcony or awning around the entire house. The outer walls and partitions are all of sliding pannels, that can be shut together at the corners and folded into boxes, leaving nothing but the roof and its supports during the hot summer days, affording a luxury that can only be exceeded by "taking off your flesh and sitting in your bones." The partition walls are of paper, the outer walls of wood; one room is to be used as a sleeping room, another as a kitchen, and the two others—in each house—for silk raising, where the worms will be kept and nursed, and the silk woven and otherwise manipulated. I had omitted to mention that silk culture will form an important branch of this enterprise, fifty thousand mulberry plants having already been set out for a beginning. The Japanese carpenters are ingenious workmen, and their work is done with marvelous neatness. A curious feature of their houses is that they do not contain a nail, all of the joints and timbers being dovetailed together by many ingenious devices, and the whole work, even to the rafters, is as smooth as if it had been polished down with sand-paper. And the Japanese are a neat people, for they use no paint to hide any blemishes of construction or ornamentation, no filigree work or plaster of Paris gewgaws, but every stick in the building is exposed. Every morning, as regularly as she cooks the breakfast or sweeps the floor, the Japanese housewife takes a wet cloth and scours the whole interior of the dwelling, leaving no part untouched, and no stain or dirt spot to mar its cleanly appearance. Then the Japanese do not come into the house with muddy boots after the style of the American "sovereign;" but having covered the floor with a neat matting, always removes the dirty sandals before stepping upon it.

I stood and watched the Japanese carpenters at their work for some minutes, and noticed the peculiarity of their movements. The Japanese works "toward him"—that is, instead of shoving a plane from him, he reaches out, sets the plane upon the board at arm's length, and pulls it toward him; and he cuts, saws, and chops in the same way. His saws are fixed in handles, like a butcher's cleaver, and the teeth slant or "rake" toward the handle. The planes are constructed like ours, but the wooden portion is very thin and wide. The adze is fastened to the end of a hooped stick like the handle of one of the crooked canes that are worn on the arm on Montgomery street, and altogether their tools are different from ours, yet I cannot observe that they are awkward in appearance or awkwardly handled. The men are bright, intelligent, and polite, lifting their hats and bowing gracefully to strangers; and the women stay at home, do their cooking, take care of the babies, keep the house in order, and manage pretty much as American housewives, even to the wearing of the Grecian bend. Take them all in all, they are in every respect a superior race to the Chinese, and resemble them in no manner except in their physical appearance.—*San Francisco Paper.*

KEEPING IRON AND STEEL GOODS FROM RUST.—Iron and steel goods of all descriptions are kept free from rust in the following manner: Dissolve ½ oz. of camphor in 1 lb. of hog's lard, take off the scum, and mix as much black-lead as will give the mixture an iron color. Iron and steel goods, as well as machinery of all kinds, rubbed over with this mixture, and left with it on for twenty-four hours, and then rubbed with a linen cloth, will keep clean for months. If the machinery is for exportation it should be kept thickly coated with this during the voyage.

[For the Scientific American.]

PLATINIZED LOOKING-GLASSES.

BY C. WIDEMANN

NO. III.

It is now unnecessary to use glass free from color or to require parallelisms of the two surfaces. Bubbles of air, stripes, foreign bodies, pieces of the pots, etc., etc., do not interfere with the process. There is then an economy of 50 per cent in the glass.

In order to manufacture a looking-glass of 5 millimeters thickness, they use at the St. Gobain works a plate measuring 10 millimeters thickness. At the Wailly-sur-Aisne works plates are used having but 7·5 millimeters thickness, as it is only necessary to polish the glass on one side. From this a saving is made of 25 per cent on the thickness of the glass.

Very correct calculations show that Mr. Dodé secures an economy of 80 per cent on platinized glasses, as he uses for that purposes only inferior glass, commonly used for flagons; even common brittle glass can be used without the least difficulty. To this saving there is another to be added, which will astonish the reader. A square meter of glass absorbs about 183 grammes of mercury and 550 grammes of tin, representing about a cost of 4 francs, 40 centimes. A square yard of platinized glass costs 1 franc and 20 centimes for platina. It results from this, that at the Wailly-sur-Aisne works, the superficial square yard of platinized glass is sold at an average of 25 francs. This price is doubled in the mercury manufacture.

There is another circumstance for which this new process is recommended to the public. It is with great difficulty that mirrors are obtained with a curved surface. By the platina process this difficulty disappears, and it is as easy to manufacture curved, round, etc., as horizontal mirrors. There is also no inconvenience arising from upsetting the glasses in transportation, or in placing them in the frame.

Already in this country a company has been organized to manufacture reflectors by the means of silver mica leaves on the posterior face, and fastened together so as to obtain a large reflective surface possessing the desired curves. They are cheap, and easily repaired; but they meet with two great difficulties: the quick alteration of the silvery surface caused by the hydrosulphurous gases of coal with which locomotive reflectors are always in contact, and the want of transparency of the mica and its yellow color. I have no doubt that by the adoption of the platina these evils would have found their remedy, for, as it has been seen before, the reflecting surface is on the anterior part of the glass.

A quite peculiar property of the platinized mirrors will no doubt be applied by architects. The platinized glasses forming mirrors are transparent when the light passes through them. A person placed in the rear of an office can see everything going on in the front office without himself being seen. I insist particularly on this property; it appears to me to give to the platinized glass quite a new application which will increase its sales. This transparency is easily explained considering the small quantity of platina deposited on the glass, which quantity is not large enough to give opacity to the glass and prevent the luminous rays from passing through it. This transparency has received a very amusing application quite lately in Paris, mirrors called *mirrors á surprise*, are sold, which, when a black paper at the back of the glass is removed, allows a photograph or any other image to be seen through the metallized surface appearing as a specter; this photograph is simply applied at the posterior side of the reflecting part, and oiled in order to add to its transparency This toy is varied in very different ways, and has just been applied in the new play of "The White Cat" at Paris, and has caused an immense sensation. So I have no doubt that the inventive mind of the Americans will find thousands of applications for this property, either in applying it to the decoration of stores or to external ornamentation. In theaters or concert halls among flowers it produces the most fairy-like effect. The window glasses of a parlor made thus would be transparent in day time, and at night, when the shutters are closed, the whole window would appear as a large looking-glass, and reflect all lights and objects in the apartment.

The manufacture of glasses with amalgam necessitates great labor. In order to obtain 50 meters of looking-glass a large number of hands and a large plot of ground are required. These glasses must remain loaded with weights from 15 to 20 days; then 20 days more are required to eliminate the superabundance of mercury, and three months more are required before they are salable; not to mention all the precautions that have to be taken at every moment in the shipping and setting in frame. Mr. Dodé & Faure are able to platinize a surface of 800 meters a day, with only the aid of a few hands, as one workmen is able to platinize 50 meters of glass in 12 hours' work.

TO SOFTEN PUTTY AND REMOVE PAINT.—To destroy paint on old doors, etc., and to soften putty in window frames, so that the glass may be taken out without breakage or cutting, take 1 lb. of American pearlash, 3 lbs. of quick stone lime, slack the lime in water, then add the pearlash, and make the whole about the consistence of paint. Apply it to both sides of the glass, and let it remain for twelve hours, when the putty will be so softened that the glass may be taken out of the frame without being cut, and with the greatest facility. To destroy paint lay the above over the whole body of the work which is required to be cleaned with an old brush (as it will spoil a new one), let it remain for twelve or fourteen hours, when the paint can be easily scraped off. This recipe has been used by a tradesman, a painter and glazier by trade, for years.

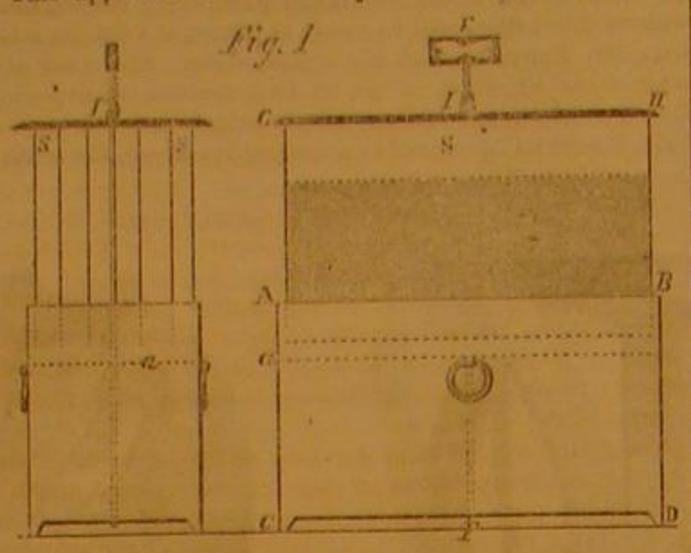
[For the Scientific American.]

APPARATUS FOR PURIFYING THE AIR BY THE EVAPORATION OF COAL TAR, PITCH, CARBOLIC ACID, PHENIC ACID, OR ANY OTHER DISINFECTANT FOR APARTMENTS, OR HOSPITALS.

BY C. WIDEMANN.

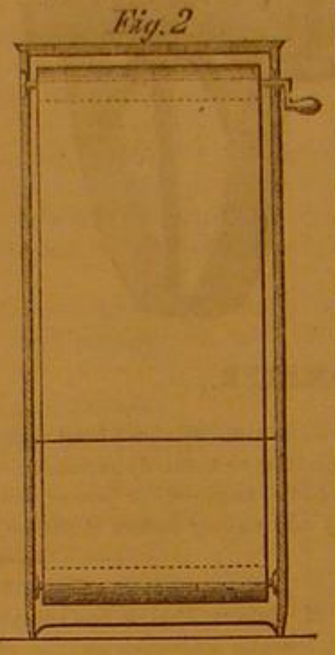
This apparatus consists of a zinc box, A B, C D. into

Fig. 1



which the liquid to be evaporated is poured, until it reaches *a*, *a*. In the middle of the box a rod, E F, passes, this rod is provided at its upper end with notches. A cover, G H, provided with blades, S, S, slides down the rod, E F, and can be fixed in any desired position by a hook spring, I, engaging with the notches of said rod.

Fig. 2

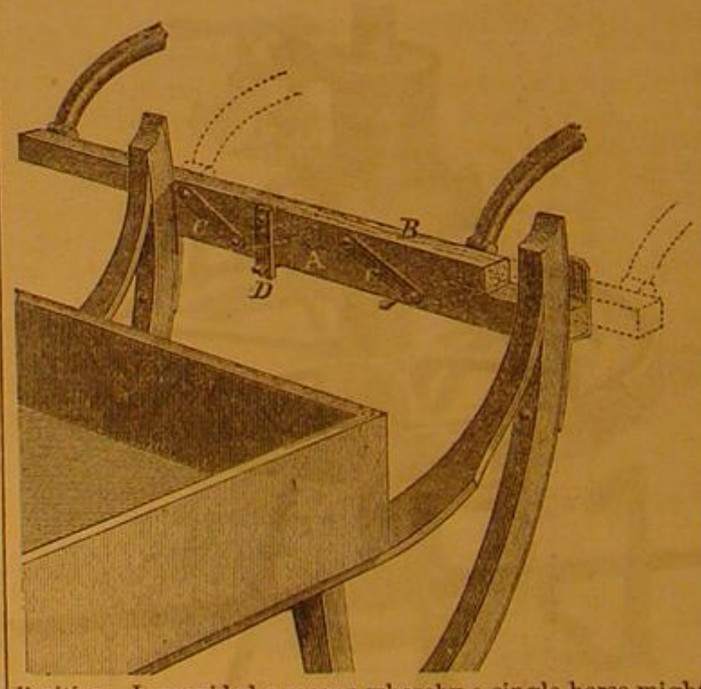


These blades having been dipped in the solution, are raised by sliding them along with the cover, and the air passing through them is saturated with the disinfecting agent. As soon as these blades begin to dry, they are re-dipped in the liquid, and raised as above described—Fig. 1.

This apparatus is very simple, and can be made of wood, tin, or any suitable metal. For hospitals the apparatus is a little modified, as more evaporating surface is required. It consists in an endless cloth passing over two rollers, and dipping in the solution, as shown in Fig. 2.

L. S. CLARK'S IMPROVED SHAFT-BAR FOR SINGLE SLEIGHS.

The old form of shaft-bar for single sleighs and cutters is so familiar to everybody that we need not dwell upon its pecu-



liarities. It provided a means whereby a single horse might travel in the right hand track made by a double team, but whenever it was desired to place the horse directly in front of the sleigh, it was found necessary to have a second pair of attachments. To make the change occupied some time, and required frequently the use of a hammer and wrench to effect it.

The device we herewith illustrate provides a means whereby this change can be effected in an instant of time without tools, and without even taking the horse out of the shafts.

The shaft-bar is double; one portion, A, being permanently fixed to the runners of the sleigh, and the other portion, B, being connected by two bars, C, with A. The bars, C, are pivoted to both A and B. When the horse is desired to travel in the right-hand track, the bar, B, is placed in the position shown, and locked at the fixed bar, A, by the spring latch-bar, D.

When it is desired to have the horse travel directly in front of the middle of the sleigh, all that is necessary is to release D, and throw B over so that it occupies the position shown by the dotted outline, and fasten it there by the latch, D. The change is effected by the hands alone, and scarcely three seconds are necessary to make it.

Patented, through the Scientific American Patent Agency, February 8, 1870, by L. S. Clark, of Bethel, Conn. For town, county, or State rights, address G. M. Lyon & Co., Bethel, Conn.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Inertia---Vis Inertiæ---What are They?

MESSRS. EDITORS:—In a late work, entitled "Force and nature," it is strenuously denied that there is any such thing as inertia in matter. The author bases this denial simply upon the alleged fact, that all matter is in motion; showing that he conceives inertia to be something that pertains only to matter at rest. He is evidently one of those amateur philosophers who enter the temple of science through its third or fourth-story windows, and never take the trouble to descend and examine its foundations, its axioms and definitions; yet he thinks himself competent to demolish the entire fabric and reconstruct it on a new plan, simply because he has traveled much, and seen a great many volcanoes and earthquakes. As the book is destined to early oblivion, it would be unnecessary to notice its error concerning inertia were this error to be found only in its pages; but similar views of inertia have been expressed in the SCIENTIFIC AMERICAN, a publication which is rarely at fault on questions of physical science, and to which thousands look with well-placed confidence for sound advice and instruction on this and other subjects. Errors in such a publication are the more likely to mislead, because they are of rare occurrence.

On pages 217 and 297, Vol. XX., the term inertia is objected to as having received various definitions: as being negative, indefinite, and uncertain in its meaning, and, therefore, liable to mislead; and it is alleged, that there is no occasion for its further use, since it had its origin in "notions of force which are now obsolete."

To the assertion that there is no such thing as inertia in matter, an appropriate reply would be that which the Romans were accustomed to make to absurd propositions: *Nil intra in pruno, nil extra in nuce duri!* "You might as well tell me that prunes have no stones, and nuts have no shells!"

That there is in matter a property which makes it necessary to employ force to impart motion to it, or to increase, diminish, or change the direction of a motion already imparted, is a fact, as well known to us as that prunes have stones, or that nuts have shells; as well known, indeed, as the existence of matter itself; for it is one of the chief characteristics whereby we recognize the existence of matter as a substantive entity. This is the property to which physicists have given the name of inertia. It is not a negative but a positive property, pertaining alike to all matter irrespective of the question whether it be in motion or at rest.

This property of matter was recognized, and received its name, prior to the time of Newton. Newton recognized it and accepted the name, declaring it to be well chosen, as happily indicating the nature of the property; and under this name he made inertia one of the fundamental axioms of his system of physics in the Principia. It is no more possible to construct an inductive system of physics without recognizing this property of matter as a fundamental axiom, than to construct such a system without recognizing the property of gravitation; indeed, to ignore the one, is to ignore the other; for the force of gravitation can have no influence upon matter which offers no resistance. The functions of the two, like action and reaction, are necessary correlatives, inseparable even in thought.

It is true that many definitions have been given of inertia; but this fact does not imply that there is any difference of opinion among physicists as to the nature of the thing defined. A property of matter can only be defined by reference to its modes of manifestation. The property of inertia manifests itself in various ways, thus admitting of as many definitions; but these different modes of manifestation are so correlated that each necessarily implies all the others, so that a definition founded upon any one of these, points us directly to that which is the common cause of all of them, and sufficiently characterizes it for all the purposes of a definition. The following, however, is perhaps a more complete definition of inertia, inasmuch as it is founded upon a feature which is common to all of its modes of manifestation.

INERTIA is that property of matter whereby it offers resistance to the action of any force which imparts motion to it, or which increases, diminishes, or changes the direction of a motion already imparted.

VIS INERTIÆ is the resistance thus offered, viewed with reference to some standard of measurement that comports with its nature as a magnitude.

We see, then, the difference between inertia and vis inertiæ: the first is the property of matter which causes its resistance to changes of motion; the second is the resistance itself considered as a measurable quantity. The "notions of force," entertained by those who recognized inertia as a property of matter and gave it its name, and which are alleged to have become obsolete, were the same as those entertained by Newton, and upon which he constructed his system of physics. He employed the term force to denote a simple quantity, expressible by the single algebraic symbol F, having but one dimension, and referable to simple gravity as its standard of measurement. He did not give that name to the products of F by other quantities, as by time, F t, or by space, F s; nor to what has been called "the force of a moving body," meaning its power to produce effects during the extinction of its motion; a power which is proportional to the product of its mass and velocity, M v, when the effect to be produced is the extinction or production of motion in other matter, and to M v^2, when the effect contemplated is such as belongs to the

department of terrestrial mechanics. Subsequent writers have used the term force not only to denote that which Newton expressed by F, but also to denote all those other varied and complex quantities totally differing from F, and from each other in their natures as magnitudes. It is this abuse of the term force which has led to all the confusion and error complained of in the articles referred to: and we shall not escape from this "slough of metaphysics" by adding another to the things miscalled force, as is proposed in the proposition "force is motion and motion is force." The true way of escape is to go back to the employment of the term to signify nothing but F,—force pure and simple.

It has been supposed by some, who perhaps have given little thought to the subject, that the theory of Tyndall, and other philosophers, in regard to the convertibility of force into various modes of molecular motion, causing, as they alledge, the different phenomena of heat, electricity, etc., and the re-convertibility of these into force, is destined to change all our previous notions of force, and even of the nature of matter itself. It was, perhaps, in view of this theory, and of the attention which has been drawn to it, that the old "notions of force" are alleged to have become obsolete. There could be no greater mistake than this. These philosophers themselves take no such view of the bearing of their theory, but regard it as tending only to extend, not to subvert the Newtonian philosophy. They suppose their molecular motions to be produced, and changed from one "mode of motion" to another, by force, acting upon the inertia of the molecules in perfect accordance with, and obedience to the laws of motion, as laid down by Newton.

This theory of molecular motions is purely speculative, and may or may not be true. It owes the attention which it has attracted, more to the reputation of its authors, and to the enthusiasm and persistency with which it has been urged, than to the force of the facts to which they appeal for its support, or to any intrinsic probability of its truth. When those adventitious supports are withdrawn, and the theory is left to stand upon its own merits it may become obsolete; but Newton's "notions of force" and inertia, being simple conceptions of facts and truths of nature as they actually exist, can never become obsolete while any sound philosophy remains, nor until truth itself becomes obsolete. ELI W. BLAKE.

New Haven, Conn.

Dying Wool Green---An Invention Wanted.

MESSRS. EDITORS:—I find an article on aniline green, on page 121, current volume, of the SCIENTIFIC AMERICAN, and as I am a practical dyer I feel an interest in these matters. I, therefore, take the liberty to address you on the subject.

Inclosed please find a few samples of iodine green on wool and cotton. The wool was boiled for two hours.

I find that the best way is to ascertain the nature of a new article, then proceed accordingly. The color is not injured by boiling, if no silicate of soda is used. We ought in coloring always, if we can, to use such substances as will not be affected in contact with the chemical influence of light. Any soda combination and the neutralization thereof with sulphuric acid does not accomplish this end. I find that tin oxide has more affinity for oxygen and is better adapted to secure permanency of the color, and not using any combinations of soda the color will not be destroyed by heat, and consequently the wool will be thoroughly colored through.

Professor Hofmann and Dr. Reimann have done great things in aniline dyeing, but it must be admitted that those practical chemists only peep, for want of time, into practical dyeing, while we practical dyers have only time to peep into the beautiful science of chemistry. I wrote a work, now out, on practical dyeing, a circular of which I inclose for your kind perusal.

Apropos, as I am now writing, I might mention that my brother writes me from Minnesota that after thrashing time "the heavens will be lighted up by fires of burning straw," the ashes of which give a universal fertilizer. But he says the straw plowed in keeps the land stronger for raising crops. I advised him to wet it with ammonia water and heap it up, as its length is objectionable to plowing, then it would rot and crumble. He replied that a straw cutter attached to the thrasher to cut the straw fine in one operation would be profitable to an inventor, and beneficial to the farmers of that and other sections. E. C. HASERICK.

Lake Village, N. H.

[The specimens of green sent us are certainly very fine.—EDS.

Soft Solder and Silver Solder for Jewelers' Use.

MESSRS. EDITORS:—In your issue of February 26, current volume, you give a recipe for soft solder. Lead and tin equal parts. A stronger, easier flowing, and whiter solder for jewelers' use is composed of lead one part and tin two parts. When the lead is melted put in the tin and then throw in a small piece of resin as a flux.

In soldering fine work wet the parts to be joined with muriatic acid in which as much zinc has been dissolved as the acid will take up. It is cleaner than the old method of using Venice turpentine or resin.

The best method of making silver solder may be useful to some of your readers—young mechanics especially who have not obtained the information during their apprenticeship. Put into a clean crucible pure silver two parts, clean brass one part, with a small piece of borax. Melt and pour into ingot. Formerly I used to return the solder to the crucible for a second melting, but it is not necessary. The solder flows easily and clean.

Solder made from coin, as it frequently is, often melts with difficulty, and remains lumpy around the joints requiring the use of the file to remove it, while the addition of any of the inferior metals to the solder causes it to eat into the article joined by it. ALEX. ALLAN.

New York city

Cheap Cotton Presses.

MESSRS. EDITORS:—I have noticed, with much interest, in your issues of January 1st and February 12th, some remarks concerning cotton presses.

I am of opinion that both correspondents are laboring under mistaken notions concerning the real wants of the planter. I believe it to be impracticable to construct a baling press that will be cheap and as powerful as would be required to bring cotton to a density of forty pounds per foot. Admitting it could be done, there are two great obstacles to be overcome, which I am of the opinion the combined efforts of all the press builders could not surmount.

1st. The planter in the Mississippi Valley pays freight per bale, and not by the 100 pounds, and the cry is for presses of greater capacity, instead of a reduction as advocated.

2d. Purchasing agents receive orders from home and foreign speculators and manufacturers, to buy a quantity of cotton of a certain grade; to do so, every bale must be sampled in order to know whether they are obtaining the quality of cotton required.

It is laborious to force the sampling auger into a bale with a density of ten or fifteen pounds per foot. Imagine the "knights" of the auger trying to penetrate the heart of a bale of cotton at two, three, or four places with a density of forty pounds per cubic foot to ascertain if it is exactly what he is looking for. He could produce a similar effect on a pine log when seasoned, or a better one, perhaps, as it is of less density than forty pounds per foot.

When manufacturers and speculators agree to purchase cotton without sampling, and steamboats carry by weight, then it may do to compress on the farm, providing a cheap press can be invented to do the compressing to the satisfaction of the planter.

It is asserted that manufacturers would receive their cotton in better order. Admitting this to be so, they are certainly laboring under a great disadvantage by not knowing the quality of a single bale of cotton in their storehouse, provided such an arrangement were perfected. As it is now, they receive the cotton sampled, classed, and marked; by the marks and classifications any grade can be selected readily. Not so, if compressed on the farm, and sold regardless of samples, which must be the case if compressed. I have ascertained by actual measurement that the average size of bales are about thirty-five cubic feet, and as the average weight is less than five hundred pounds the density is less than fourteen pounds. Compressed cotton will average about eighteen feet after expansion, and about twenty-eight pounds per cubic foot. Now if some inventive genius can construct a very cheap press that will handle two or three hundred bales per day, and bring them to a density of forty pounds per foot, I have no doubt but he could do a flourishing business in seaports in opposition to hydrostatic and steam presses.

Memphis, Tenn. E. L. MORSE.

Value of the "Scientific American"---Portable Saw Mills.

MESSRS. EDITORS:—Allow me to express my sincere thanks for your generous advice and prompt manner in obtaining a patent for my concrete pavement.

I am and have been a constant subscriber for your valuable journal since 1865, and expect to be as long as I live. I frequently find one single paragraph in it that repays me for a whole year's subscription. I especially remember one in regard to setting boilers. I have a tubular boiler that was more expense than profit to me until I learned the proper way to set it; and I am sure, in the article referred to, the information has paid me more than the price of a dozen years' subscriptions.

I notice in No. 8, current volume, that one of your correspondents, who signs his name C. E. Grandy, has discovered a new way to burn green wood, and has sawed 10,000 feet of lumber in nine and a half hours with a 20-horse power engine.

I think his plan in burning wood for fuel is excellent, but I think the above amount of lumber is a great deal to saw with a 20-horse power.

I will not dispute his word, but I have built a number of mills and I never could make them saw so much. The only one I tried was a 12-horse power; the belt ran direct from the crank-shaft pulley to the saw arbor; circular saw 46-inch; speed 600 per minute; with all the modern improvements, and the most I could saw was 2,500 feet, ¾ boards, from white wood logs. HIRAM M. CONKLIN.

Carlstadt, N. J.

Construction of Portable Boilers.

MESSRS. EDITORS:—I am a practical boiler maker of over thirty years' experience, and as such I feel safe in answering C. E. Grandy's question in your issue of the 19th February.

The fire will not injure the rivets providing the boiler is kept clear of deposits, and the true way to arrive at this very desirable result is to pump up the boiler to the upper gage once a day, and blow out with a full head of steam to the middle gage (there should be at least three gages attached to all boilers). Mr. Grandy had recourse to a very ingenious device in alteration of furnace, but this would not be at all necessary if the boiler possessed proper proportions. The grate surface being so small (26 by 36 in.) and the furnace so low (26 in.) the heat from fuel passed into the tubes in form of smoke, and having no chance to expand, passed out of smoke stack in same condition; now having his furnace built in brick work beneath the boiler, his original furnace answers as a combustion chamber, where the smoke ignites into a clear flame, and hence the result; but the great primary cause of this trouble lay in the boiler not being of sufficient capacity to do his work.

It would be much more satisfactory (at least to me) if he had given the diameter of cylinder, speed of engine, etc., than to state that his engine was 20-horse power. Herein lies the great mistake of many manufacturers of steam engines, particularly of the portable kind, they do not give sufficient boiler to generate the necessary amount of steam except by the use of the very best fuel. Now I will give you what I consider the right proportion of a 20-H. P. portable boiler: Steam cylinder, 10 in. diameter; stroke, 18 in.; speed 120 revolutions per minute; boiler furnace 52 in. long, 38 in. wide, 40 in. high; 88 tubes 2 in. diameter by 7 feet long. Thus you will perceive that this boiler is as it should be, large enough to supply the engine with steam with green sawdust and slabs as fuel, running a 54-in. saw, and in many instances a shingle mill; and each boiler tested before leaving the boiler department at least 160 pounds hydrostatic pressure.

I am a constant reader of your valuable paper; it is of infinite value to me. I consider it worth more than all the story trash of your city put together. It makes my blood run cold when I read in your paper of so many explosions of steam boilers—at least one half caused by misconstruction of new, and improper care and repairs of old boilers.

PATRICK QUINN.

South New Market, N. H.

Dangerous Stoves.

MESSRS. EDITORS:—Permit me to address you upon a subject fraught with interest to all who use *stoves*, as one of the victims of one of the vilest annoyances and dangers incident to civilized domestic life. I allude to those most provoking and dangerous things—as much to be dreaded and shunned as an ignited bomb-shell, or an "infernal machine"—stoves made with *insecure "feet,"* legs or supports; with these indispensable appendages pretended to be fastened (?) to the stove, or provided with a means of attachment in setting it up in its place.

It sounds very amusing, sometimes, to read or hear descriptions of the "miseries" of stove and pipe placing, fitting, and adjusting, under the head of "Putting up Stoves," but there is quite another and more serious point of view of the whole subject. After many a most vexatious experience with stoves ill fitted and ill furnished with feet, the following occurrence recently took place in the writer's own family. An "air-tight," wood-consuming stove, connected with a long range of pipe, and a large "drum" in an upper room, was well supplied with fuel, and contained a glowing fire. One of its feet was discovered to have *fallen* out, by a little child who happened to be alone in the room at the time. The child, fearing the stove would fall over, attempted to replace the stray foot, when the stove fell over with a crash, endangering the life of the child, and scattering pipe, ashes, fire, and danger in all directions over the carpeted floor, besides consternation all over the house, and breaking the stove. It was a narrow escape from a serious calamity, but it was at the same time excessively alarming and troublesome, calling for much labor in two stories of the house.

Is there no simple, and at the same time effectual mode, not only of attaching, but of securely *fastening* the feet of stoves *to* the stove, as to form part and parcel of it, whether standing, or when moved from place to place, instead of the miserable tapering "dove-tail" insertion so commonly in use for stoves of all sizes and descriptions? And should it not be classed among the "catalogue of crimes," for stove makers to make and sell stoves with a "make believe" appendage at the bottom, which will be either so loose as to fall out of its place from its own weight or a slight jar, or so tight as only to go half way in?

Is there not in existence, in some available shape, the desideratum above alluded to? If so, your correspondent would be pleased to be informed what it is like, and also why it is not in general use among founders? If there is such a thing, why, in the name of common sense and common safety, do we not have the benefit of it accordingly, as well as of the thousands of inventions of minor importance? And why should stove makers not be compelled to provide for safety in this respect, as well as those using steam engines to see to the safety of their boilers?

A Suggestion to Boiler and Engine Builders.

MESSRS. EDITORS:—I have had considerable experience in the brass and machine business, and have experienced a great deal of inconvenience in the practice of the different machine shops and boiler makers in tapping holes for cylinder, gage, and pump cocks with a variety of different threads and sizes. I take this method of suggesting to the boiler and engine builders, through your valuable paper, a uniform system of size and thread by using the standard gas taps, which are suitable, and, I think, could be adopted with considerable advantage to all concerned throughout the United States.

ISAAC B. POLK.

Columbus, Ohio.

CEMENT FOR CLOSING CRACKS IN STOVES, ETC.—A useful cement for closing up cracks in stove plates, stove doors, etc., is prepared by mixing finely-pulverized iron, such as can be procured at the druggists, with liquid water-glass, to a thick paste, and then coating the cracks with it. The hotter the fire then becomes, the more does the cement melt and combine with its metallic ingredients, and the more completely will the crack become closed.

Improved Washing Machine.

This machine is designed to imitate the action of hand-rubbing, without the use of the washboard, as nearly as can be done by a mechanical device. In fact it both squeezes and forces the water through the texture to be cleansed as gently or as forcibly as desired.

It consists of a water tub or case, A, Fig. 1, of rectangular or other form, within which is placed a revolving cylinder B, Fig. 2. Around this cylinder is placed a casing, C, Fig. 2, made in segmental sections, each so arranged as to be capable of motion to or from the cylinder, and being pressed toward the cylinder by a chain pulley and weight, as shown in Fig. 2.

One of the sections is hinged, as shown in Fig. 1, and may be opened to take out or put in the articles to be washed, and when closed may be fastened so as to act in conjunction with the other sections.

The external surface of the cylinder, A, and the internal surface of the segmental casing, are grooved as shown in Fig. 2, to facilitate the carrying the clothes around between them, and to increase the squeezing and cleansing action.

The operation of the machine is as follows: The clothes being put in by opening the hinged segment—the interior of which is so constructed that the space narrows toward the cylinder—two turns of the crank brings them under and between the cylinder, and the segmental casing, where they are squeezed and cleansed by oscillating the crank. When sufficiently cleansed, the same number of turns brings them to the hinged segment again, and they are then taken out and wrung by a wringer attached to the machine in the usual manner.

The inventor claims that this machine is superior to any machine heretofore devised, because it imitates the action of hand washing so closely; a constant squeezing being kept up by the action of the grooved surfaces. The boiling is kept up by means of a steam pipe, which conveys steam to the machine from a kettle, range boiler, or any vessel generating steam, and the washing and boiling are thus done simultaneously, the use of the washboard being entirely superseded.

It is claimed that the finest goods can be washed without injury to the fabric, and that family machines will wash from four to six shirts, or two sheets, in from two to five minutes. The steam being confined does not cause annoyance by spreading through the house.

The mechanical arrangement and construction are simple and not liable to get out of order.

Patented, through the Scientific American Patent Agency, August 24, 1869, by Jerome B. King, who may be addressed for further information, corner Horatio and West streets, New York city. Machines may be seen in operation at 71 West Broadway.

Fig. 1

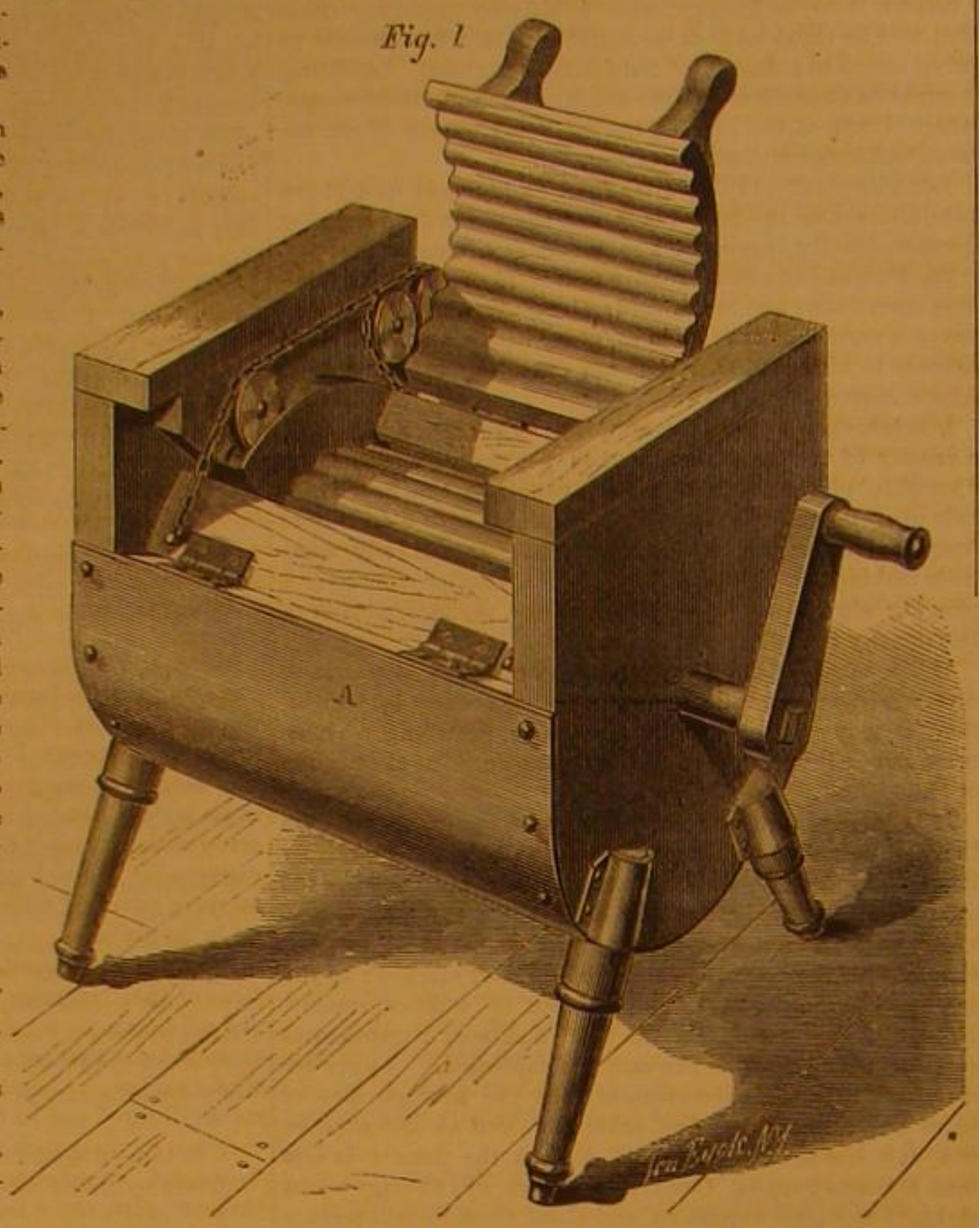
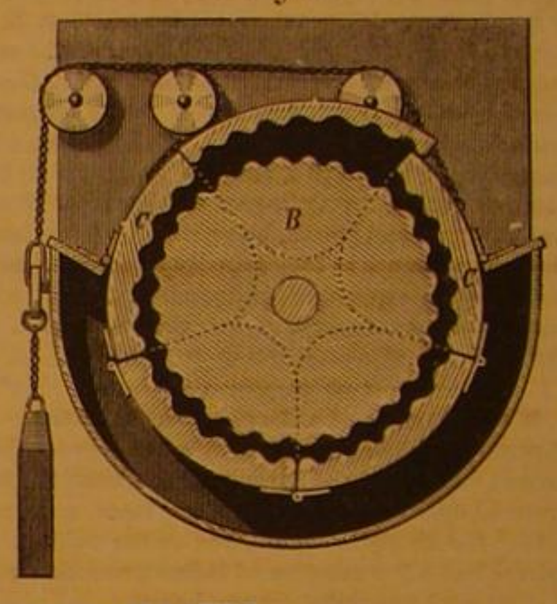


Fig. 2

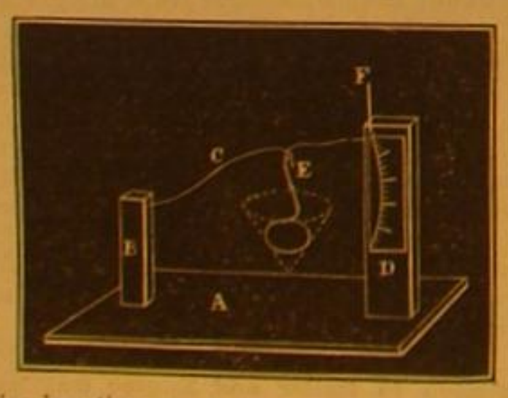


JEROME B. KING'S SELF-ADJUSTING DOUBLE WASHER.

SPRING BALANCE FOR CHEMICALS.

A contributor to the *Illustrated Photographer* writes:

"On trying some chemical experiments lately, I found that my ordinary photo scales were very uncertain with



quantities less than one or two grains. So I constructed a spring balance, which I find so very delicate and useful that I think a description of it may be of service to fellow-subscribers.

"A is a deal stand 12 by 3 inches; B is a hard wood block, firmly attached to A; C is a spring; D is an index pillar; E is a scale-holder; F is a small bent pin, to hold the spring steady while changing the scale pan.

"The spring, C, should be very fine steel wire, bent over so as to form a loop or eye near the index for E to hook into. The index is a slip of card set out with a fine pen. The scale pan is of thin letter paper; circular, and folded something like a filter paper. Indicated by the dotted line.

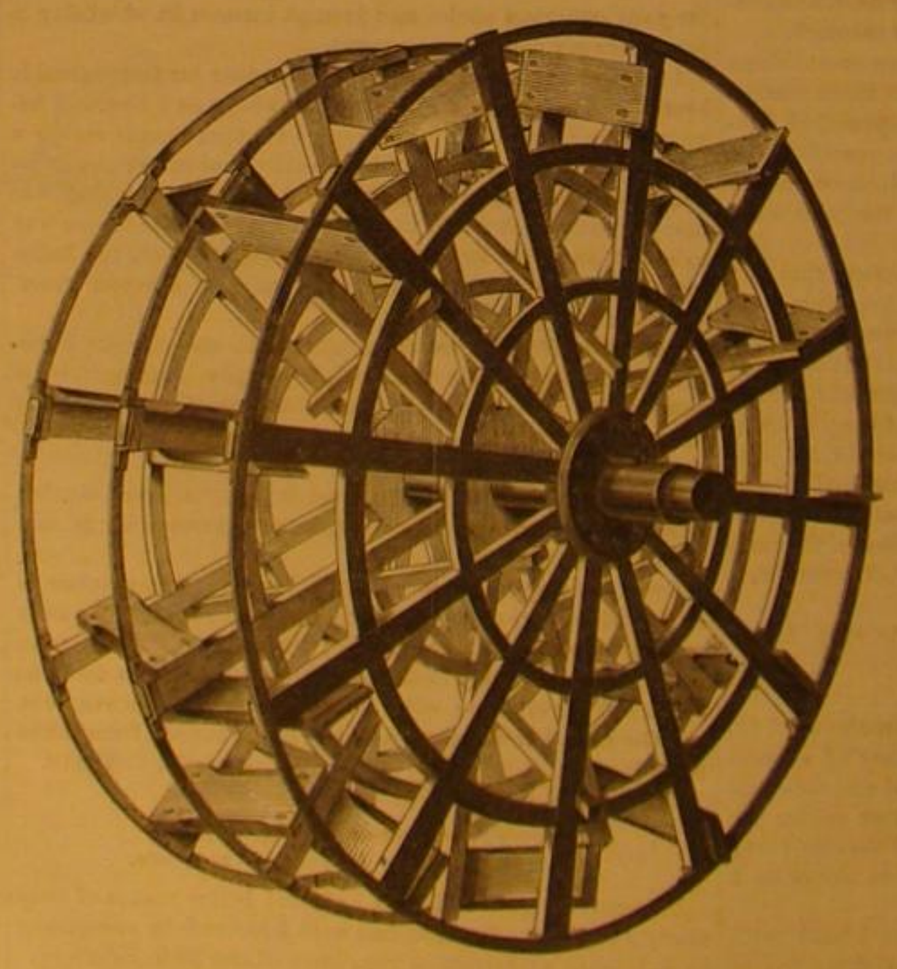
"I find that with it I can tell off, with the greatest accuracy, the minutest fragment of a grain.

"Or, by substituting a stouter wire, grains, on the index, read drachms or ounces."

Improved Paddle Wheel.

In very rough water the paddles are exposed alternately to the extremes of being too deeply immersed, or working almost or completely out of water. In all intermediate conditions the surface is inclined constantly in various directions, and the paddles arranged in the ordinary way, strike gently or gradually, commencing at one end or the middle, and the contact with the water progressing gradually along the length of each float. But when working in smooth water, which is or ought to be the best condition for favorable working, it is found that the percussive force with which the broad surface of a long paddle strikes against the water, is not only a serious annoyance but exerts a very destructive influence on the machinery by its continuous concussions. On some of the western rivers an approaching steamboat may be heard long before she is in sight by the rapidly-recurring blows of the paddles on the water.

Some machines, built apparently like others, have peculiarities, idiosyncracies, perhaps some college professor might say, a sort of personal peculiarity which it is rather difficult



THE MAHONEY PADDLE WHEEL.

to explain. A lot of locomotives made in the same shop, from the same pattern and by the same men, will not work exactly alike. Three Peck Slip ferry boats were once made in this city, as near alike throughout as skill could make them; and two steered well, and one nobody could steer with satisfaction. From the same unexplainable reasons, probably due to slight differences in materials or form, some steamers are peculiarly susceptible to the ague from the cause now referred to.

The matter attracted the attention of a practical engineer, Mr. James Mahoney, formerly the Chief Engineer of the Boston, Newport, and New York Steamboat Company, who attained a solution of the difficulty by very simple and apparently very obvious means. All paddle wheels are divided into two breadths by a central beam, that is, there are three rims or slender circles of iron, with three sets of arms extending out from the shaft thereto. The paddles are bolted to these arms. The Mahoney wheel has the buckets divided into two lengths, and placed so as to alternate in position, and each half length is placed a little oblique or inclined. It is found that the obliquity need not be very great to obviate all or nearly all the trembling. The steamer, *What Cheer*, running on Providence river and vicinity, was one in which the concussion was very severe. Her paddles were five feet eight inches long and twenty inches wide, and the wheels sixteen feet in diameter. The alteration of the paddles, according to Mr. Mahoney's plan, as is officially certified by the captain and engineer, obviated the jar, trembling, etc., fully one half, and increased the speed of the boat, giving a gain in this latter respect of five minutes in each hour with ten pounds less steam.

The steamer *Monahansett*, a larger steamer, running between New Bedford and Edgartown, with wheels twenty-six feet in diameter, paddles seven and a half feet long and twenty-two inches wide, were altered to the Mahoney plan with an entire removal of the jar or trembling and a marked increase in the speed. The average running time with the old wheels was two hours and fifty-five minutes; with the new wheels two hours and thirty-five minutes. Previous to the change the jar or trembling was unusually severe. In this case the same buckets were used, simply cut in two lengths obliquely and rebolted. On this boat the obliquity was eleven inches, that is, each bucket or half length was eleven inches further in at one end than the other. The wheel is now about being applied to the *Ironsides*, now lying at the Erie Basin, Brooklyn.

There has been an almost countless multitude of contorted and curious modifications of the paddle wheel. Some of them have approximated to this idea in various ways. Mr. Mahoney, however, whose invention is illustrated by the accompanying engraving, seems to have made a practical and successful improvement in this important adjunct of navigation. The paddles stand in their ordinary planes, and act on the water in other respects in the same manner as the long approved common paddles. They will, it is presumed, endure all the rough usage among floating lumber and ice of the ordinary wheel, and having demonstrated their efficiency as propelling means, the smoothness of their action, and their relieving the vessel and machinery from concussion, will go far to hasten their general and rapid introduction. Patented Nov. 9, 1869.

Further particulars, rights, or supervision in the application of this invention, may be had by addressing James Mahoney, Newport, R. I., P.O. Box 635, or William Burnett, Supervising Inspector of Steamboats, San Francisco, Cal.

THE New York Central Railroad, one year ago, issued a scrip dividend of eighty per cent on the capital stock of the road, and having failed to make returns to the Revenue Office, the Company was assessed by Ralph P. Lathrop, United States Assessor for the Albany district, five per cent on the dividend, the tax amounting to $1,152,000. This appears to us to be right. We see no reason why this dividend tax should not be collected the same as any other.

INCOMBUSTIBLE wicks for kerosene lamps are made in Vienna, Austria, of asbestos, which is boiled in wax. They last at least a year.

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NEW YORK, SATURDAY, MARCH 12, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

*The Cere Viaduct....167
Railway Economy....167
On Tin....168
The Century Plant....168
Louisiana State Fair....168
On a new method of Straightening High Chimneys....169
Varnish for Iron....169
*Working Millstones with an Air-blast....170
How Dualin is made....170
*William's Improved Tracelock....170
J. D. Michael's Egg Box....170
The Moon as a Terrestrial Motor....170
*The Measurement of Power — Emerson's Dynamometer....171
Metallic spectra....171
The Japs in California—An Interesting Sketch of the Colony near Gold Hill....171
Platinized Looking-glasses....172
Apparatus for Purifying the Air by the Evaporation of Coal Tar, Pitch, Carbolic Acid, Phenic Acid, or any other Disinfectant for Apartments, or Hospitals....172
*L. S. Clark's Improved Shaft Bar for Single Sleighs....172
Inertia — Vis Inertiæ — What are they....172
Dyeing Wool Green—An Invention Wanted....173
Soft Solder and Silver Solder for Jeweler's use....173
Cheap Cotton Presses....173
Value of the SCIENTIFIC AMERICAN—Portable Saw Mills....173
Construction of Portable Boilers....173
Dangerous Stoves....173
A Suggestion to Boiler and Engine Builders....173
*Improved Washing Machine....174
*Spring Balance for Chemicals....174
*Improved Paddle Wheel....174
Wood Engravings....175
Hardening and Tempering Steel....175
Inertia and Vis Inertiæ....175
An Inexplicable Power....175
Lockage Waste on our Canals....176
Restrictions on the Weighing of Coal....176
The Water Wheel Tests at Lowell....176
An Immense Salt Mine....176
Opera House Dirt....176
Zinc Light....176
Dust and Disease....177
The Bulging of Walls—Cause and Prevention....177
Nickel Plating....177
Answers to Correspondents....177
Recent American and Foreign Patents....178
New Books and Publications....178
Inventions Patented in England by Americans....179
List of Patents....179

WOOD ENGRAVINGS.

Not the least of the means by which science and knowledge are disseminated at the present day, and by which the present stage of civilization has been reached, is the art of wood engraving. So far has its power as an educational means been recognized that scarcely a primary school book is now published without illustrations.

From the ape which helps to impress upon the infant mind the first letter of the alphabet, to the zebra which performs a similar office for the last, through the first primer of arithmetic, and so on progressively to the higher studies of geometry, surveying, astronomy, physics, and chemistry, the pupil finds his imagination aided and cultivated by wood engravings; not rude, uncouth caricatures but really meritorious productions.

In our early school-days the only picture contained in any school book then in use, except the geography, was the frontispiece to Webster's Spelling Book. A picture of a female with a forbidding countenance inviting us to come up to the temple of knowledge, and giving us to understand that if we wanted to win fame, we must devote ourselves to orthography with the utmost diligence.

We are confident we fulfilled our part of that contract, but the female with the forbidding countenance has never fulfilled hers.

At that period a picture in a newspaper was a thing to be wondered at and talked about by a whole neighborhood. Now even the dailies endeavor occasionally to grace their columns with pictures, but as yet such pictures can scarcely be called works of art.

We venture to predict that men of two-score years now, will, ere they arrive at three-score, see illustrations in every daily paper as regularly as they now see the market reports.

Of course nothing good will ever be originated that the spirit of evil will not pervert to its own purposes. There now exist a large number of papers, the illustrations in which as well as the reading matter, are wholly vile, and the influence of which is entirely bad. The strong arm of the law ought to be invoked to suppress these obscene publications.

On the contrary, there are a large number of publications which teem with, in some instances, really superb works of art, the circulation of which cannot be too much encouraged, for their refining and cultivating influence on the masses.

One of the earliest illustrated papers in this country was our SCIENTIFIC AMERICAN, and the educating influence it has exercised has doubtless been to a great extent due to the able manner in which our artists have sustained this feature. In a description of machinery a stroke of the artist's pencil will often do more to elucidate a subject, than a page of verbal description.

Many an invention dates its financial success from its illustration and description in the SCIENTIFIC AMERICAN, and the study and examination of these illustrations have probably originated more useful and ingenious inventions in this country than any other cause.

HARDENING AND TEMPERING STEEL.

When we penned our recent article on the above subject, we had little idea what a sensation we were preparing. Such a shower of correspondence as has fallen upon our sanctum, and fairly snowed us in with arguments pro and con, is something we hardly expected.

This correspondence gives evidence that we did not overstate the diversity of opinion existing among mechanics. The urine theory has, we find, many adherents, one individual going so far as to say that in the variety of qualities of this fluid generated by different animals, nature had no doubt special regard for the wants of mankind. He regards the influence of urine on steel as entirely distinct from any of the ordinary forces of nature.

Of artificial solutions we have no end. Most of our correspondents believe in putting salt in the water, but those who advocate this, base their approval on the fact that it seems to prevent the spheroidal state which takes place in pure water, and thus the water adheres more closely to the iron, and cools the latter more rapidly. We are willing to concede this mechanical action of salt, but it is evident that it would not do for such grades of temper in steel as can only be obtained by slower cooling. Indeed, some tools are best tempered in water with the chill taken off.

On the other hand, we have plenty of letters from practical men who are convinced that all solutions are better replaced with pure water.

One gentleman of very long experience and every way a practical as well as a scientific mechanic, takes this ground; and, in addition to his own experience, furnishes us with the experience of Mr. N. P. Ames, late of Chicopee, Mass., who, some thirty-five or forty years since, succeeded in making sabers, swords, and cutlasses in this country, that would stand the U. S. Government tests. After expending much time and more than three thousand dollars in experiments with various solutions and baths, he found that heating in a charcoal fire, hardening in pure spring water, and drawing the temper in a charcoal flame was the best practice.

A correspondent from Chicago writes us an interesting letter in favor of the pure water practice, which we should be glad to publish, as he evidently has based his views both upon study and long practice; but our friends who favor solutions might deem us partial as we publish nothing on their side of the question. This writer seems to have touched hard pan when he says "let co-laborers discard all superstitions, solutions, incantations, etc., and pay more attention to how they heat steel before hardening, and, my word for it, they will soon lose trust in solutions."

It is time we had a new definition of steel. Any compound of iron hard enough to make some kind of cutting implements now goes by that name. The term has even been extended to alloys of iron with other metals, and when steel is spoken of a very indefinite idea is conveyed. The grade of carbonization, the presence of substances other than carbon and iron, or their proportions if present, are not indicated by the term. Upon no subject is there less accurate information diffused among the masses than that of steel, and in the absence of more precise terms by which to indicate the various qualities of what is called steel, it will be very difficult to impart accurate knowledge.

Finally, we consider that chemical reactions do not take place in the act of hardening and tempering steel, when those terms are understood to mean the process of hardening steel by sudden cooling after heating it and subsequently drawing the temper by heat. This being the case, we see no use of solutions except perhaps as in the case of a brine of common salt they cause the water to hug the metal more closely and thus facilitate the cooling. We are confident, however, that if the character of the steel be thoroughly understood previous to hardening and tempering, and heating and working be regulated accordingly, water, pure and simple, is all that is wanted to secure any degree of hardening, and the proper temper upon subsequent heating, if the latter is performed judiciously.

INERTIA AND VIS INERTIÆ.

A correspondent, in another column, under the above heading, criticises, rather more severely than ably, a recent work entitled "Force and Nature," chiefly on account of its denial that there is any such thing as inertia in matter. This correspondent charges the author of "Force and Nature" with having "entered the fourth-story window of the temple of Science," and having never descended to examine the foundations—its axioms and definitions. He might not have adopted this ingenious figure had he seen how easily the author, whom he has attacked, might turn the tables, and charge that his critic had never been able to climb from the cellar of the temple in which he has ensconced himself, and, therefore, cannot be supposed to know what discoveries and theories go to make up the upper stories of the structure.

Newton was a great man, but scientific knowledge has grown some since his day. Because he thought the term inertia an appropriate one, it is hardly safe to say that everybody who thinks will accept it as such for all time. The subject of molecular motion was very little understood in Newton's time, and, had he known what is now known, he might have modified his views.

But we have not taken up the pen to defend the author of "Force and Nature," with whose conclusions we do not agree. We have other matter of difference with our correspondent, who charges *us* with false teaching on this matter, referring to articles on pages 217 and 297, Vol. XX., for confirmation of this statement.

It is true, that in those articles we took exceptions to the term inertia, as being one variously defined, and, at best, negative in its signification; and charged that it grew out of the obsolete notion that there is a property residing in matter by which it resists motion. And notwithstanding our correspondent's reverence for the opinions of the thinkers of a past generation, we shall, in the absence of more light than we can at present attain, still hold that opinion.

We do not say, that the term inertia is now, or was ever understood by our best thinkers as applying to a state of rest alone, but it has been used, even in modern textbooks to express the idea of resistance of matter to motion. In Silliman's Physics, page 13, we find in his definition of inertia the following: "Matter has no spontaneous power, either of rest or motion." In Bartlett's Mechanics, page 20, we find: "Inertia is that principle by which a body resists all change of its condition in respect to rest or motion." In Ganot's Physics, page 7: "Inertia is a *purely negative property* of matter. It is the incapability of matter to change its own state of motion or rest." In Nichols' Physical Sciences, page 465: "The principle generally named the principle of the inertia of matter is two-fold. The first part of it *is a pure but a convenient hypothesis.* This hypothesis is that *all nature is naturally inert, motionless, lifeless; and that action or activity can be impressed on it solely by external agencies or forces. But in so far as we can form any conception of the constitution of matter, this is physically quite untrue, not an atom existing which is not the center and source of manifold and multiform activities.*"

But we have quoted enough for our purpose. We might go on quoting authors by the dozen to show that this term is not accepted as meaning the same thing by those who write and think upon it; and that it had its origin in the "obsolete notion" of the *naturally inert condition of matter.* Morin, in his Mechanics, does not apply the term to matter, *per se*, but to bodies or masses of matter (see page 8, Bennett's Translation).

The idea of the resistance of matter to motion originally grew out of the fact that time is required to transmit *mass motion.* A team of horses attempting to draw a canal boat, does not instantly move it as a mass, but it moves something immediately. Instantaneously, with the application of the power, there begins to exist the state of matter known as tension, in the harness, rope, etc., and this tension is an increase of motion in the molecules in one direction. Gradually this tension is converted into mass motion, and the boat moves. There is nothing about this to indicate that matter resists motion. It only indicates this fact, that, as we can not by any mechanical means apply power instantaneously to all the molecules of a mass, the power we do apply must be communicated from molecule to molecule throughout the mass, and this takes time.

Now is inertia, loaded down—as is every term born of false conceptions and hypotheses—with different meanings and interpretations, a good term to express this fact that time is required for a mass to impart or to receive motion? With all due deference to other people's opinions, and not desiring to force our opinions upon any one's acceptance, we still submit that it is not.

We insist that it is, as Ganot says, purely a negative property of matter, and is as illogical in its use and application as it would be to define snow as being something not black, not made of whalebone, not good to eat, and not having the property of being agreeable to bare feet. There is no end to definitions, if we accept negatives as such, and their use only blinds the mind to positive facts and just conceptions.

AN INEXPLICABLE POWER.

In Dayton, Ohio, on the 17th of Feb., a terrible boiler explosion took place at the works known as the Western Machine Shops, making a complete wreck of the works, killing five persons, and seriously injuring many others.

The Coroner's jury, after a full investigation of the facts in the case, found that the cause of the explosion was from a low stage of water in the boiler, the result of negligence on the part of the engineer in charge.

We learn that Mr. Fetters, late official inspector of boilers for the district, had, in a conversation with the foreman of the works, pronounced the engineer incompetent, and too careless for such a post. The foreman stated that he was afraid of the concern, and had several times complained of the matter.

The boiler was a nearly new one and in excellent order.

An intelligent engineer sends us now an article called forth by this accident, clipped from a paper the name of which is not given, entitled "An Inexplicable Power," which is really a curiosity in its way, and we therefore give it entire.

"A number of engineers insist that there was inexplicable power in the atmosphere on Thursday afternoon, which prevented boilers from operating properly, that they were unable to account for. They found it impossible to run their engines evenly. They either got too much steam, or not enough, and there was difficulty about the working of the pumps; and they were not able to account for it. There are times—these men affirm—when boilers will explode without any apparent cause, despite the most careful labor by the most practical engineers to be found anywhere. We conversed with several practical engineers, yesterday, and they all agreed as to the strange influence to which we have referred. 'What is it?' we inquired of one. 'Why, it's in the air,' he replied, 'but I can't explain it. I can't run my engine even: for a few minutes steam is generated too fast, and that which escapes from the valve gets blue as blazes, and makes things fairly sing again; and it's really not safe. Then, suddenly the water gains on me, and, although there's a good fire, it appears to be impossible to generate steam; it won't rise, do the best I can with it. Now, the engine is in excellent order, and the pumps work like a top, and there is nothing in the machinery to induce this condition. I think it must be in the air. It was just so Thursday afternoon, and I worked with my engine for half an hour, after dinner, and getting discouraged, I drew my fires to let the boiler cool, so that I could have a fair look at things. I hadn't been out doors a minute until I heard the explosion at Taylor's. I knew in a minute what it was. If I'd kept up my fires five minutes longer, I'd been blowed to bits—I *know* it. There are certain times when an engineer feels that there's an influence at work in his boiler which he don't understand and which he is powerless to control. An engineer who don't know and feel this, will explode a boiler. There may be a shade of superstition in this, but the speaker was in real earnest."

We are able to give a full exposition of this inexplicable

power, as it is called. It does not reside in the air, as supposed, although it may easily be traced, as we shall see. It produces a great deal of mischief, other than exploding steam boilers. It is the *love of money*. Avarice is the mysterious agent that is blowing up boilers and destroying property.

The mischief is not in the air, it is in the pocket. All talk about any other "inexplicable power" is inexplicable bosh. Here was a confessed ignoramus and a *careless* ignoramus repeatedly complained of, but still allowed to retain his position until his carelessness resulted in a wholesale murder. We do not gather how much was paid him for his services, but if it was two or three dollars a week less than a competent man would have demanded, that would be a sufficient inducement for many employers to risk the lives of their employés.

If this sort of thing goes on much longer, it will correct itself. People working in steam factories will demand so much greater wages for the extra risk they take, that it will be much cheaper to employ competent engineers.

As to the tantrums of boilers described by engineers (sic) in the above quotation, they are simply sensational moonshine. There has been enough of this kind of endeavor to saddle ignorance and incapacity upon Providence. There is nothing mysterious about boiler explosions, in general. In some cases there is absence of knowledge as to the particulars in which neglect or carelessness has been permitted, but in ninety-nine cases out of every hundred, there has been some neglect. Boilers explode from the disruptive force of steam, aided sometimes by the force of unequal expansion in the iron; and if weakened by age or bad usage, they explode more easily than when sound and strong. This is the whole story in a nutshell. Put ignorance and steam in contact, and you have a very dangerous combination. Place integrity, fidelity, and intelligence in charge of steam generators, and keep them there from the time the first plate is cut, and the first rivet driven, till the boiler is pronounced unfit for service, and boiler explosions will become as rare as they are now abundant.

LOCKAGE WASTE ON OUR CANALS.

The following extract from the *Pittsburgh Commercial*, has been referred to us for opinion:

There seems to be some doubt entertained as to whether a sufficient supply of water can be had on the higher "levels" of the Erie Canal to accommodate the large tunnage that will undoubtedly seek transportation over this line when it is enlarged to the capacity of a ship canal! In discussing this phase of the subject your correspondent, "Observer" (Mr. John F. Bennett), raises the question of the possibility of passing boats through the locks with a less expenditure of water than is commonly required. This is a pertinent inquiry that can be very satisfactorily answered. If boats have never yet been passed through canal locks without the usual waste of water and water power, it must be because *that* economy has not been needed, for a very little practical knowledge will establish the fact that the *power due to the water falling from the higher to the lower level* in passing boats up and down, DOES NO WORK in raising or lowering the tunnage, and may be employed in pumping back into the higher level a volume of water almost equal to the entire lockage. Moderately efficient machinery ought certainly to return more than one half, and thus add more than one half to the ordinary capacity of the canal. No fears of a scarcity of water need operate to deprive us of this great improvement.

In its construction, the locks may be at once made large enough to accommodate any probable future traffic, leaving the "levels" to be enlarged from time to time as the demands of business shall require.

To make the water power that now goes to waste available in preserving the maxmium of water in the levels, it is only necessary, instead of letting the water into the locks through the ordinary wicket gates, to let it pass into the lock *through a turbine wheel*, and employ the wheel in driving suitable pumping machinery that will lift water from the lower to the higher level, and in emptying the lock let the water *pass out through the same* or another wheel, and again employ the power in raising a further quantity of water to the higher level.

When the immense power thus to be utilized is not needed to assist navigation by returning the lockage water to the higher levels, it can be readily made available for other uses, and along the entire line may be the source of no small income to the company owning the canal.

The general theory of mechanical saving in water waste given above is correct, and has attracted the attention of hydraulic engineers for many years, as to convenient and useful *modus operandi*, one favorite idea being to make the summit locks double acting by balanced frames, so that an emptied chamber on one side would in part restore a supply to the upper level. If, however, the gentleman who has advanced this suggestion, with a slight *coleur de rose*, will patiently work out the process by exact calculations of the power available for the net return, and more carefully examine the various sources of loss which go to make up canal waste, as a whole, he will see that the economy is far less demonstrable than the primary impressions indicate.

The lockage waste itself, on a canal of any length, between points of supply, though undoubtedly a large item, does not measure the whole waste.

If we take, for instance, the estimated water supply for the "Improvement of the Champlain Canal," as given on page 98 of Mr. McElroy's Report in 1867, it will be observed that the items for one summit group of locks, on 11¼ miles of canal, 225 and 100 feet lock, were for

	Cubic feet.
Lockage per day	5,203,167
Evaporation, filtration, and weirs	2,368,800
Gate waste	720,000
Total	8,291,967

about 62 per cent being lockage waste on a short length like this.

Taking into account then the restriction of this mechanical device for return supply at the upper lock, the limited quantity of water which is delivered with a descending boat, the absolute limit to time of filling and discharging on any important canal, the necessity of an entire rearrangement of the methods of inlet and outlet, the fluctuating head under which the pumping machinery must work, and the probable or possible ratio of return supply, engineers who have carefully studied the general subject have rather been induced to advise the use of an independent pumping establishment. It would, however, be a professional service, if any detail and careful analysis is presented of the advantages of a local and special lock return, on the general plan above mentioned, by which the actual merits could be carefully estimated.

RESTRICTIONS ON THE WEIGHING OF COAL.

Granted that coal dealers are on the average as honest as any other class of men, and that they are no more disposed to rob the poor than their neighbors who have less opportunity for so doing; is it safe to tempt men as coal dealers must be tempted?

Not one man in fifty, when he orders a tun of coal delivered at his house knows whether he gets full weight; and the coal dealers are perfectly aware of this fact. They know that if a purchaser stands and looks on while the weighing is performed, that he must, perforce, take the weight of the cart on trust, and therefore that even such vigilance would avail little to prevent fraud in the weighing.

It is so inconvenient for people in general to re-weigh their coal, and so difficult to devise any means whereby in the absence of personal attention, and without extra expense to themselves, they can be secured against fraudulent weighing, that in our opinion the system of selling coal by weight is a bad one. It would be far better to sell it by measure.

There is no doubt that short weights are common in the retailing of coal, and cases have come to our knowledge where such fraudulent dealing has been practiced in the filling of contracts to large manufacturing establishments, which ought to be able to take care of themselves, and therefore are not much to be pitied.

But the poor who are only able to get coal by the very hardest, and who are wholly at the mercy of the dealer, ought to have some protection. This would be afforded were coal sold by measure. They would soon learn to detect frauds in bulk, and thus the power to cheat would no longer exist so far as quantity is concerned.

We do not suppose coal dealers more likely to take an advantage of opportunities to defraud than retail grocers, or even milkmen, but we respect them too much as a class, to wish them subjected to temptation, which might be removed by a prayer to the Legislature to deliver them from it.

THE WATER WHEEL TESTS AT LOWELL.

There are always two sides to every question. Our recent article on the test of turbine wheels at Lowell, has called forth a communication from Mr. Emerson, whose testing apparatus was employed at Lowell, and which will be found illustrated and described in another page of this issue.

We have so far resisted all importunities to publish communications upon this subject, and we shall adhere to this rule; but having given a *resume* of one side of the question, as gathered from our correspondence, we do not wish to commit the injustice of refusing the same for the other side. We therefore, now give the gist of Mr. Emerson's statements, leaving our readers to form their own opinion upon it.

It is denied that the charges made in the correspondence, upon which our former article was based, are true, and a copy of the circular sent to manufacturers inviting them to send wheels to be tested, and stated to contain the only terms ever made in any way whatever, now lies before us.

The statement that the wheels were required to be of a specified power, is not contained in the circular; but, on the contrary, it is distinctly announced that "each competitor will select the size and finish of wheel to suit himself."

The circular further specifies that "for use of flume and weir, competitors will be charged $250; for use of dynamometer and water, enough to cover expenses. Cost of flume, water, and dynamometer will not exceed $300. The arrangements have cost $1,500. If there is sufficient competition, the cost will be divided fairly with all. Each will make their own arrangement with Engineers." It adds that further information may be obtained by addressing James Emerson, and invites all who wish to witness the test.

That anything different from this was communicated by letter in answer to subsequent inquiries, is denied by Mr. Emerson, who positively states that "*these were the only terms ever made.*"

The arrangements alluded to as costing $1,500 was the flume only. The dynamometers cost $1,700 and nearly a year's time was given by Mr. Emerson to the tests, and to preparations for it.

In regard to the cost of the tests, we are informed that as the wheel specified in the circular as one of those to be tested, was distinctly announced as finished in the ordinary manner, it was expected that the others would follow in the same way and without delay; instead of which, four months elapsed before some of the wheels were prepared for the test, and it was well understood by the tardy competitors that the expense would be increased by this delay.

Mr. Emerson states that in return for over a year's expenditure of time, and an outlay of several thousand dollars, he has received in all only $650, a considerable part of which has been paid out for freight on wheels, telegrams, oil, etc. This certainly does not look much like extortion.

In regard to the settling of the flume, we are told that it still stands in the same place, and has been in use all winter for testing large and expensive wheels, and that it is considered as being in good condition.

It is stated that there was abundance of water for months after the test was announced. Early in the autumn there was a slight drought, but before the wheels were ready there was plenty of water again. At the time of the disastrous freshet which occurred in the fall, there was a break in the canal which caused a delay of four or five days, but Mr Emerson states that at the time of testing there was so much water that unless restrained at the head gates it would over flow the flume. So much for the statement that there was a scarcity of water.

In regard to the placing of the wheels, we are told each party placed his wheel as he liked, and if there were any fault the exhibitors were solely to blame, as each party had full control of the flume, while their wheels were tested, cutting out or filling in as they liked.

The steadiness of the brake is attested by Mr. Hiram F. Mills, C. E., under whose supervision the tests were conducted. Our own reporter also stated that when he was present in July (see issue of July 17, 1869), the arrangements seemed perfect and the brake worked satisfactorily.

It seems then that the question resolves itself into one of fact, so far as this controversy is concerned; and we have endeavored to give impartially every essential statement made on either side.

The apparatus for testing turbine wheels, shown in the descriptive article we this week publish, is the same as that used in the Lowell tests, and our readers will be able to judge intelligently of its probable efficiency.

We may, in closing, remark that the terms in which the tests were announced in the circular before us, seem not to be sufficiently specific. There cannot in such matters be too definite an understanding. It would seem that not only the size and finish of the wheels, but the time when they were to be on the ground ought to have been definitely fixed, and no departure from the prescribed conditions permitted. A competitive test will always give dissatisfaction if performed under variable conditions.

An Immense Salt Mine.

The great Humboldt salt mine, near Austin, Nevada, is described by a California paper as looking like a lake frozen over. The salt is as hard and as smooth as ice. Were it not for fine particles which are condensed from vapors arising from beneath, and which cover the crystalline salt to the depth of perhaps one eighth of an inch, it would make an excellent skating rink at all times of the year, except on the very infrequent occasions when it is covered with water. The expanse of crystallized salt is no less than twenty miles in length and twelve in width, without a break or flaw for the greater portion of that extent. The stratum of solid salt is about six or seven inches thick, under which comes a layer of sticky, singular looking mud, about two feet thick, and under this again another stratum of solid salt, as transparent as glass, of which the depth has been found in some parts to be six feet. In summer, this salt plain, glittering and scintillating in the light of an almost tropical sun, presents a brilliant appearance. The frosty covering and the solid salt is as white as the snow, while the crystalline portion, when exposed, reflects dazzling prismatic colors. This immense deposit is remarkably pure, being ninety-five per cent of salt and five per cent of soda—which is purer than what we commonly use for our tables.

Opera House Dirt.

The dust obtained from the places of amusement in New York have recently been analyzed by the scientific officers of the Metropolitan Board of Health. Over one hundred specimens of the particles floating in the air and failing as dust, were collected on plates of glass, and were examined under the microscope. The proportions of the different ingredients varied, but the same substances were found in all the specimens. The composition of the matter subjected to the microscope was as follows: "The dust of the streets in its finer or coarser particles, according to the hight at which it had been collected, with a large proportion of organic elements; particles of sand, of quartz and feldspar; of carbon, from coal dust and lampblack; fibers of wool and cotton of various tints; epidermic scales; granules of starch, of wheat, mainly the tissues of plants; the epidermic tissue, recognized by the stomata or breathing pores; vegetable ducts and fibers, with spiral markings; vegetable hairs or down, either single or in tufts of four or eight, and of great variety, and three distinct kinds of pollens. Fungi were abundant from mere micrococcus granules to filaments of mold. When water was added to a portion of dust from whatever source, and exposed in a test tube to sunlight or heat for a few hours, vibriones and bacteria made their appearance, and the fungous elements sprouted and multiplied showing that they maintained their vitality, and proving that the germs of fermentation and putrefaction are very widely diffused."

Zinc Light.

By digesting metallic zinc in iodide of ethyl, we obtain a volatile liquid which takes fire spontaneously in the air, and is known to chemists under the name of "zinc-ethyl." It can be distilled in an atmosphere of hydrogen, and if this gas be made to pass through the liquid it will carry off some of the zinc-ethyl, and when ignited will burn with a magnificent white flame. It is probable that ordinary illuminating gas would answer as well as hydrogen for this experiment. The light produced in this way can be employed to take photographs, but its actinic properties are not equal to the effects produced by burning magnesium.

Dust and Disease.

Mr. Horace Waller, F.R.G.S., writes to *Nature* as follows:

The extremely important discoveries brought to light by Professor Tyndall will call forth great exertions on the part of thinking persons to carry his plans into operation, and I have no doubt, when due precautions are taken to sift infected air as it passes into the lungs of those whose duties take them where contagion abounds, we shall have the happiest results.

So great will be the tide of interest in this direction, that I am anxious to cast into it a theory I have long held, in hopes that it may drift in some one's way to be turned to use; I commend it to the traveling portion of your readers especially.

While traveling in some very unhealthy parts of Africa, more particularly among the marshes bordering on the Shiré and Zambesi rivers, it was often necessary to camp at night just where the canoe happened to be moored when daylight failed us. Reeds, rushes, and mud were never many feet off, and the accumulation of scum, decaying vegetation, etc., lodged in the sedge, made the situation as delightful to mosquitoes as it was trying to the constitution of the European.

Still, with all this, as long as it was possible to rig up a mosquito curtain, I am convinced that really less danger existed in thus sleeping in the midst of miasma than in other places where less of it was supposed to be present, but where the traveler felt no necessity to stretch this thin covering over him.

I have in this way done canoe journeys of twenty to twenty-five days in length without a day's illness from fever, and I could instance similar experiences on the part of others.

Now the reason I assign is this: the mosquito curtain is to miasma, what the Professor's cotton-wood respirator is to the poison of scarlatina, we will say.

The curtain, after being used once or twice, saturated with dew, folded up while damp and crammed into the limited space generally provided for it in the safest place, becomes just so much affected by this treatment that each thread loses its smooth glaze, and is soon fluffy and fuzzy for want of a better expression.

The little honeycomb holes in the fine "net" are now a series of small six-sided sieves, each covered over with the fine filaments of cotton which have got disturbed and frayed up. Dew, falling upon a surface of this kind, quickly turns it into an exquisitely fine strainer—in fact almost a film of water—through which all the air has to pass which is breathed by the person reposing beneath it.

Now, it is an old notion that the miasma which produces the bilious remittent fever (the pest of this part of Africa in question) and various other diseases of the tropics, cannot pass across water.

I believe that acting upon this theory, the Admiralty provides that boats' crews shall sleep in their boats anchored off shore in malarious rivers. However, be this as it may, I have a strong belief that the "wet sieve" *does* stop the poison in some way or other, and that it is a great safeguard to the voyager in these places.

The whole subject of miasm is in the dark; it is lawless as a cause of disease; it baffles the most astute, but the day may be coming when such hints as those of Prof. Tyndall's shall fit into an organized attack upon it, and we shall be able to overcome it in a measure.

A curtain, properly made, and taken care of with that instinct which alone is begotten by the buzz of mosquitoes, is perhaps the most valuable possession a man can have against deadly attacks in the night while men are asleep; were its merits studied more, we should not find men stuffing their companions so perpetually with quinine, to the keeping up an unhealthy tone by this abuse alone, and to the confusion of this most invaluable medicine when it is really called in to do its duty upon the fever-stricken patient.

The Bulging of Walls---Cause and Prevention.

The ugly protruding curvature commonly called a bulge, to which external and front walls seem especially subject, may frequently be traced to original defects of construction. Bulges very often occur at about the level of a floor, and where there is a floor, the brick work of outer walls is commonly weakest. To avoid running the floor-timbers into party walls, they are generally made to rest on the front and back, and the party-wall will often appear in better condition than the front. Immediately below the level of the intended floor, a timber scantling about 4½ in. by 3 in. is laid along the wall flush with its inner face, to receive the ends of the joists. The joists, let it be assumed, are about ten inches deep, notched to nine inches at the ends, so as to rise the hight of three courses of brick work. Here, then, bond-timber and joists together make a hight of 12 in., or four courses of brick work. The joists will have a bearing of 6 in. on the wall, and the wall may be supposed to be a brick and a half thick. Now wherever the joists occur, there is a complete interruption of the bond on the inner side of the work, while externally it appears unbroken, the outer face, in fact, being carried up half a brick in thickness, and looking as though the whole wall were perfectly solid and uniform; but the backing between the timbers too often consists of bats and small pieces put together in a mysterious though incongruous way. So long as the timber remains sound and of its full dimensions, all is well, but this is seldom very long. The manner of converting balk timber into scantlings precludes the permanent retention of its original form. When felled and squared in its native forests, it is thrown into the first lake or river, formed into rafts, and navigated to some port of shipment, where it is formed into cargoes for conveyance across the ocean. The sea voyage over, it may be assumed to the port of London, the timber is again immersed in the water, which usually constitutes its only place of storage till wanted for actual application to some building. As to deals, an architect may specify dryness as a necessary quality, but he must not expect it in timber. He may say that it shall be sound and well seasoned, but water seasoning is all that takes place previous to conversion, and this fact is noteworthy, because as the subsequent shrinkage may be estimated at three quarters of an inch in the foot, it becomes obvious that so far as the bond timber and joists are to be regarded as forming the inner material of the wall, a subsidence equal to the shrinkage must take place. But the wall does not depend on the woodwork alone, and the irregular filling up between the joists will receive the weight, and so the evil will be deferred. For the time there may be no other visible result than the dropping of the floor from the skirting, and when the latter is of wood, the simultaneous rising of the skirting from the floor. It is when the wooden bond, having shrunk to the minimum dimension of perfect dryness, enters upon its course of decay that the worst consequences of inserting timber constructionally in walls are developed. The inner face then sinks, and the statical conditions are disturbed, and bulging is inevitable.

It was a custom of by-gone days to insert timber very freely in walls. Foundations were fortified, as it was thought by the introduction of a "chain-bond" of large scantling, and many a goodly edifice has suffered from the practice. Great, therefore, have been the improvements adopted in the modern construction of walls. A solid basis is formed by the use of concrete; wrought iron hooping has advantageously displaced wooden bond, and the joists are kept as much as possible out of the walls, their ends being supported by brick or iron corbels. Thus all rapidly perishable matters are excluded, and a lasting character imparted to work so executed. Skirtings also are made of stucco instead of wood, and shrinkage in that quarter got rid of. Thus experience and science are gradually removing one of the old defects and disfigurements of buildings—the bulging of walls.—*Building News.*

DAVIS' PATENT FENCE.—We call attention to the advertisement published in another column of P. Davis' patent wire and picket fence, an illustrated description of which appeared in a recent number of this journal. We are informed that since that publication the demand for this excellent fence has so exceeded Mr. Davis' facilities, that he finds it necessary to dispose of more territory than was at first anticipated.

JOHN LA MOUNTAIN, the celebrated aeronaut, is dead.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisemets at $1.00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

N. K., of Ohio.—You can bleach broom corn brush as follows: Construct at some distance from your other buildings a small building of boards and batten the joints. Hang your brush on suitable frames within this building and make your door to shut pretty tight. At one end of the building and at the top construct a shelf with an outside door so that the shelf may be reached from the outside with a ladder. When the brush is placed in the building, place on the shelf in an open earthen pan, a mixture of four parts by weight of hydrochloric (muriatic) acid and one part black oxide of manganese with two parts of water. Set the vessel—which should be three or four times as large as will contain the mixture, and also broad and shallow—upon bricks, so that you can put under it a bit of candle capable of burning about five minutes before it goes out, the heat of which will start the reaction, then close the door leading to the shelf and leave the whole for twenty-four hours. The bleaching agent developed here is chlorine, and as it is poisonous when inhaled, the building should be ventilated before any one enters it by opening the upper and lower doors, and removing the vessel from the shelf. The quantity of the mixture will depend on the size of the building, and this you must learn by experience. Too much bleaching will rot the brush.

T. K., of La.—A cistern wall laid up with a putty made of ground white lead with as much red lead as will make it of the proper consistence will probably remain tight under the circumstances you mention, if bricks or square stones are employed. It is only necessary to use it for an inch or two next the water; the rest of the joints may be filled with good water cement. If the water is used for drinking, we are informed that this cement may be used as above, and that no contamination of the water will occur if after the putty is perfectly dry the inside of the cistern be plastered.

C. G. B., of Pa.—If you will lay a cellar wall with the cement recommended in answer to T. K., of La., in this column, we think you will be able to keep it tolerably dry. You can ceil over with boards for an out-door cellar, leaving a foot or so of space to be filled in with dry moss, or a couple of feet filled in with shavings pressed in gently but not packed hard. If kept dry by a suitable roof this will keep out frost. Carry up the walls sufficiently high to prevent surface water from running in.

F. G. G., of Conn.—An excellent cement for broken glass and porcelain is shellac melted and run into small sticks. The broken edges must be warmed so that they will melt the cement, and the latter is then thinly spread over them. This cement resists moisture, but of course remelts when sufficient heat is applied. A cement that will resist heat but does not withstand moisture, is made of white of egg mixed with finely-powdered quicklime.

F. W. E., of N. Y.—We know of no roofing material that is without a fault of some kind, and it is too much to expect perfection in any human device. We think a flat roof can hardly be made to remain perfectly tight fifty years by any material now known. With sufficient inclination of roof we prefer slate to any other kind of roofing material.

D. F., of Mass.—The tensile strength of aluminum bronze is 73,000 pounds per square inch of section; that of steel in bars is 100,000 to 130,000. These figures are from Rankine's tables. Aluminum bronze is more ductile than steel, but its modulus of elasticity has, we believe, not yet been determined.

W. M. M.—You can use a thin wash of glue or isinglass before painting, into which small articles may be dipped and afterwards allowed to drain; but for articles to be exposed to wet, no sizing, but good linseed oil with red lead, messicot or litharge, will stand long without peeling off.

J. K., of Pa.—An inch of water will make 1,696 cubic inches of steam. Two volumes of hydrogen combine with one of oxygen to form water.

A. W. A., of N. Y.—With the best constructed hydraulic ram, and a fall of four feet, about two and four tenths per cent of the falling water can be elevated one hundred feet.

L. B., of Wis.—It would be impossible to give you a good idea of the shapes of different turning tools without engravings. Watson's "Manual of the Hand-Lathe" gives all necessary information. It is published by Henry Carey Baird, 406 Walnut street, Philadelphia, Pa.

Full Files of this Paper

Can be found in New York, at the office of George P. Rowell & Co., Advertising Agents, No. 40 Park Row.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line

Kidder's Pastilles.—A sure relief for Asthma. Price 40 cents by mail. Stowell & Co., Charlestown, Mass.

Needles for all sewing machines at Bartlett's, 569 Broadway, N.Y.

Dickinson's Patent Shaped Carbon Points and adjustable holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24th, and Nov. 20, 1869. 64 Nassau st., New York.

Manufacturers and dealers in articles for family use from $1 to $5 will please send circulars with price to G.B.Bull, 233 Main st, Buffalo, N.Y.

Wanted—The address of the different pocketbook manufacturers. Address H. R. S. Celton, Houghton, Mich.

For tool making, buy 15-in. engine lathes with taper attachment, made by the Pratt & Whitney Company, Hartford, Conn.

Steam Plow.—Patent for sale, on liberal terms, for the North and West. Machine of 11-H. P. to cost $1,500. J. C. Delavigne, New Orleans, La.

Pat. paper for buildings, inside & out, C. J. Fay, Camden, N. J.

For Sale at a bargain—A complete 1-set woolen mill, with 27 acres of land and good improvements. Woodruff & Co., O'Bannon's, Ky.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Messrs. Howard & Co., Broadway, N. Y.—Please send me your Illustrated Price List of Waltham Watches, as per advertisement in Tribune. Sign name and address in full. Any one who will write to us as above will receive the price list by return mail, postpaid. It describes the different watches, gives weight and quality of the cases, with prices of each. All who intend purchasing a watch should see it before making a selection. Howard & Co., Jewelers and Silversmiths, Broadway, N. Y.

For first-quality new 14, 17, and 20-in. screw lathes, milling machines, and one-spindle drills, at small advance from cost, apply to Geo. S. Lincoln & Co., Hartford, Conn.

Drop, power, hand, screw, and lever presses, lathes, dies, models, and all kinds of light machinery, built by John Dane, Jr., Newark, N. J. Also, any work to order.

Hackle, Gill Pins, etc., at Bartlett's, 569 Broadway, New York.

Curtain Holder.—See engraving and advertisement on back page. It is just the thing to make and sell at a good profit.

Wanted—A set of 2d-hand Boiler Makers' Tools, all in good working order. Address Frick & Bowman, Box 109, Waynesboro, Franklin county, Pa.

Best Decarbonized Cast Steel for armory uses, shafting, spindles, stay bolts, axles, set screws, keys, agricultural works, etc., 10 to 11c.; or in sheets, tough as copper, 9 to 12c., ordinary gages. Offices: 42 Cliff st., N. Y.; 14 N. 5th st., Phil'a. Philip S. Justice.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

Anti-friction Horse-powers, for from one to eight horses. This power, as now made, is the easiest of draft for the amount of work done and we recommend it to all who want a strong machine. Prices reduced. Send for a circular to R. H. Allen & Co., Postoffice Box 376, New York.

"Winn's Portable Steam Brick Machine," makes more and better brick than any other machine in the world. Address Wright & Winn, Lock Haven, Pa.

Perforated Zinc and Sheet Iron for separators, smut machines grain dryers, tubular wells, malt kilns, etc. R. Aitchison & Co., Chicago

T. F. Randolph, Steam Model Works, Cincinnati, Ohio.

For the Best Upright Drill in the World, address Wm. M. Hawes & Co., Fall River, Mass.

Scientific American—Back Nos. and Vols., for sale. Address Theo. Tusch, No. 37 Park Row, New York.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

To Rent—East River water front, stores and vacant lots suitable for manufacturing or mercantile purposes, together or separate Daniel W. Richards & Co., 92 Maiden st.

Portable Pumping or Hoisting Machinery to Hire for Coffer Dams, Wells, Sewers, etc. Wm. D. Andrews & Bro., 414 Water st., N. Y.

Two 60-Horse Locomotive Boilers, used 5 mos., $1,300 each. The machinery of two 500-ton iron propellers, in good order, for sale by Wm. D. Andrews & Bro., 414 Water st., New York.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

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For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Machinists, boiler makers, tinners, and workers of sheet metals read advertisement of the Parker Power Presses.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

U. S. Patent Office.

How to Obtain Letters Patent
FOR
NEW INVENTIONS.

Information about Caveats, Extensions, Interferences, Designs, Trade Marks; also, Foreign Patents.

For a period of nearly twenty-five years, MUNN & CO. have occupied the position of leading Solicitors of American and European Patents, and during this extended experience of nearly a quarter of a century, they have examined not less than fifty thousand alleged new inventions, and have prosecuted upward of thirty thousand applications for patents, and, in addition to this, they have made, at the Patent Office, over twenty thousand preliminary examinations into the novelty of inventions, with a careful report on the same.

The important advantages of MUNN & CO.'S Agency are, that their practice has been ten-fold greater than that of any other Agency in existence, with the additional advantage of having the assistance of the best professional skill in every department, and a Branch Office at Washington, which watches and supervises, when necessary, cases as they pass through official examination.

CONSULTATIONS AND OPINIONS FREE.

Those who have made inventions and desire a consultation are cordially invited to advise with MUNN & CO. who will be happy to see them in person at the office, or to advise them by letter. In all cases, they may expect an HONEST OPINION. For such consultations, opinion, and advice, NO CHARGE is made. A pen-and-ink sketch and a description of the invention should be sent.

TO APPLY FOR A PATENT,

A model must be furnished, not over a foot in any dimension. Send model to MUNN & CO., 37 Park Row, New York, by express, charges paid, also, a description of the improvement, and remit $16 to cover first Government fee, and revenue and postage stamps.

The model should be neatly made, of any suitable materials, strongly fastened, without glue, and neatly painted. The name of the inventor should be engraved or painted upon it. When the invention consists of an improvement upon some other machine, a full working model of the whole machine will not be necessary. But the model must be sufficiently perfect to show with clearness the nature and operation of the improvement.

PRELIMINARY EXAMINATION

Is made into the patentability of an invention by persons search at the Patent Office, among the models of the patents pertaining to the class to which the improvement relates. For this special search, and a report in writing, a fee of $5 is charged. This search is made by a corps of examiners of long experience.

Inventors who employ us are not required to incur the cost of a preliminary examination. But it is advised in doubtful cases.

COST OF APPLICATIONS.

When the model is received, and first Government fee paid, the drawings and specification are carefully prepared and forwarded to the applicant for his signature and oath, at which time the agency fee is called for. This fee is generally not over $25. The cases are exceptionally complex if a higher fee than $25 is called for, and, upon the return of the papers, they are filed at the Patent Office to await Official examination. If the case should be rejected for any cause, or objections made to a claim, the reasons are inquired into and communicated to the applicant, with sketches and explanations of the references; and should it appear that the reasons given are insufficient, the claims are prosecuted immediately, and the rejection set aside, and usually

Without Extra Charge to the Applicant.

MUNN & CO. are determined to place within the reach of those who confide to them their business, the best facilities and the highest professional skill and experience.

The only cases of this character, in which MUNN & CO. expect an extra fee, are those wherein appeals are taken from the decision of the Examiner after a second rejection; and MUNN & CO. wish to state very distinctly, that they have but few cases which can not be settled without the necessity of an appeal; and before an appeal is taken, in any case, the applicant is fully advised of all facts and charges, and no proceedings are had without his sanction; so that all inventors who employ MUNN & CO. know in advance what their applications and patents are to cost.

MUNN & CO. make no charge for prosecuting the rejected claims of their own clients before the Examiners and when their patents are granted, the invention is noticed editorially in the SCIENTIFIC AMERICAN.

REJECTED CASES.

MUNN & CO. give very special attention to the examination and prosecution of rejected cases filed by inventors and other attorneys. In such cases a fee of $5 is required for special examination and report, and in case of probable success by further prosecution, and the papers are found tolerably well prepared, MUNN & CO. will take up the case and endeavor to get it through for a reasonable fee, to be agreed upon in advance of prosecution

CAVEATS

Are desirable if an inventor is not fully prepared to apply for a Patent. A Caveat affords protection, for one year, against the issue of a patent to another for the same invention. Caveat papers should be carefully prepared.

The Government fee on filing a Caveat is $10, and MUNN & CO.'S charges for preparing the necessary papers are usually from $10 to $12.

REISSUES.

A patent when discovered to be defective, may be reissued by the surrender of the original patent, and the filing of amended papers. This proceeding should be taken with great care.

DESIGNS, TRADE MARKS, AND COMPOSITIONS

Can be patented for a term of years, also, new medicines or medical compounds, and useful mixtures of all kinds. When the invention consists of a medicine or compound, or a new article of manufacture, or a new composition, samples of the article must be furnished, neatly put up. Also, send a full statement of the ingredients, proportions, mode of preparation, uses, and merits.

PATENTS CAN BE EXTENDED.

All patents issued prior to 1861, and now in force, may be extended for a period of seven years upon the presentation of proper testimony. The extended term of a patent is frequently of much greater value than the first term; but an application for an extension, to be successful, must be carefully prepared. MUNN & CO. have had a large experience in obtaining extensions, and are prepared to give reliable advice.

INTERFERENCES

Between pending applications before the Commissioners are managed and testimony taken; also, Assignments, Agreements, and Licenses prepared. In fact, there is no branch of the Patent Business which MUNN & CO. are not fully prepared to undertake and manage with fidelity and dispatch.

FOREIGN PATENTS.

American inventors should bear in mind that five Patents—American, English, French, Belgian, and Prussian—will secure an inventor exclusive monopoly to his discovery among ONE HUNDRED AND THIRTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such, that patents can be obtained abroad by our citizens almost as easily as at home. MUNN & CO. have prepared and taken a larger number of European Patents than any other American Agency. They have Agents of great experience in London, Paris, Berlin, and other Capitals.

A Pamphlet, containing a synopsis of the Foreign Patent Laws, sent free. Address MUNN & CO., 37 Park Row, New York.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Steam Pumping Engine.—Wm. H. Roberts, Mauch Chunk, Pa.—This invention has for its object to secure uniformity of motion in the plunger of a steam pump throughout the stroke.

Jack for Moving the Cross-Heads of Steam Engines.—John S. Funk, Marysville, Pa.—This invention has for its object to move the cross-heads of locomotives or other engines when disconnected from their piston rods.

Automatic Regulator for Valves, Dampers, etc.—George Miller Sternberg, Fort Riley, Kansas.—This invention has for its object the operation of valves on the principle of gradually opening when a supply is needed, and gradually closing when the supply is obtained. It is applicable to the regulation of any sort of liquid or gaseous current that may be required to flow into or from a receptacle.

Device for Reversing Motions.—Charles F. Hadley, Chicopee, Mass.—This invention is designed for direct-acting steam pumps, engines, or other machinery where reverse motion is required. The object of this invention is to overcome dead points in machinery, where continual reciprocating motion is required.

Stove.—William Magill, Port Deposit, Md.—This invention has for its object to cause the draft of a base-burning stove to enter at the top, pass over the fuel in the magazine, effecting by its weight, during this passage, the retention of the gaseous products in the region of combustion beneath, and thereby contributing to their more thorough consumption; and, by flowing down a vertical flue at the rear of the stove, to gain a position whence it may strike the fire from beneath.

Churn.—N. A. Prentiss, Silver Creek, N. Y.—This invention has for its object to furnish an improved churn, simple in construction and effective in operation, doing its work quickly and well.

Folding Crate, Box, etc.—Landy A. Lindsey, Jackson, Miss.—This invention has for its object to furnish an improved crate, box, chest, or trunk, which shall be so constructed and arranged that it may be conveniently and quickly folded into a compact form for storage or transportation, and which, when opened for use, will be strong and serviceable.

Carriage Top.—M. T. Jackson, Montrose, Pa.—This invention has for its object to furnish an improvement for carriage tops by means of which the labor of raising and lowering the top shall be lessened and which will partially support the top when down, taking part of the weight of said top off the bows.

Breaker Roller.—Edwin Douden, Lykens, Pa.—This invention has for its object to furnish an improvement in the construction of breaker rollers by means of which the teeth may be detached and sharpened when required, and which will enable the breaker to split the coal, instead of crushing it, as is the case with breakers constructed in the ordinary manner.

Adjustable Bedstead.—Wm. O. Reid, Vienna, N. C.—This invention relates to improvements in beds for sick persons, and consists in an arrangement of the bottom in three sections and joining them together, and supporting them on a transverse axis mounted in the side rails of the bedstead, and producing therewith novel arrangements of supporting and adjusting arms, and hoisting and adjusting cords and pulleys, whereby the patient may while lying on the bed, raise himself to a sitting posture, with the feet projecting below the plane of the bottom of the bed, which assumes the position of a large chair; and whereby also he may, while lying on the back, raise the thighs to a perpendicular position, the lower legs remaining in a horizontal position. The said improved bed is particularly adapted for the treatment of diseases requiring the patient to be changed and placed in particular positions, which changes are greatly facilitated by it.

Rock Drill.—A. Blatchly, Central City, Colorado Territory.—This invention relates to improvements in rock drilling machines, designed to provide an automatically feeding drill to be actuated by steam power, under a more simple and reliable arrangement than now in use. The invention consists in certain improvements in the construction of the rotary engines for operating the drill, relating to the valve mechanism, pistons, bridges, or dividing plates, and to packing the cylinders; also, in the combination therewith of a cam wheel of peculiar construction, for communicating a reciprocating movement to the drill carriage; also, an arrangement for disconnecting the propelling action of the cams with the drill carriage, previous to the blow of the drill.

Bottle Cock.—L. A. Perrault, Natchez, Miss.—This invention relates to improvements in cocks for bottles, jugs, and other like articles, and consists of a cock attached to the cork or other plug, and having a turning pin provided with a loose key for operating it, the said cock having at the end of the tube projecting through the cork, a pair of wing or friction plates, so connected to it and bearing against the inner walls of the bottle, that a sliding tube or a piece of steel or other wire within the cock tube, and acted on by a cock plug, when turned to stop the passage of the liquid will force the wing plates against the walls of the bottle, so as to prevent the withdrawal of the cork.

Butt Hinges.—A. P. Seymour, Hecla Works, N. Y.—This invention relates to improvements in butt hinges, and consists in an improved arrangement of the same for adaptation for use either as right or left handed hinges, and for self-locking to hold the door or shutter open when working on either hand; also, for unlocking by pressing on the stile of the shutter to which the hinge is connected.

Flower Pot.—Mathias Ludlum, Williston, Conn.—This invention relates to improvements in flower pots, and has for its object to provide pots from which the plants with the earth enveloping the roots may be more readily transplanted, and an improvement in form calculated to give greater room for the roots.

Gang Plow.—George R. Duval, Salem, Oregon.—This invention relates to new and useful improvements in gang plows, and consists in the method of raising and delivering the plows from the ground.

Parlor Hot House.—Patrick Griffith, Brooklyn, N. Y.—This invention relates to a new and useful improvement in apparatus for propagating and growing plants, cultivating flowers, and for preserving them in cold weather.

Wagon.—J. H. Barr, Mansfield, Ohio.—This invention relates to a new and useful improvement in wagon gearing, whereby the wagon is made to turn shorter curves, and therefore be less liable to upset than wagons of ordinary construction.

Chameleotrope.—Smith W. Anderson, New York city.—The object of this invention is to produce a spinning toy, which will exhibit in constant variation, a beautiful array of colors. The invention consists in the employment of a holder or support, which will retain a colored disk eccentric to the rotating shaft on which the said holder is secured. The invention also consists in connecting the said shaft by suitable gear connection with a hand lever, so that its revolutions may be unequal being produced by muscular power.

Stop-motion for Carding Machines.—C. W. Anderson, Grosvenordale, Conn.—The object of this invention is to provide an attachment to the railway head of a carding machine, whereby any rupture in the fleece or crowding of the sliver between the rollers will at once cause the machine to stop. The invention consists in the use of a pivoted funnel or trumpet through which the fleece is passed, and which, as long as it is acted upon by the moving fibers remains inactive. As soon, however, as the fleece ceases to pass through it and to draw it back by friction, it is thrown forward and releases the shipper bar which throws the belt upon the loose pulley. The invention consists also in the use of a pivoted lever, which acts in conjunction with the afore-mentioned pivoted funnel, to arrest the machine as soon as the upper roller is elevated by the doubling or crowding of the sliver

Toy.—H. J. Heald, Birmingham, Conn.—This invention consists in the combination of a rotating figure, which is propelled by a wheel revolving on the ground, with a rattle, which is a spring elevated by pins on the wheel.

Compressed Air Cylinder.—G. W. W. Goodwin, New Orleans, La.—This invention consists in an improved construction of cylinders for holding compressed air, by soldering successive sheets of tin or other thin sheet metal on a cylinder of the same substance to insure great strength, and forming the ends in conical shape, and similar construction the whole being tinned inside and out.

NEW BOOKS AND PUBLICATIONS.

A Practical Treatise on Mechanical Engineering. Comprising Metallurgy, Molding, Casting, Forging, Tools, Workshop Machinery, Mechanical Manipulation, Manufacture of the Steam Engine, etc. With an Appendix on the Analysis of Iron and Iron Ores. By Francis Campin, C. E., President of the Civil and Mechanical Engineers' Society, Author of "The Engineer's Pocket Remembrancer, for Civil and Mechanical Engineers," etc. To which are added Observations on the Construction of Steam Boilers, Remarks upon Furnaces Used for Smoke Prevention and on Explosions. By Robert Armstrong, C. E. Revised, with Notes, by John Bourne. Rules for Calculating the Change of Wheels for Screws on a Turning Lathe, and for a Wheel-Cutting Machine. By J. La Nicca. The Management of Steel, including Forging, Hardening, Tempering, Annealing, Shrinking, Expansion, and the Case-Hardening of Iron. By George Ede. Illustrated with Twenty-nine Plates of Boilers, Steam Engines, Workshop Machinery, Change Wheels for Screws, etc., and One Hundred Wood Engravings. Philadelphia: Henry Carey Baird, Industrial Publisher, No. 406 Walnut street. Price, by mail, free of postage, $6·00.

The object of this work appears to have been to bridge a chasm in the literature of mechanical engineering. The author informs us in his preface that when the various works published on the different branches of mechanical engineering are classed they may be grouped under two general heads; that is, elementary works and complete treatises. There has been then an obvious want for a work combining practical method, portability and conciseness, with the exclusion of all unnecessary matter. The present work is designed to meet this want, and it will be seen from the title, which we give in full, that the whole field of practical mechanical engineering has been covered. That this has been done ably and well will, we think, be acknowledged by every intelligent engineer who gives the work a careful perusal. If the many young mechanics who so frequently write to us for information upon various mechanical subjects would possess themselves of this work and give it a careful reading they would find the money and time thus expended, a capital investment.

Trout Culture. By Seth Green. Published by Seth Green and A. S. Collins. Caledonia, N. Y.

This pamphlet, written by one of the first to practice fish culture in this country, and now perhaps the largest and most successful trout culturist in America, is intended especially as a manual for those who wish to raise trout. It is essentially practical in character, and will be read with avidity by all who have any interest in fish farming.

Howe's Musical Monthly.

We have received No. 8 of this valuable musical publication. It contains twenty-one pieces of music, and is sold at thirty-five cents each for single copies. Terms, per annum, three dollars. Elias Howe, publisher, 193 Court street, Boston, Mass.

Bicknell's Village Builder. Elevations and Plans for Cottages, Villas, Suburban Residences, Farm Houses, Stables and Carriage Houses, Churches, Court Houses, and a Model Jail. Also Exterior and Interior Details for Public and Private Buildings. With Approved Forms of Contracts and Specifications, including Prices of Building Materials and Labor at Boston, Mass., and St. Louis, Mo. Containing Fifty-five Plates Drawn to Scale, Showing the Style and Cost of Building in Different Sections of the Country. Being an Original Work, comprising the Designs of Fifteen Leading Architects, representing the New England, Middle, Western, and South-western States. A. J. Bicknell & Co., Publishers, Troy, N. Y., and Springfield, Ill.

We should do violence to our estimate of its merits did we fail to express our most cordial approbation of this large, elegant, and complete work. The title sufficiently sets forth its scope, and all we need say on that head is that it gives only a truthful exposition of the valuable contents of the book. We notice that the elevations are drawn on the scale of one eighth, one twelfth, or one sixteenth, and the details on a scale of from one half to three fourths of one inch to the foot, so that they may be easily comprehended and executed. The book is not characterized by the style of any one architect or locality, but being general in its adaptation, is eminently fitted to meet the wants of village builders throughout the country. To such we recommend it. The style of execution is excellent, and does credit to the publishers. Send for descriptive catalogue to A. J. Bicknell & Co., Troy, N. Y., or Springfield, Ill.

Barns, Outbuildings, and Fences. By George G. Harney, Architect, Newburgh and Cold Spring, N. Y. New York: George E. Woodward.

This is a series of designs for the different outbuildings required on farms and country places generally, and on village and suburban lots, besides a number of suggestions for gateways and fences, and for rustic structures of all kinds. It contains sixteen designs for stables and a large number of designs for wood-houses, tool-houses, workshops, poultry-houses, together with one for an ice-house, a Swiss Chalet, and one for a small billiard house. It also contains two complete sets of farm buildings, and a large number of designs for rustic fences, inclosures, etc., etc., with descriptive text. The designs are well executed, and the work is printed in quarto form with large type, and on good paper. We commend the work to builders and those who are about to select designs for buildings of this class.

The Two Great Books of Nature and Revelation; or, the Cosmos and the Logos. Being a History of the Origin and Progression of the Universe from Cause to Effect; more particularly of the Earth and the Solar System, the *modus operandi* of the Creation of Vegetables, Animals and Man, and how they are the Types and Symbols by which the Creator Wrote the Logos. Illustrated by the First Chapters of Genesis. By George Field. New York: S. R. Wells, 389 Broadway. Boston: H. H. and T. W. Carter, 13 Beacon street.

B. K. Bliss & Son's Illustrated Catalogue of Horticulture, for 1870. New York: 41 Park Row.

The sixteenth spring catalogue of this old-established house, formerly of Springfield, Mass., is just out. It contains 120 pages, is full of well-executed engravings of every variety of flowers, plants, vegetables, grains, etc., with description and hints as to soil and time to cultivate. It is a publication which every person will take pleasure and derive profit in examining, and which every one in the country who has ever so small a patch of ground, should possess. See advertisement on another page.

The Carpenters' and Builders' Guide. Being a Hand Book for Workmen. Also a Manual of Reference for Contractors, Builders, etc. By P. W. Plummer. Second Edition. Portland: Hoyt, Fogg & Breed, Publishers. St Louis: Keith & Woods.

THE PRACTICAL BRASS AND IRON FOUNDERS' GUIDE. A Concise Treatise on Brass Founding, Molding the Metals, and their Alloys, etc. To which are added Recent Improvements in the Manufacture of Iron and Steel by the Bessemer Process, etc. By James Larkin, late Conductor of the Brass Foundery Department in Reaney, Neafie & Co.'s Works Philadelphia. Fifth Edition. Revised with extensive Additions. Philadelphia: Henry Carey Baird, Industrial Publisher, No. 406 Walnut street. Price, by mail, free of postage, $2·25.

This edition of a well-known and popular work, has been prepared from the manuscript of the author, and is essentially improved and enlarged. It now contains a vast mass of practical information, useful not only to brass and iron founders, but to mechanics of all kinds. It is one of those books that any mechanic can read with pleasure and profit.

GRISWOLD'S RAILROAD ENGINEERS' POCKET COMPANION FOR THE FIELD. Comprising Rules for Calculating Deflexion, Distances, and Angles, Tangential Distances and Angles, and all necessary Tables for Engineers; also the Art of Leveling, from Preliminary Survey to the Construction of Railroads. Intended expressly for the Young Engineer. Together with numerous valuable Rules and Examples. By W. Griswold. Philadelphia: Henry Carey Baird, Publisher, No. 406 Walnut street. Price, by mail, $1·75.

This is a book of reference, designed to aid the memory in field work, and has been prepared from notes taken during a long experience in railroad engineering. It is bound in morocco, with a clasp and pocket, and seems to be in every way adapted to subserve the purpose designed.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

3,188.—APPARATUS FOR SHAMPOOING.—M. L. Winn, San Francisco, Cal. Nov. 3, 1869.

87.—SHARPENING KNIVES.—C. Robbins and H. A. Robbins, Washington, D. C. January 11, 1870.

241.—CONNECTING TRACES TO CARRIAGES.—J. W. Currier, Newbury, Vt. January 27, 1870.

306.—PROPELLER.—C. Kinzler and A. Keppler, New York city. February 2, 1870.

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100,244.—SUCTION HOSE.—Albert F. Allen, Providence, R. I.

100,245.—MAIN SPRING BARREL FOR WATCHES.—John P. Allen, Springfield, Ohio.

100,246.—WATCH REGULATOR.—J. P. Allen and W. E. Banta, Springfield, Ohio.

100,247.—STOP MECHANISM FOR CARDING MACHINE.—C. W. Anderson, Grosvenor Dale, Conn.

100,248.—CHAMELEOTROPE.—Smith W. Anderson, New York city.

100,249.—STEAM TRAP.—John Ashworth, North Andover, Mass.

100,250.—FASTENING FOR NECKTIES.—John Bachelder, Norwich, Conn.

100,251.—WAGON.—J. H. Barr, Mansfield, Ohio.

100,252.—ROCK DRILL.—A. Batchly, Central City, Colorado.

100,253.—WASHING MACHINE.—W. A. Brown, Philadelphia, Pa.

100,254.—IRON BRIDGE.—Henry C. Brundage, Buffalo, N. Y.

100,255.—HYDRANT.—S. G. Cabell, Quincy, Ill., and A. Q. Ross, Cincinnati, Ohio. Antedated Feb. 16, 1870.

100,256.—SPRING BED BOTTOM.—J. B. Campbell, Cincinnati, Ohio.

100,257.—BED LOUNGE.—H. S. Carter, Chicago, Ill.

100,258.—TAG MACHINE.—C. H. Chapman (assignor to A. G. Snell), Shirley, Mass.

100,259.—COAL-HOISTING APPARATUS.—Lewis S. Chichester Brooklyn, N. Y. Antedated Feb. 19, 1870.

100,260.—LAMP BURNER.—Michael Henry Collins, Chelsea, Mass.

100,261.—SPOKE LATHE.—C. B. Conant and Hiram Thompson, Worcester, Mass.

00,262.—FOUNDATION FOR BUILDINGS.—A. F. Cooper, San Francisco, Cal.

100,263.—ROCKING HORSE.—Jesse A. Crandall, Brooklyn, N. Y.

100,264.—SAFETY HATCH FOR BUILDINGS.—G. N. Creamer, Trenton, N. J.

100,265.—SELF-ACTING HATCHWAY HOIST.—G. N. Creamer Trenton, N. J.

100,266.—GRAND PIANO.—G. H. Davis, Boston, Mass.

100,267.—VENTILATOR.—Edward Mortimer Decy, New York city.

100,268.—HYDROCARBON BURNER.—Adolphe De Landsee, Paris, France.

100,269.—COMPOSITION FOR ROOFING, PAVING, ETC.—E. J. De Smedt, New York city, assignor to New York Improved Anthracite Co., New York city.

100,270.—VAPOR BURNER.—Henry C. De Witt, Waukegan, Ill.

100,271.—UMBRELLA FRAME.—Harry E. Douor (assignor to himself and Robert E. Brett), New York city, Antedated February 17, 1870.

100,272.—RAILWAY CAR COUPLING.—J. W. H. Doubler (assignor to himself, J. M. Clendening, S. C. Hayes, and T. F. Rooney), Chicago, Ill. Antedated Feb. 16, 1870.

100,273.—BREAKER ROLLER.—Edwin Douden (assignor to himself and Charles Broome), Lykens, Pa.

100,274.—CARBURETER.—Cleaveland F. Dunderdale, New York city.

100,275.—SCHOOL DESK.—W. P. Erwin and T. A. Dugdale, Richmond, Ind.

100,276.—SCHOOL DESK AND SEAT.—W. P. Erwin and T. A. Dugdale, Richmond, Ind.

100,277.—CORN CULTIVATOR.—John C. Erwood, Vernon, Ind.

100,278.—CORSET.—D. H. Fanning, Worcester, Mass.

100,279.—OIL CAN.—J. L. Folsom, East Boston, Mass.

100,280.—VEGETABLE CUTTER.—Michael Gerhard, Newark, N. J.

100,281.—HOT AIR FURNACE.—B. Gommenginger, Rochester, N. Y.

100,282.—COMPRESSED AIR CYLINDER.—G. W. Warfield Goodwin, New Orleans, La.

100,283.—BREASTPLATE FOR THE BREAST COLLARS OF DOUBLE HARNESS.—C. Graham, New York city.

100,284.—VIOLIN.—Joseph Grandjon, Paris, France.

100,285.—WICK TUBE FOR LAMPS.—J. H. Gray, Boston, Mass. Antedated Feb. 21, 1870.

100,286.—CONSTRUCTION OF BARRELS AND PACKAGES.—C. Green, Wilmington, Del.

100,287.—PARLOR HOT HOUSE.—Patrick Griffith, Brooklyn N. Y.

100,288.—ADDING MACHINE.—John Groesbeck, Philadelphia, Pa.

100,289.—LANTERN.—Charles Hart, Wakefield, Mass.

100,290.—TOY.—H. J. Heald (assignor to himself and Henry Somers), Birmingham, Conn.

100,291.—FERROTYPE PLATE.—H. M. Hedden, Worcester, Mass.

100,292.—CHURN.—C. P. Holmes, Governeur, and A. L. Howell, Mohawk, N. Y.

100,293.—MANUFACTURE OF ARTIFICIAL FLOWERS.—Catherine E. Howard, San Gabriel, Cal.

100,294.—STEAM BLOWER AND EXHAUSTER.—John Howarth, Salem, Mass.

100,295.—CARRIAGE TOP.—M. T. Jackson, Montrose, Pa.

100,296.—CIGAR BOX.—Chauncey Jerome, New Haven, Conn., assignor, by mesne assignments, to S. B. Jerome, administrator of estate of Chauncey Jerome, deceased, and S. B. Jerome, assignor to R. A. Douglass, Philadelphia, Pa.

100,297.—PORTABLE BATH.—E. J. Knowlton, Ann Arbor, Mich.

100,298.—DOUBLE-SHOVEL PLOW.—G. W. Lawbaugh, Geneseo, Ill. Antedated Feb. 26, 1870.

100,299.—FOLDING CRATE.—Landy A. Lindsey, Jackson, Miss.

100,300.—FLOWER POT.—Mathias Ludlum, Williston, Vt.

100,301.—FLOOR FOR DRYING PEAT.—J. B. Lyons, Milton, Conn.

100,302.—PEAT MACHINE.—J. B. Lyons, Milton, Conn.

100,303.—SHAFT COUPLING.—H. F. Mann, Pittsburgh, Pa.

100,304.—MANUFACTURE OF POTTERY, ETC.—Philip Marquardt, Buffalo, N. Y.

100,305.—ICE-CREAM FREEZER.—B. G. Martin, Williamsburgh, N. Y. Antedated Feb. 14, 1870.

100,306.—FRUIT JAR.—J. L. Mason, New York city.

100,307.—LIQUID MEASURE.—Martin McDevitt, Hampton, Vt.

100,308.—PUDDLING FURNACE.—Samuel McLaughlin (assignor to himself and B. R. Caskey), Philadelphia, Pa.

100,309.—PURIFICATION OF COAL GAS.—Emerson McMillin, Ironton, Ohio.

100,310.—FENCE.—G. S. Mills, Johnson, Vt.

100,311.—MANURE HOOK.—S. B. Minnich, Landisville, Pa.

100,312.—SAW GUMMER.—Gilbert Munday, Montezuma, Ohio.

100,313.—REVERSIBLE LATCH.—W. T. Munger (assignor to P. & F. Corbin), New Britain, Conn.

100,314.—ROSE FOR DOOR KNOBS.—W. T. Munger (assignor to P. & F. Corbin), New Britain, Conn.

100,315.—RATCHET AND PAWL MECHANISM.—M. D. Myers, Frankfort, N. Y.

100,316.—CHILDREN'S HORSE AND SELF-PROPELLER.—J. H. Nolan, Waterville, N. Y. Antedated Feb. 11, 1870.

100,317.—SHUTTLE FOR LOOMS.—E. A. Paine, Grafton, Mass.

100,318.—APPARATUS FOR MAKING SOLID CORES.—S. J. Peet, New York city. Antedated Feb. 16, 1870.

100,319.—MACHINE FOR PRODUCING MOLDS.—S. J. Peet, New York city. Antedated Feb. 16, 1870.

100,320.—MACHINE FOR PRODUCING CORES.—S. J. Peet, New York city. Antedated Feb. 16, 1870.

100,321.—BOTTLE COCK.—L. A. Perrault, Natchez, Miss.

100,322.—BASE BURNING STOVE.—J. S. Perry and Andrew Dickey, Albany, N. Y.

100,323.—FILTER FOR CISTERNS.—B. B. Redfield, Lapeer, Mich.

100,324.—ADJUSTABLE BEDSTEAD.—Wm. O. Reid, Vienna, N. C.

100,325.—PLOW.—Mark Rigell, Newton, Ala., assignor to himself, Robert D., Wm. D., and Robert F. Joy, Milford, Ga.

100,326.—PLOW.—Mark Rigell, Newton, Ala., assignor to himself, Robert D., Wm. D., and Robert F. Joy, Milford, Ga.

100,327.—DISINFECTING COMPOUND.—L. S. Robbins, New York city.

100,328.—HORSESHOE.—David Roberge, Mooer's Forks, N. Y.

100,329.—HORSESHOE.—David Roberge, Mooer's Forks, N. Y.

100,330.—GRAPPLE.—Seymour Rogers, Pittsburgh, Pa.

100,331.—COAL SIFTER.—Brown Sears, Cold Spring, N. Y.

100,332.—REVERSIBLE HINGE.—A. P. Seymour, Hecla Works, N. Y.

100,333.—RAILROAD CAR HEATER.—Frederick Shaller, Hudson, N. Y.

100,334.—SCHOOL DESK.—James Smith, Richmond, Ind.

100,335.—BASE BURNING STOVE.—James Spear, Philadelphia, Pa.

100,336.—BROOM.—W. C. Spellman, Hartford, Conn.

100,337.—MACHINE FOR FEEDING ORES INTO SHAFT ROASTING-FURNACES.—Chas Stetefeldt, Austin, Nevada.

100,338.—CALENDAR.—J. T. Tannatt, Springfield, Mass.

100,339.—WOODEN PAVEMENT.—J. K. Thompson, Chicago, Ill.

100,340.—PEN.—E. P. Tiffany, Hartford, Conn.

100,341.—CURTAIN FIXTURE.—Jas. Turnbull and Wm. Turnbull, Vancouver, Washington Territory.

100,342.—DEVICE FOR OILING CARRIAGE AXLES.—Jas. Vanderpool, Hackensack, N. J.

100,343.—BROOM.—Thomas Walter, Philadelphia, Pa.

100,344.—FEED-WATER FILTER.—G. Waters, Cincinnati, Ohio.

100,345.—CLOTHES PIN.—Wm. Wellington, Rockford, Ill.

100,346.—APPARATUS FOR TRANSMITTING MOTION TO SEWING MACHINES.—Wm. Wellington, Rockford, Ill.

100,347.—FERTILIZER FROM EXCREMENTS.—Friedrich Wicke, Bockenheim, Julius Bronner, Theodor Petersen, and J. G. Zehfuss, Frankfort-on-the-Main, Prussia.

100,348.—MACHINE FOR PARING FRUIT.—W. H. Williams (assignor to himself and C. H. Williams), Cantor, Ohio.

100,349.—PARLOR FOUNTAIN FOR DIFFUSING LIQUIDS.—Wm. Altie, Dayton, Ohio.

100,350.—HORSE POWER.—J. E. Atwood, Willimantic, Conn.

100,351.—BARN DOOR HANGER.—W. R. Axe, Rockton, Ill.

100,352.—METHOD OF PRESERVING THE AROMATIC PRINCIPLE OF HOPS.—Henry Bartholomay (assignor to Bartholomay & Frauenberger), Rochester, N. Y.

100,353.—MANUFACTURE OF DRY WHITE LEAD.—E. O. Bartlett, Birmingham, Pa.

100,354.—COVERING FOR STEAM BOILERS.—C. A. Baumann, New York city.

100,355.—FASTENING FOR CARRIAGE CURTAINS.—Frederick Baumgartner, Brooklyn, N. Y.

100,356.—VELOCIPEDE.—Joseph Beck, Morrisania, N. Y. Antedated Feb. 26, 1870.

100,357.—BRAKE FOR CARRIAGES AND WAGONS.—Joseph G. Bicknell, Cambridge, assignor to himself, C. S. Wilkins, Boston, Mass., and G. F. Jennings, New York city.

100,358.—COMPOUND FOR PREVENTING INCRUSTATION IN STEAM BOILERS.—Geo. Birks, Marine, Ill.

100,359.—COMBINED ENGINE BOILER AND SUPERHEATER.—F. B. Blanchard, Spuyten Duyvil, N. Y. Antedated Feb. 18, 1870.

100,360.—SIFTING APPARATUS.—S. O. Blanding, Vineland, N. J.

100,361.—CULINARY BOILER.—G. W. Bliss, Brooklyn, N. Y.

100,362.—WATER-WHEEL CASE.—J. W. Bookwalter, Springfield, Ohio.

100,363.—WOOD PAVEMENT.—L. H. Boole, New York city.

100,364.—SNAP-HOOK AND BUCKLE.—J. C. Brady and J. H. Brady, Corsica Borough, Pa.

100,365.—MANUFACTURE OF MADDER DYES.—Thos. Bristow (assignor to Amasa Sprague), Cranston, R. I.

100,366.—TYPE-DISTRIBUTING MACHINE.—Orren L. Brown, Boston, Mass.

100,367.—ROTARY PAPER-CUTTING MACHINE.—Richard Vose, Philadelphia, Pa., administrator of Wm. Bullock, deceased. Antedated Feb. 23, 1870.

100,368.—MACHINE FOR PLANING AND SQUARING THE ENDS OF SEGMENTAL STEREOTYPE PLATES.—Richard Vose, Philadelphia, Pa., administrator of Wm. Bullock, deceased. Antedated Feb. 23, 1870.

100,369.—STOVE PIPE DAMPER AND VENTILATOR.—A. R. Burdick, Racine, Wis.

100,370.—SPRING WAGON SEAT.—Peter Burress, Braidwood, Ill.

100,371.—FLUTING MACHINE.—S. G. Cabell, Washington, D. C.

100,372.—CHIMNEY COWL.—E. P. H. Capron, Springfield, Ohio.

100,373.—SLIDING DOOR.—Jacob Capron, New York city.

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REISSUES.

3,853.—Steam Generator.—W. P. Abendroth, John Griffith, G. W. Wundram, and T. H. Müller, New York city, assignees of T. H. Müller.—Patent No. 83,528, dated Oct. 27, 1868.
3,854.—Hay Rake and Loader.—Horace Baker, Cortland, assignor to R. K. Sanford, Volney, N. Y.—Patent No. 55,919, dated July 3, 1866; reissue 2,911, dated April 7, 1868.
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3,859.—Electro-Magnetic Alarm for Railroad Switches.—Hall's Patent Electric Railway Switch and Drawbridge Signal Co., New Haven, Conn., assignees of Thos. S. Hall. Patent No. 62,414, dated Feb. 26, 1867.
3,860.—Breech-loading Fire-arm.—W. C. Hicks, Summit, N. J. Patent No. 16,797, dated March 10, 1857; reissue 1,952, dated May 9, 1865; reissue 3,708, dated Jan. 18, 1870.
3,861.—Fluting Machine.—Susan R. Knox, New York city, for herself, and assignee of W. D. Corrister. Patent No. 58,639, dated April 3, 1866.
3,862.—Reversible Latch.—Burton Mallory, New Haven, Conn.—Patent No. 38,466, dated May 5, 1863.
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3,864.—Compound for Treating Hides and Skins.—L. F. Robertson, Morrisania, N. Y. Patent No. 77,699, dated April 21, 1868; reissue 2,947, dated May 26, 1868.
3,865.—Machine for Milling the Knife Edges of Scale Beams.—T. J. Rockwood, St. Johnsbury, Vt. Patent No. 81,267, dated Aug. 11, 1868.
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Machine for Folding Paper, etc.—John Thompson, of New York city, executor of Thomas Thompson, deceased. Letters Patent No. 14,200, dated Feb. 12, 1856.
Method of Bottling Fluids Under Gaseous Pressure.—Jane Quantin and H. A. Pintard, of Philadelphia, Pa., executors of the estate of Alphonse Quantin, deceased. Letters Patent No. 14,268, dated March 4, 1856; reissue No. 3,175, dated Oct. 27, 1868; reissue 3,272, dated January 19, 1869.

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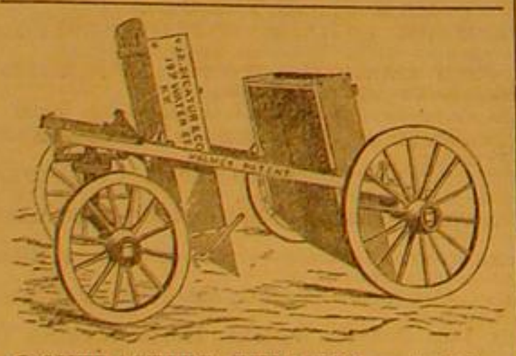

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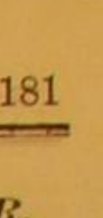

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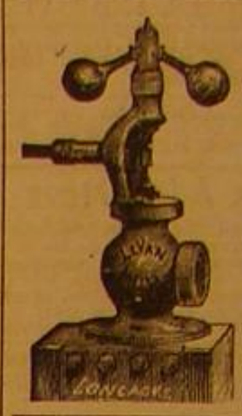

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SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXII.—No. 12. [NEW SERIES.] NEW YORK, MARCH 19, 1870. $3 per Annum. [IN ADVANCE]

The Pedespeed.

Mercury, the messenger of the gods in ancient mythology, had winged feet. Some three thousand years hence, some antiquarian digging for relics among the ruins of American cities, will discover that the Yankee Mercury had his feet furnished with wheels, and that he probably made faster time than the Greek Mercury by odds.

A few mornings since a quiet gentleman and a handsome youth walked into our sanctum, bringing with them a queer looking package. The queer looking package was no matter of surprise to us, for our eyes are familiar with nearly all the forms into which the genius of inventors can torture wood and metal. But while the elder of the two gentlemen entered into conversation with us the younger undid the package, disclosing a pair of wheels some fourteen or fifteen inches in diameter, to which were attached some stout hickory stirrup-like appendages, in the bottoms of which were foot pieces, shaped like the woods of common skates.

On one side of the stirrup-like appendages were firmly fastened metallic plates, each having a short axle or bearing projecting from its center, upon which the wheels above mentioned turned. The stirrup-like appendages were made of flat strips of wood about three inches wide in the broadest portion, bent so that one side was nearly straight, while the other was made to meet it about midway to form a sort of loop. In the bottom of this loop were placed the foot-pieces above described, provided with toe straps and a clasp for the heel. To the upper end of the stirrups was attached a piece of wood to fit the outer and upper conformation of the calves of the legs.

In less time than it took us to note these points, the young gentleman—who was subsequently introduced to us as the son of the inventor of this singular device—had strapped on the wheels and commenced rapidly gliding about among chairs and tables with singular swiftness and gracefulness. A space being cleared he proceeded to execute with seemingly perfect ease, the inside and outside roll, figure of eight, etc., etc., amply demonstrating that the "pedespeed" has all the capabilities of the skate, both in the variety and grace of the evolutions that can be performed with it.

THOMAS L. LUDERS' PEDESPEED.

Our engraving gives an excellent representation of this invention. Of course no mere carpet knight accustomed to roll about on the common parlor skate, can use these at the first attempt. They require practice; but when skill is once attained, there is skating the year round. Had the pedespeed been introduced on our rinks this winter during the long period stockholders have prayed in vain for ice, their stock would have stood higher in the market than it does at present.

The pedespeed is light and strong, and is capable of use on surfaces where the ordinary parlor skate would be useless The inventor, a large and heavy man, informs us he can use it constantly for two hours without fatigue. For gymnasiums, colleges, and parts of the country where no ice ever occurs, it affords a delightful, healthful, and graceful pastime at all seasons of the year.

When used by ladies, shields may be employed to cover the top of the wheels so as to protect the dress.

Thomas L. Luders, Olney, Ill., is the designer of this new appliance for locomotion, and of him further information may be had.

Improved Fan Blower.

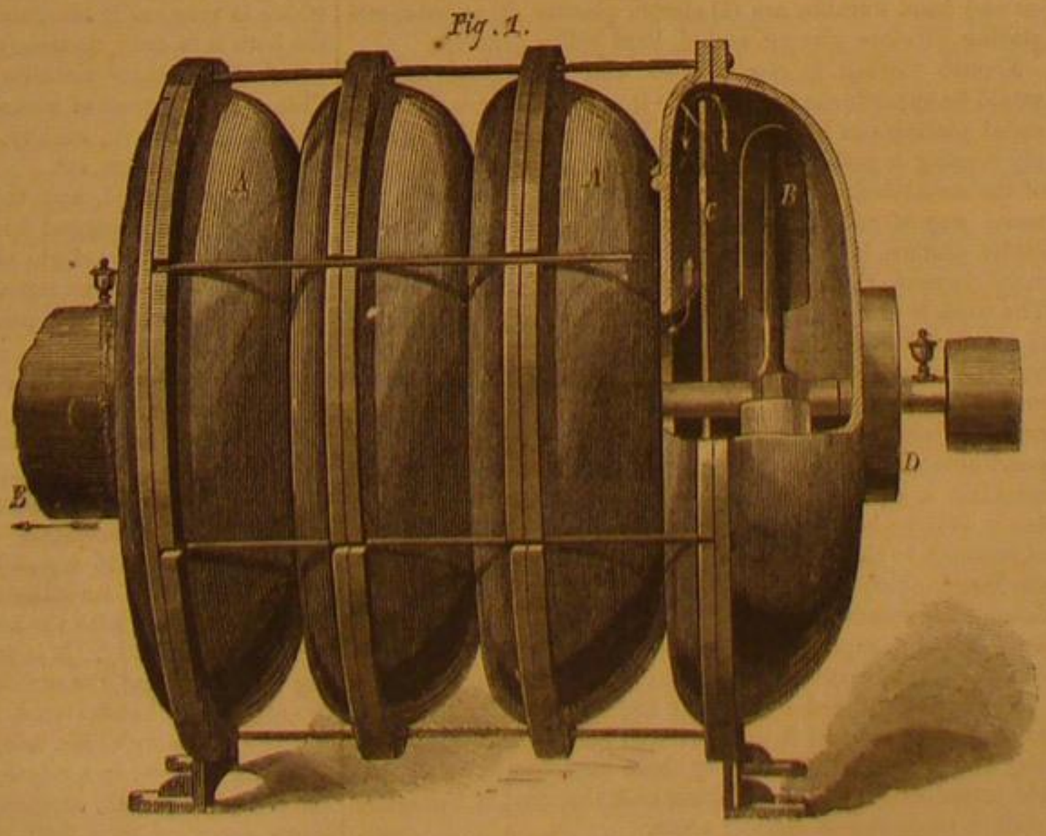
The fan blower has held a position as a standard machine for about forty years, the first having been built by Ericsson & Braithwaite, in 1829.

The high speed at which it has to be driven, and the consequent great consumption of power and excessive wear and tear, have justly been considered serious objections to it. Notwithstanding the many attempts made to overcome these defects they still exist.

Clark's "Multiplying-Pressure Fan Blower," illustrated in the accompanying engravings, attains the desired end. It gives the requisite pressure without high speed, and yet has all the simplicity of the ordinary fan blower.

The illustrations represent two forms of the blower, and also a longitudinal sectional view, enlarged, of one of the bearings, and the adjustable device connected therewith. The same letters refer to similar parts in all the cuts. Fig. 1 shows one of these blowers that multiplies the force of the blast four times. Fig. 2 shows one that doubles the force of the blast with the same speed required by an ordinary blower of the same diameter of fan. Fig. 3 is an enlarged view of the bearings with an improved mode of adjustment.

Fig. 1.



CLARK'S MULTIPLYING-PRESSURE FAN BLOWER.

The blower is made in compartments, each of which is formed exactly like the others. In fact each compartment is a well constructed fan blower, receiving the air at the center and delivering it at the circumference, where it is forced over the edge of the disk, C, through the annulus between the disk, C, and the shell or case, A, in the direction of the arrows, and thence down between the disk, C, and the opposite side of the shell, A, to the center of the next fan, by which it is received and delivered exactly as in the first, and so on through the whole series, whether the number be four or more.

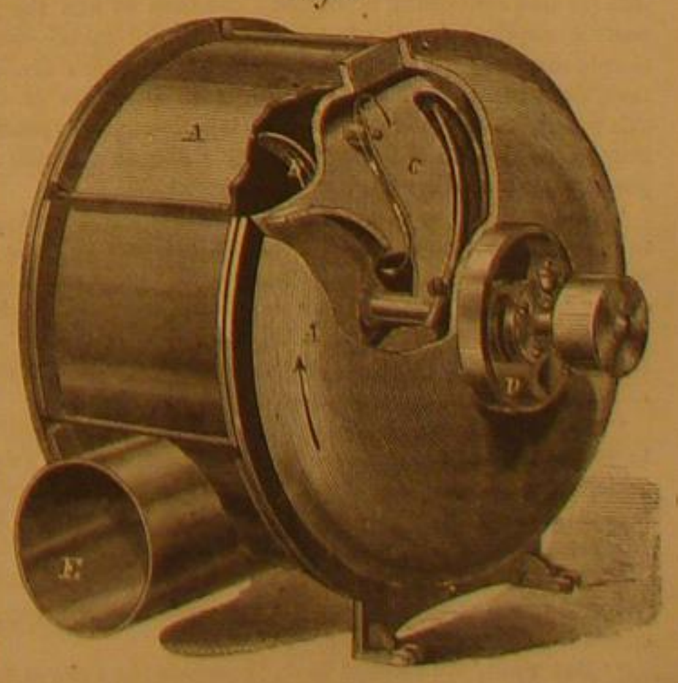
The passages leading from one compartment to the next may seem tortuous and difficult for the passage of the air, but they are made in all cases eight times greater in area than would be required to deliver the air under pressure at the point of final delivery, and as the resistance to the flow of aeriform fluids diminishes in the ratio of the square root of their velocity, the loss from that source being only one sixty-fourth, becomes insignificant.

Fig. 2, which only doubles the force of the blast, consists of two of the above described sections—one at each end delivering the air into the center of a fan that is common to both. This form makes a cheaper blower than Fig. 1, and answers well for many purposes where a very high pressure is not required; such as small forges, steam boilers, puddling and heating furnaces, and melting holes for cast steel. For cupola furnaces, where great pressure of blast is so essential, Fig. 1 is decidedly preferable.

Fig. 3 shows a device by which the shaft may be moved lengthwise, so that in the event of the fans in either compartment touching the side of the shell they may be easily adjusted. The journal box (Fig. 3) is a hollow tube lined with Babbit metal; a plano-convex ring fits over this tube; this ring is cut in the line of its axis, so that by compression it may he made to gripe the journal box. A hub, so formed as to receive one half the plano-convex ring, is held in the center of the central opening by the three arms, as shown. Another hub, made to fit the other half of the plano-convex ring, is secured to the first one by bolts. When the bolts are slack the journal box may be moved endwise, but when they are tight it is held firmly in place.

We have seen this blower tested, and can assure our readers

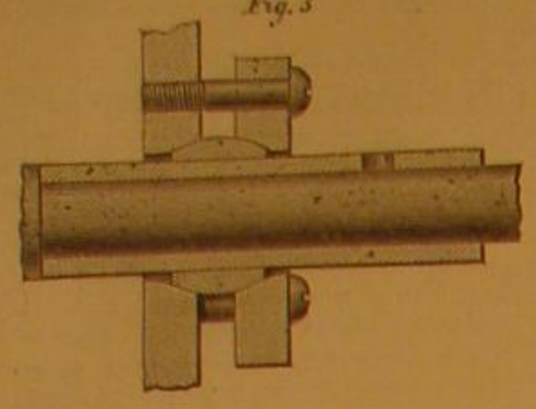
Fig. 2



that it accomplishes what its inventor claims for it; we have seen it with a pressure gage on each compartment, and invariably the gage on the fourth one indicated a pressure four times greater than that on the first. We have been shown very flattering testimonials from some of the best foundrymen and machinists in the country, respecting this blower. It is no longer an experiment.

This invention, which we regard as one of much interest, both in a scientific and practical point of view, is covered by two patents, dated, respectively, Oct. 23, 1866, and Dec. 22, 1868. A patent has also been secured in England through the Scientific American Patent Agency. The inventor, Patrick Clark, of Rahway, N. J., is well known in the field of mechanical invention.

Fig. 3



A company has been formed for the manufacture of these blowers, under the name of the "Rahway Manufacturing Co.," at Rahway, N. J., to whom all inquiries should be addressed.

VISIT TO A STEEL MANUFACTORY.

A writer in the *Atlantic Monthly* for March gives a very graphic account of the manufacture of steel by the Bessemer process, which we copy.

"Our entire party thronged the building, some passing directly to the floor of the casting house, while others mounted the high platform of the cupola furnaces, to see the beginning of the famous 'Bessemer process,' used in the manufacture of steel at this establishment. For me, who knew nothing of steel-making except by the old-fashioned, roundabout methods, this new 'short-cut,' as it is fitly termed, possessed a surprising interest. Laborers were casting into one of the furnaces barrow-loads of coal and pig, each fragment of which had been carefully examined, for not every quality of iron and anthracite can be used in this process. The molten metal was run off into a huge bucket, weighed (for precision as to proportions is also necessary), and finally poured like some terrible, fiery beverage, a soup of liquid iron, into the stomach of a monster with an egg-shaped body, and a short, curved, open neck, resembling some gigantic plucked and decapitated bird. In place of wings a pair of stout iron trunnions projected from its sides. Upon these it was so hung that it could be set upright or turned down on its belly. It was down, receiving its pottage, when we first saw it. Presently it was full-fed—five tuns of molten iron having been complacently swallowed. Then, moved by an invisible power, the creature, slowly turning on its wings, sat, or rather hung, upright. 'Now they are going to blow,' said our guide.

"In the casting-room below, immediately beneath the monster, was a semicircular pit, round the side of which was ranged a row of smaller iron vessels, reminding me of Ali Baba's oil jars, each capable of containing a bandit. Or, if we regard the large bird as a goose, these may be called goslings. They were all sitting on the bottom of the pit, with expectant mouths in the air, waiting to be fed. But the mother's food was to undergo a remarkable change before it could become fit nutriment for them. Iron ore, besides containing silicium, sulphur, and other earthy impurities, is combined with a large proportion of oxygen. The smelting furnace burns out the oxygen, and removes a portion of the impurities, but only to replace them with another interloper—carbon, absorbed from the coal. Cast iron contains from four to five per cent of carbon; steel, only about one quarter as much, or even less, according to its quality. To refine the crude cast iron, eliminating the excess of carbon, and yet retaining enough to make steel—or to reduce it first to wrought iron (or iron containing no carbon), and then to add the proportion required for the tougher and harder metal—seems simple enough; yet the various processes by which civilized men, from the time of Tubal Cain, have aimed to produce this result, have hitherto been slow, laborious, and expensive. Bessemer's method of doing this very thing on a simple and grand scale was what we were now to witness.

"The moment the monster was turned upright he began to roar terribly, and to spout flame in a dazzling volcanic jet, which even by daylight cast its glare upon the upturned faces of the spectators grouped about the floor of the casting-house. As we had seen only molten metal enter the 'converter'—so the huge iron bird is called—the appearance of such furious combustion was not a little astonishing.

"'In the bottom of the converter,' said our guide, shouting to make himself heard above the roar, 'there are tweers which admit a cold blast of sufficient force to blow the molten iron all into spray. This brings the oxygen of the air into contact with every minute drop of the metal, and what took place in the smelting-furnace is reversed; there the carbon helped to burn out the oxygen of the ore, now the oxygen comes to burn out the carbon.'

"'But what,' we shouted back, 'prevents the oxygen from playing the same trick the carbon played before?'

"'That is just what it will do if the blast is continued too long—the iron will oxidize again. But the oxygen has a stronger affinity for the carbon and other impurities than it has for the iron, and doesn't begin on that till those are burned out.'

"'I see: you shut off the blast at a moment when just enough carbon remains to make steel.'

"'Not exactly, though that is what Bessemer spent a great deal of time and money trying to do. But he found it impossible always to determine the time when the blast should be stopped, and often too much or too little carbon left in would spoil the product. So he changed his tactics. You will notice that we first burn out all the carbon; that is done in about fifteen minutes. You see that man in green glasses, on the little platform over in the corner, watching the flame from the converter? The instant he sees it lose its dazzling colors and become pale, and decrease, he knows the last of the carbon is burning, and the blast is shut off.'

"Meanwhile it seemed very wonderful that molten metal should contain fluid enough to make so furious a fire; nor was our astonishment diminished when we were told that the cold-air blast actually raised the temperature of the mass from 3,000° to 5,000° Fahrenheit during the brief process.

The blast shut off, the converter was turned down on its belly again, in order to prevent the metal from running into the tweers, now that the pressure was removed. 'The iron,' said our guide, 'is left by the blast decarbonized, and in a slight degree reoxidized. It also contains a little sulphur, after all its doctoring. Now we add a certain quantity of pig iron of a peculiar quality—either Franklinite or Spiegeleisen will do—containing a known percentum of carbon and manganese.' The dose was poured into the monster's throat, and a violent commotion in his stomach ensued, accompanied by a copious outpouring of smoke and flame. After a minute or two all was quiet. The new ingredients had burned out the oxygen and sulphur from the mass—just enough of the freshly introduced carbon remaining unconsumed to take up its permanent lodging in the metal and make steel.

"The contents of the converter were now poured into a huge ladle swung up under it by the long arm of a crane worked by invisible power, and afterwards discharged into the open mouths of the smaller monsters in the pit. These were, of course, merely molds; and into each was cast an ingot of steel weighing some six hundred pounds. The metal was discharged from the bottom of the ladle, and thus kept separate from the slag, which floated on its surface and was retained until the last. In twenty-five minutes from the time we entered the building we had seen five tuns of pig iron 'converted,' and cast into six hundred-pound ingots of steel.

"Having given one glance at Bessemer's method of lining his ladles and converters, to enable them to resist the intense heat of the charge, and another at the hydraulic machinery by means of which a lad on the little platform in the corner could rotate the converter, and lift ladles and ingots, doing the work of fifty men, we passed on to the rolling mill, where each ingot is heated and hammered (the enormous steam hammer coming down upon it with a resounding thump), then reheated, and rolled out into a rail, to be sawed off red hot at the right length (twenty-five feet) by a pair of shrill circular saws that do their work neatly and swiftly, as if the steel were soft pine, and the pyrotechnic spark-showers thrown out mere sawdust. Lastly, we saw the strength of a rail tested under repeated blows from a V-shaped tun-weight of iron dropped upon it from a hight of eighteen feet; and came away inspired with a high respect for Bessemer, both as an inventor and a public benefactor."

Soft Solder Silver Plating.

The art of plating metal upon metal, or, so to speak, metallic veneering, is very widely practiced, and is of great utility, both in the industrial and ornamental arts. The variety of metals capable of being plated on to the surface of other metals is very great, and the methods of applying them differ accordingly. Silver is the most universally applied metal in plating, and I propose to give a short, practical account of two of the least known methods of silver plating.

The four principal methods of silver plating, placed in the order of their cost and durability, the first being the cheapest and least durable, are (1) electro plating, (2) rolled-metal plating, (3) close plating, and (4) hard solder plating.

Electro plating is generally so well understood, that it would be superfluous to enter into that subject here. Rolled metal plating can be dismissed in a few words, it being simply brazing together a thin ingot of silver and a thick ingot of the metal desired to be plated, and rolling them out in the usual way of rolling sheet metals. Close plating, or soft solder plating, is an art which is very little known or understood beyond the trade itself and its immediate connections. The work is of such nicety, and requires such a high degree of manipulative skill, that not more than four out of every ten who are apprenticed to it make thoroughly good workmen. Silver plating is not an unhealthy occupation, although until of late years the workmen were not remarkable for steadiness and sobriety; several attempts have been made to establish a provident society among them without success, but it is to be hoped that this will soon cease to be a matter of reproach to them. The principal seats of the plating trade are Birmingham and Walsall, the operative silver platers in London not numbering more than fifty. The tools required are few and inexpensive, and the workshop space limited in extent, but the materials, of course, are very expensive.

The articles plated by the soft and hard solder processes are now confined mainly to coach and harness furniture. Cutlery and spoons were plated by these processes formerly, but the introduction of electro plating took that part of the solder plater's trade almost entirely away.

The article intended to be "soft" plated, termed the rough, is first prepared from the forging or casting (as the case may be) by means of files of successive degrees of fineness, which produce a smooth surface. It is next "tinned" by being immersed for a short time in a solution of sal ammoniac in water, or diluted muriate of zinc, and then dipped into a melted amalgam of tin and lead, taken out, and smartly shaken, a little finely powdered sal ammoniac being sprinkled over it the while, which "flushes" the tin, and causes it to have an equal thickness all over the article, which is next dipped as suddenly as possible into clear cold water. This completes the tinning process, and it is now ready for the silver.

The silver used is usually in the form of sheets 4in. or 5in. wide, and of an indefinite length, which, being very thin, cannot be measured by mechanical gages; the thickness is, therefore, determined by the length per ounce, assuming the sheet to be 4in. wide; so that a piece of sheet silver, 18in. long by 4in. wide, and weighing 1oz., is No. 18 gage.

This is cut out with scissors to the proper size and shape, and "stuck" to the article, by passing a well-tinned heated copper bit over it with a slight pressure; the heat passing through the silver, melts the tin, and thus causes it to "stick." It is then hammered with a leaden hammer, clothed with kersey or woolen cloth, called a madge, which lays it closer to the article, and next skillfully worked into the crevices of the work, great care being required in this stage to avoid cracking or splitting the silver; when it is sufficiently worked down, the heated copper bit is rubbed closely and evenly all over the parts of the work that the silver is applied to. This finishes what is called the "getting on," that is, supposing the work to be one-sided, or plated on the front only; but if it is required to be plated all over, this operation has to be repeated on the back, and the two edges of silver neatly brought together, forming what is termed a joint. This "all-over" work is only intrusted to the best workmen, it being much more difficult than the "one-sided."

The next process is "soldering," and is effected by the work being held over a clear coke fire, and plentifully sprinkled at intervals with powdered black resin, first removing it from the fire for that purpose. As soon as it is sufficiently hot to cause the resin to ignite, it is rubbed with a cotton rag, saturated with oil, care being taken to rub from the lighter toward the heavier portions of the article; this rubbing is continued, with gradually increasing pressure, until the article is sufficiently cool for the substratum of tin below the silver to solidify. The effect of the soldering is to equalize the thickness of the tin, and to expel the air, thus insuring the "soundness" of the work.

We now come to the "rubbing," which is a sort of burnishing with a rough burnisher, called a rub; the tool offers rather a singular illustration of wearing out giving value to an article, a rub being simply a half-round, smooth file worn down so much as to be useless for filing, which, if worn equally in all parts, and not nicked on the edges, is worth three or four shillings, the original cost being sevenpence. The use of the rub is to smooth and harden the silver. The work is next "dressed" by rubbing with leather thinly spread with pumice powder moistened with oil, which removes the coating of tin left on the outside surface of the silver by the "getting on" and "soldering" processes, and, at the same time, smooths the surface, and prepares it for the final polishing with leather, slightly dusted with powdered rottenstone.—*English Mechanic.*

Nickel Plating.

The following is from some remarks made by M. Dumas upon this subject before the French Academy of Sciences.

"In the numerous experiments attempted heretofore by M. Becquerel, Sr., M. de Kurlz, and others, they have succeeded in depositing upon objects a coating of nickel, but the means of which they made use had not the certainty and regularity necessary to an application really practical, which qualities are particularly marked in the method of Dr. Isaac Adams, of Boston.

"The Academy will notice with interest several of the results obtained by Mr. Adams. The coating of nickel is very uniform. It adheres perfectly. It is susceptible of any desirable thickness. It has a remarkably brilliant polish, which is very easily obtained. When the article comes from the bath it is only necessary to rub it with a cloth impregnated with a little metallic powder to give it all its luster. This electro-deposit of nickel can be well used for covering articles of saddlery, cutlery, plumbing, clockmaking, tools, fire-arms, decoration, etc.

"It may be used, and this is a valuable application, for covering plates designed for reprinting engravings; and on account of the very slight abrasion of the nickel covering, a perfect drawing can be repeatedly procured.

"Nickel is white, and possesses the property of resisting the action of the air, acids, and any substance with which it may come accidentally in contact. Its hardness is superior to that of untempered steel, and its cost is little. So much for the useful and industrial side of the question. From a scientific point of view, continues M. Dumas, the researches of Mr. Adams are of a nature to throw great light upon many of the phenomena displayed by electro deposits. When one wishes to separate the oxide of nickel by a fixed alkali from one of its solutions, there remains either potash or soda combined with the nickel, and nickelate of potash is formed accidentally. It is precisely this difficulty of obtaining the oxides and the carbonates of nickel free from potash or soda, which has defeated, until now, other experimenters.

"The discovery of Mr. Adams consists above all in having observed that when a solution of nickel contains the slightest traces of potash, magnesia, etc., the metal, instead of being deposited pure, will be found mixed with little particles of peroxide of nickel, which take from the adherent plating all its cohesion and its beauty. Further, the American chemist employs nickel salts entirely free from a fixed alkaline substance, such as the double sulphate of nickel and ammonia, or the double chlorate of nickel and ammonia. From this moment the operation is made with the greatest ease. The salt is decomposed in the bath, the nickel is de-

posited on the object placed at the negative pole, and the solution keeps neutral.

"The invention or discovery is no longer under trial. It has been shown to be practicable, and we may say that the new process belongs henceforth to the arts. It is a new and excellent victory, which it is permitted to us to chronicle."

AN INTERESTING REVIEW OF THE AMERICAN PATENT SYSTEM.

GENERAL SAMUEL A. DUNCAN.

The fourth of the Lowell Institute lectures, under the auspices of the American Social Science Association, was delivered on the 4th inst., by Gen. Samuel A. Duncan. He said: The wonderful progress in the arts and sciences during the last four centuries, especially during the last hundred years, is the combined result of various influences. The invention of the art of printing, by multiplying and cheapening the means of knowledge, and placing within the reach of every seeker after truth the accumulated experience and wisdom of the race, stimulated the mind into unwonted activity. The development of the laws of steam, and their practical application to the purposes of locomotion, and in all the industrial pursuits of life, has made that wonderful mechanism, the steam engine, one of the most potent instrumentalities in molding the civil, the social, and the political institutions of the world. The Reformation, too, operated to release the human mind from the galling bondage under which it groaned; when its fetters were broken, then came freedom of thought and liberty of conscience and a larger spirit of inquiry. But, all other reasons aside, the changed condition of affairs is largely the result of the liberal encouragement which enlightened governments have extended to persons who have been the discoverers and introducers of new and useful inventions. Recognizing the great and lasting benefits that naturally accrue to the State from the creation within its limits of a new branch of industry, or the introduction of any improvement in trade or manufactures, the legislation of every country in Christendom, with a solitary exception, has provided a system of patents with a view to encouraging the spirit of invention. When our own Government was founded this source of national prosperity was not overlooked. Wisely judged the wise men who framed the fundamental law of the Republic, when they incorporated therein a provision conferring authority upon the National Legislature "to promote the progress of science and the useful arts by securing, for limited times, to authors and inventors the exclusive right to their respective writings and discoveries."

Conformably with the power conferred by the Constitution, Congress has placed upon the statute book various laws, designed to secure the contemplated protection to inventors. The first law relating to patents for inventions was passed by the 1st Congress in 1790. This was repealed in the act of 1793; and this, again, with subsequent amendments, was superseded by the legislation of 1836. The act approved July 4th of that year, entitled "An act to promote the progress of the useful arts," as variously amended and supplemented, forms the basis of our present system of patents.

Much has been said about the inherent natural right of property in the products of one's brain, and it is upon this ground that frequent attempts are made to justify the granting of patents. Wherever thought and time and ingenuity have been expended, and valuable results produced, the full benefits thereof, it is argued, should accrue to him whose brain and hands have done the work—just as the capitalist possesses full control over his stock dividends and the interest upon his bonds, the farmer over the products of his land, or the laborer over his hard-earned daily wages. It is doubted whether this be the correct theory. Man undoubtedly has a natural right over everything of his own creation, and which at the same time he has the power to monopolize; but only to the extent and so long as he can monopolize it. When it goes beyond that, and the individual calls upon the State to interpose its strong arm for his protection, the State responds only when in its judgment it is for the interest of the whole to do it. In things material, as houses, and lands, and beasts of burden, the world is agreed that society derives advantage from their exclusive ownership by individuals. They are capable of individual appropriation; and hence the State recognizes and protects the right of property therein. But ideas are incapable of appropriation. So long as an idea remains in the breast of him with whom it originated, it is his, because he can control it; when once it is communicated, it is beyond his control forever. Driven from a material possession, a man may recover it by physical force; but recovery of exclusive possession of an idea which has once passed to others, is beyond human power. If there be a natural right of property in ideas, so as to control, not simply the idea itself while it remains a secret, but all the various embodiments of it by which it has become disclosed, why shall not that right be held in perpetuity? But against such a proposition the sense of the whole world revolts. If its adoption were possible, it would check progress forever.

In the case of a given application for a patent, it being primarily decided that there is invention displayed, the questions then to be determined are: Is it new with the applicant, and is it useful? To decide these questions properly is a work of labor and extensive research. It involves an examination of the entire body of American patents, now numbering more than 100,000, a large mass of rejected applications, the patents of foreign countries, numerous text-books, encyclopedias, reports of scientific associations, and a long list of rapidly multiplying scientific and technical journals. Many legal questions are also involved which require an acquaintance with the entire body of judicial decisions in this branch of jurisprudence.

The question of novelty is usually found to be the most difficult one, because of the labor required in ascertaining the facts upon which it is to be settled. The question of utility divides into three branches: 1. Is the machine or process operative—i. e., theoretically? 2. Is it trivial or frivolous? 3. Is it pernicious? How these various questions are practically managed may, perhaps, best be illustrated by a few examples. For instance: An application was recently filed for alleged improvement in the mode of propelling vessels. A screw is projected into the water from the prow of the vessel, and the shaft, running back, gears with a transverse shaft carrying paddle-wheels; masts are provided and sails erected; the wind gives motion to the vessel; this puts the screw in revolution, and the screw of course the wheels; the action of the wheels, added to that of the wind, impels the craft with increasing velocity; and so the work goes on, the screw giving power to the wheels and the wheels to the screw—until, carrying the invention to its logical conclusion, the vessel must either take fire from excessive friction, as she dashes onward in her maddened career, or bring up against some unlucky continent with a shock sufficient to discharge cargo and passengers at any point in the interior without the delay attending the ordinary mode of discharging freight. His application was properly rejected. "Perpetual motions" have never yet succeeded.

As regards inventions of a mischievous tendency, a notable case came before the officer under the administration of the Hon. Joseph Holt. The applicant sought a patent for a "policeman's club," so constructed that upon releasing a spring, a triple row of keen-edged lancets would leap from the hidden recesses and mangle the hand of an adversary. Applicant's professed object was to provide policemen with ample means of protection and yet obviate the necessity of arming them with deadly weapons—so objectionable because so often used with fatal effect in the heat and danger of personal encounter. The Commissioner refused the patent on the ground that while the safety of the conservatory of the public peace in their conflicts with lawless men was a laudable object, and might be secured by the new implement, yet, if transformed to a weapon of defense in the hands of desperadoes, as it inevitably would be, it would be an evil.

Among the many thousand applications received yearly, it is to be expected that many singular inventions will be found. Besides the cases already named, reference might be made to a patent granted years ago for a mode of removing worms from the human system without medicine. A small cylinder filled with a tempting bait, and having a string attached to it, is swallowed by the sufferer. The worm, if he kindly consents to carry on his part of the programme, thrusts his head into the trap, and disturbs a spring which is armed with a set of teeth, and which, on being released, darts forward to seize the intruder by the throat, when worm and trap are withdrawn together. The description suggests a strict course of preliminary dieting for the patient, and actually recommends in obstinate cases, in order to insure complete success, that he be kept without nourishment for five and six, or even seven days.

A few statistics as to the current business of the Patent Office may not be uninteresting. The whole number of patents issued up to date is 100,486, while about 50,000 cases have been rejected. In 1869 the applications numbered 19,271, and the patents issued 13,986. Of these 15,442 were to citizens of the United States, and 544 to citizens of 27 different foreign countries. To put these patents into print there is constantly employed at the Government Printing-Office a force of 17 compositors. The patents to American citizens were distributed in part as follows: To New England about 20 per cent, Massachusetts having as her share 10 per cent and Connecticut 5½ per cent; to the Middle States, 36 per cent, New York alone receiving 23 per cent; to Ohio and Illinois 7 per cent each; to California 2 per cent; and to the 11 States that engaged in the Rebellion, but 4½ per cent. Before the war these States had never received a larger proportion of the patents granted than 7½ per cent. The figures show that New-England receives the largest proportion of patents according to her population.

The expenses of the Patent Office up to the present time have been $5,583,337·35, to which, if be added the cost of the building itself, and the money expended upon the annual reports, the entire sum will reach perhaps $12,000,000. But what is this compared to the benefit derived by the public from a single invention of real importance. There are, perhaps, 400,000 sewing-machines in use in the country. Ten cents a day would seem an absurdly low estimate of the value of each of these to its owner; and yet even this daily profit would make the aggregate annual sum to the community from this source alone $15,000,000. It is computed that the saving of grain by the use of thrashing machines in place of the flail which they have supplanted is 10,000,000 bushels annually.

The distinctive feature of the American system as compared with the European is the official inquiry instituted into the character of the invention as regards its alleged novelty and utility. In Europe patents are usually granted upon simple registration. Two or three countries only provide for a preliminary examination; but this is conducted upon such illiberal principles as to amount almost to prohibition. In Prussia, for instance, in 1867, only 103 patents were issued, while in the United States the number reached 13,000. The patent of registration carries with it no presumption of validity.

The recent outcry in England against patents is based largely upon the amount and excessive cost of litigation in this class of causes. The great majority of American patents are beyond doubt good and valid, and by consequence patent property possesses a commercial value in this country that attaches to it nowhere else. And this too, has contributed largely to induce the liberal policy displayed by our courts in dealing with patent questions; since, in marked contrast to the English practice, they have generally aimed, in accordance with the maxim of interpretation, *ut res magis valeat quam pereat*, to sustain the patent, if not plainly in violation of principle.

In the Netherlands abolition has actually been voted by large majorities in both Chambers of the Legislature. Switzerland never had a law on the subject. And in December, 1868, Count Bismarck, in a message to the Federal Parliament of the North German Confederation, took the ground that conferring exclusive rights in industrial inventions is warranted neither by a natural claim on the part of an inventor which should be protected by the State, nor is it sanctioned by general economic principles.

It is the inevitable tendency of all improvements in the arts to cheapen production. Heathcoat's machines reduced our prices of bobbin net lace from five guineas a yard to six pence. The Bigelow looms for weaving ingrain carpets, both reduced the cost of the manufactured article 20 per cent, and improved the quality of the goods. The cotton gin reduced our price of raw cotton, stimulating the production so that it increased in three years from 138,000 pounds to 5,000,000 pounds. The Bessemer process of making steel has so cheapened that most useful article, that from a very limited use before it has now become largely available for engineering purposes. Without the prospect of protection and the accompanying hope of gain, it is hardly probable that Bessemer would have been encouraged to carry on the long series of costly experiment necessary to the perfecting of his process. Without the same inducement the Lowell Company would hardly have ventured an investment of several hundred thousand dollars in developing the capacity and economy of the Bigelow loom, Cartwright would not have been justified in devoting a princely fortune to the creation of the power loom, nor is it reasonable to suppose that Goodyear would have given his life to the vulcanization of rubber. A great invention is usually a thing of slow development. It is the creation of years of toil and perplexing thought and heroic effort and costly experiment. Without the prospect of reward capital will not go to the aid of the inventor in his uncertain efforts, and it is equally absurd to suppose that men will invent to any great extent from the pure love of inventing, or actuated by the hope of honor and prestige merely. They cannot afford to expend time and energies and means upon that which will, when attained, be at once appropriated by the world at large.

In view of the diminution of labor, the abridgment of time, the annihilation of space—which have marked man's assertion (through the agency of machinery) of his dominion over nature who can withhold assent from the verdict that "the introduction of great inventions is one of the most distinguished of human action;" for, says Bacon, "the benefits derived therefrom may extend to mankind in general, but civil benefit to particular spots alone; the latter, moreover, lasts but for a time; the former forever!" Neither king, nor emperor, nor sage, nor warrior ever won a prouder tribute than the inscription in Westminister Abbey upon the monument of James Watt: "He enlarged the resources of his country, increased the power of man, and rose to an eminent place among the most illustrious followers of science and the real benefactors of the world."

MISSOURI LEAD.—The annual yield of lead in Missouri is estimated to be less than 2,000,000 pounds, though that State may be taken as one of the best lead producing regions in the world. Lead has been discovered in 48 counties and over 500 localities. The St. Louis *Journal of Commerce* reports the receipts of Missouri lead at that city, in 1869, at 172,538 pigs. Receipts of foreign lead 7,856 pigs, and of Illinois lead 26,775 pigs consumed in city, and 15,801 pigs re-shipped. Lead is in Missouri mostly found in sulphuret. Out of 120 specimens of ore referred to by the *Journal* 113 were sulphuret, 6 sulphuret and carbonate, and 1 sulphate. From 60 to 85 per cent of the ore is pure lead. The gangue is generally sulphate of baryta; the ore is often found in magnesian limestone, or red clay interspersed with brown hematite, pyrites, and ocher.

IMPROVEMENTS IN GUNPOWDER AND ITS MANUFACTURE.—One of the buildings of the Luzerne Powder Company, at Wilkesbarre, Pa., recently took fire and was burned to the ground. Although some 400 pounds of powder were in the premises, no explosion took place, and all the workmen escaped without injury. Loss $2000. This Company is working under the patents of Paul A. Oliver, who has made valuable improvements in the quality of powder and in the machinery for its manufacture, whereby safety to workmen is secured, a stronger explosive is produced, and the prime cost lessened. This powder does not develop explosive properties until tamped or confined where it is to act, and then its power is enormous. But when exposed in a loose condition or in kegs it burns slowly without explosion.

CEMENT FOR LEATHER.—A cement for leather is made by mixing 10 parts of sulphide of carbon with 1 of oil of turpentine, and then adding enough gutta-percha to make a tough thickly-flowing liquid. One essential pre-requisite to a thorough union of the parts consist in freedom of the surfaces to be joined from grease. This may be accomplished by laying a cloth upon them and applying a hot iron for a time. The cement is then applied to both pieces, the surfaces brought in contact, and pressure applied until the joint is dry.

PRODUCTS OF THE PINE FOREST.

BY PROF. HENRY E. COLTON.

Turpentine, resin, tar, and pitch, are largely used in various trades, as well as for many domestic purposes. The chief supply comes from the long-leaved pine (*Pinus australis*) of the Southern States. This tree grows from the northeastern boundary of North Carolina, along the Atlantic coast, to Florida, across that State to the Gulf, and thence to Louisiana, in a belt averaging one hundred miles in width.

The soil is sandy, with an under stratum of yellow clay. This whole region is cut by deep, sluggish rivers and immense swamps, almost all underlaid with marl. The manufacture was first commenced at Newbern, in North Carolina, and that State still supplies by far the largest proportion of the product. The first step is to obtain the crude turpentine. This is the natural juice of the pine tree, and is sometimes called white turpentine and gum turpentine. It is a mixture of the essential oil known as spirits of turpentine and of resin. A half-moon shaped box is cut in the tree, as near as possible to the surface of the ground. The shape of this "box" will be seen in Figs. 1, 2, 3, and 4. The box cutting commences about the first of December and continues until March—perhaps a few weeks longer if the spring is late. A hand can cut from 100 to 150 boxes per day; the price now is from one to one and a half cents per box of from one quart to half a gallon in capacity. After cutting, the boxes are "cornered" by taking out a triangular piece at each end of the half moon. This is the commencement of the regular season, and the boxes are now all tasked off. A "task" is usually 10,000 boxes, but we have known hands to tend 18,000. These must be cornered once, and "hacked" about six times, from the first of spring until into November. The dipping (shown in Fig. 2) is done by task work, too, so many barrels or boxes per day being a task. This is accomplished with a spoon-shaped instrument and a peculiar twist of the wrist, only well done by long practice. Two dippers generally attend one hacker. Hacking is the making a groove-shaped cut on each side, downward, to the center of the half-moon. These grooves can be seen in all the cuts. The "hacker" is shown in Fig. 8. It is used with a downward stroke, and has at the lower end of the handle a weight of lead or iron, to give great impetus to the blow. The barrels for filling are placed at intervals through the woods; the dipper gathers his gum in a rude bucket, and empties it into the barrels, which, when filled, are hauled off. A frequent mode of hauling is seen in Fig. 1; the same cut shows a primitive but cheap mode of "rolling" tar to market. Both articles are frequently rafted to a seaport between sticks of hewn timber.

Fig 1.—HAULING TO MARKET AND HACKING.

Fig. 2.—DIPPING THE CRUDE TURPENTINE.

Fig. 3.—CHIPPING THE BOX FACE.

Fig. 4.—GATHERING THE SCRAPE.

The first year's operation produces "virgin dip," the second "yellow dip," the third some common yellow dip and scrape; then the further product of the trees is all "scrape." The virgin dip is, when carefully gathered, a honey-like gum, of whitish appearance. From it are produced No. 1. pale, extra, and window-glass resins. It yields about seven gallons of spirits, and net quite three fourths of a barrel of resin to the barrel (280 lbs). Yellow dip yields over three fourths of resin, and about six gallons of spirits to the 280 lbs. of gum. Scrape yields about the same. "Scrape" is the gum which gathers on the face of the tree or box when worked up three, four, or more feet. It is a white, cheesy-like substance. The operation of chipping the box face and gathering the scrape is seen in Figs. 3 and 4. With care a very light resin can be made from it. The "round shave," an implement used in chipping, is shown in Fig. 9, and the "scraper" in Fig. 10.

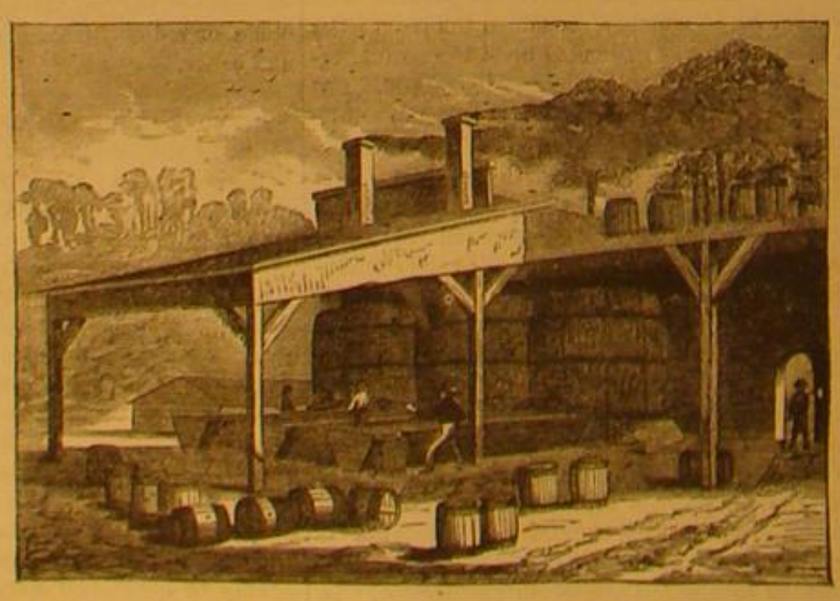


Fig. 5.—THE DISTILLERY AND RESIN VATS.

Fig. 6.—BURNING A TAR KILN.

The operation of distilling the gum is carried on in turnip-shaped copper stills of a capacity from ten barrels up to sixty—the ordinary size being twenty and thirty barrels. They are bricked up at the sides, and the fire strikes directly on the bottom. The top has a large hole for the "cap," which connects with the worm for condensing the spirits, and a small hole through which the "stiller" examines the state of his charge, and lets in water as it may be needed. The resin, being a residuum, is let off on one side into vats, through strainers, from which it is dipped into barrels to cool. Many attempts have been made to use steam as a heating agent, but not yet with success. If the resin is not entirely free of either spirits or water it is opaque and loses value. Previous to the war much white turpentine was distilled for the spirits alone, and the resin run to waste. These (called "beds") in many cases, under the stimulus of war prices, were "resurrected." During Sherman's march a body of troops encamped one night on one of these beds, it appearing to be a vast rock. The resin melting from their camp fires soon caught fire, and they had barely time to save themselves, losing the bridge they had built across the streams in their front. Few will forget the awful grandeur of the burning of one near the distillery at the battle of Bentonsville.

The rear of the stills and the resin vats are shown in Fig. 5. Probably the largest distillery in the country is at Wilmington, N. C.

The profits of this business depend entirely upon the vigor with which it is pushed, and the economy with which it is conducted. A store usually accompanies and adds to the profits of a country distillery. A task of 10,000 boxes may safely be calculated to yield two hundred and fifty barrels of virgin or yellow dip in a season. If convenient to railroads, cities, or towns, the trees, when worked out, are cut into cord wood, quantities of which now find their way to New York. In trees deadened by fire, stumps of trees cut down when the sap is up, and old boxed trees left standing, a peculiar transformation of the wood takes place; all its pores become filled with pitchy matter, it increases greatly in weight, and will take fire almost as readily as gunpowder. In this state it is called "light-wood," because it is used for kindling, and with the poor as a substitute for candles or other light. The smothered burning of this wood is the source of tar. The wood is split into billets three or four feet long and about three inches in diameter. To form a tar kiln the operation is commenced by scooping out of the ground a saucer-shaped foundation, making a hole in its middle, and thence running a wooden spout outside the rim of the foundation. Billets of wood are then placed radiating to this center hole and piled upward, each upper and outer stick lapping a little over, so that when finished, the pile (as shown in Fig. 6) resembles a cone with the point cut off, small end down; logs of wood and green twigs are then piled around, and the kiln thus made is covered with dirt, the top as well as sides. The fire is then lighted at the top eaves of the kiln, and the tar trickles down to the center hole, whence it runs out through the spout. A kiln yields fifty, one hundred, or more barrels of tar, according to its size. Large iron retorts have been used, but the product is not sufficiently greater or more cleanly to pay for increased cost. In process of distillation a tar and pitch are obtained. Pitch is tar boiled down until all its volatile matter is driven off. The manufacture of tar is chiefly carried on by the poor whites and negroes. It is but seldom the object of regular work, being rather a job for odd times. The kiln burning is generally a frolic, or was in olden time. Few sights have in them more of somber grandeur than a large tar kiln at night. Its immense columns of slowly ascending smoke are now and then illumined by the leaping forth of a tongue of flame. The wild cries of the men in their efforts to cover it quickly with earth add to the wildness of the scene.

A diagram of the construction of a tar kiln is given in Fig. 7. A is the pit to receive the tar which flows through the gutter, B, from a hollow space, C, in the kiln, into which it drips from the burning wood. D are strips of light wood laid with their inner ends sloping toward the center. E E E is a space between the green pine logs, F, which inclose the whole. This space is tightly packed with turf, and the top of the kiln

is covered with the same material, except at G G, where the fires are first placed.

Lumber made from trees that have been boxed has a beautiful white, rather hot-house plant look, but will not last so well, nor is it so strong as that which has never been boxed. Fire and worms sometimes destroy immense tracts of the pines, and hundreds of thousands of dollars worth of trees have thus been rendered valueless. The traveler along any railroad of the Southern Atlantic coast will be greeted with the sight of the gaunt, ghost-like, leafless monuments of these destroyers.

Spirits or oil of turpentine is used in painting, the manu-

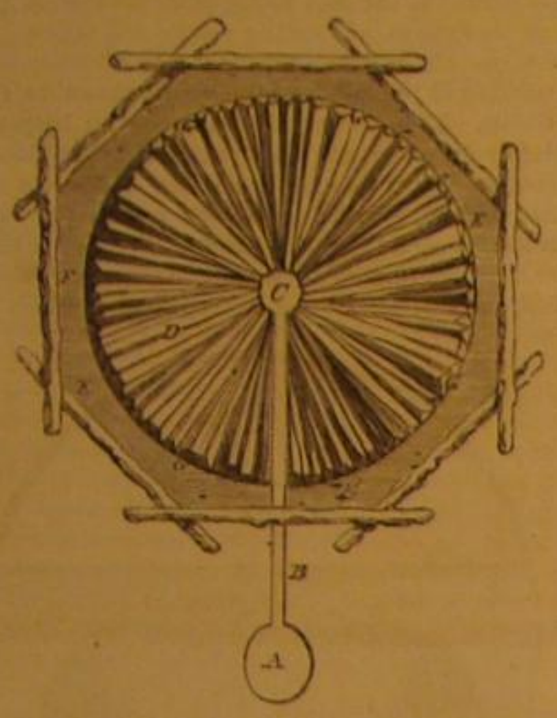


FIG. 7.—DIAGRAM OF A TAR KILN.

facture of varnishes, oil cloths, etc., and as a medicine. It has peculiar characteristics in which respect no substitute for it has yet been found. Benzine took its place to some extent during the war, but with the regeneration of Southern industry that has been abandoned. Still, with a less production than before the war, it is sold at about the same price. The discovery of petroleum has lessened its consumption, the spirits having formerly been used with alcohol in the manufacture of burning fluid and camphene. Many were the shifts made to dispense with its use during the war; some varnish manufacturers erected costly apparatus for collecting the spirit thrown off in melting kowrie gum. White paints mixed with benzine rapidly turn yellow and peel off, while with spirits of turpentine they grow whiter, are elastic, and tenacious. These qualities are attributed to its property in absorbing oxygen or transmuting that gas into its allotropic form—ozone. As a medicine it is diuretic, so powerfully so that sailors of vessels loaded with it are sometimes intensely affected by its fumes; rubbed on the joints it has a strange, and if often repeated,

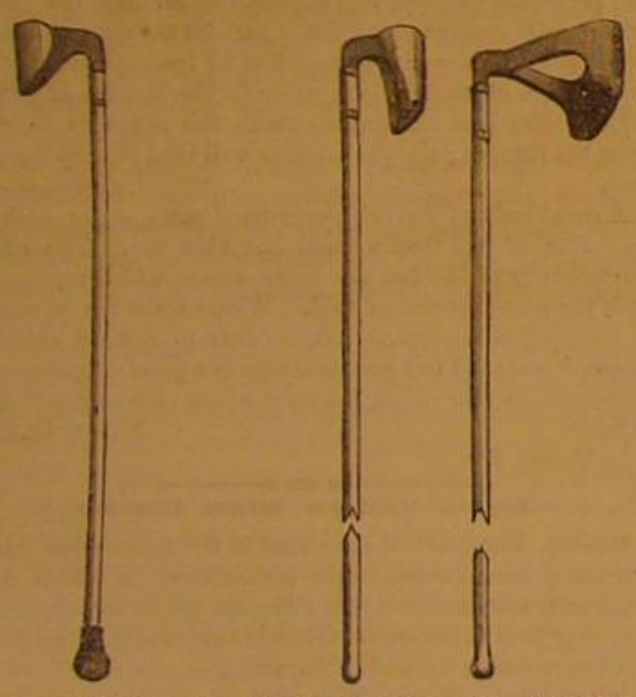


FIG. 8.—HACKER. 9.—ROUND SHAVE. 10.—SCRAPER

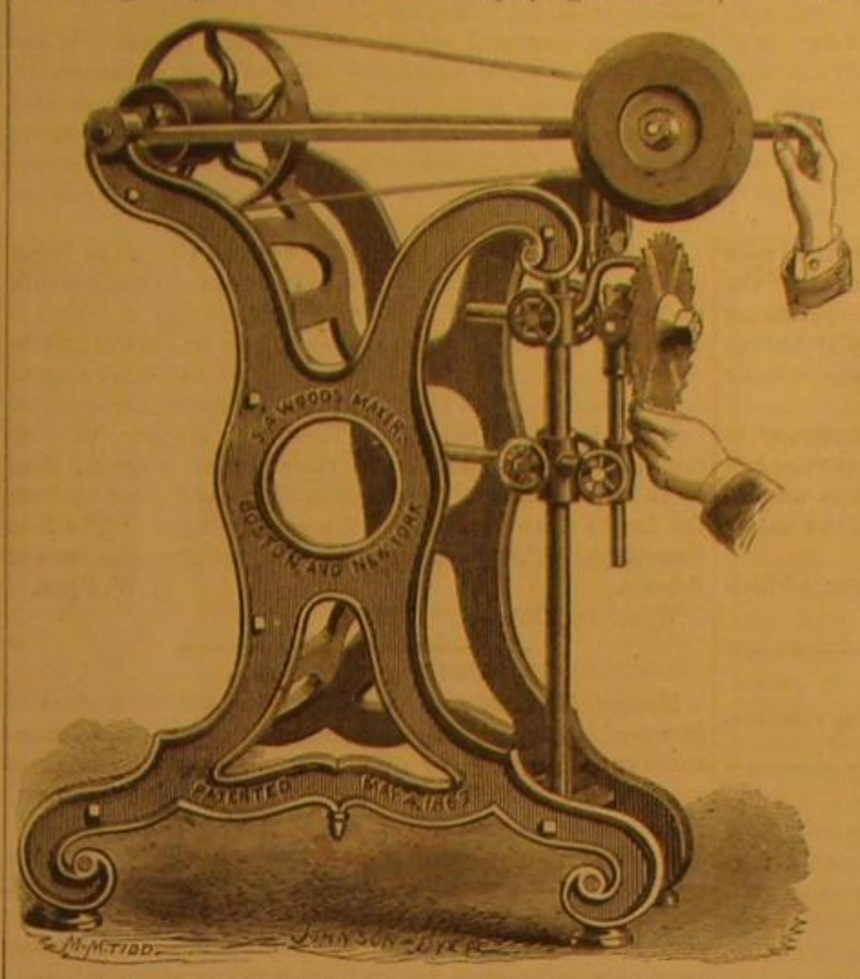
an injurious effect. Chemically it is a hydrocarbon, being C_{20} H_{16}. It is a powerful solvent of india-rubber, and if allowed to stand exposed to the air for a length of time is said to obtain the power of bleaching vegetable colors. A substitute was endeavored to be made for it by distillation of the white pine wood in iron retorts, and even yet a species of spirit is made by distillation of that wood, and also of the long leaf pine, but it belongs to the methylic series, and when deodorized is used as a substitute for alcohol in dissolving aniline crystals in dyeing. Pine rosin or resin enters largely into many manufactures. The pale window-glass article has a share in the soap which graces the toilet of the belle, and the dark grades go far to make up the coarser bar. It helps to wash our clothes and to mend the tin caldron in which they are boiled. It furnishes gas light for hundreds of the smaller towns, helps to paste up our thousands of placard advertisements, and assists in sizing the manufacturer's cloth. It is used for making lampblack, and is largely distilled for its oil and residuary pitch. In 1860, $550,000 of capital were invested in this last branch of business alone, and there is equally as much now, while the character of the product has been greatly improved.

MANY cases of poisoning have occurred by contact of guano with wounds. It should be handled with gloves.

WOODS' SAW-GUMMING AND SHARPENING MACHINE.

The desirability of replacing the old and tedious method of filing saws, has led to the invention of various devices designed to perform the work in a more rapid and accurate manner; and the file is fast giving way to the emery wheel.

Our engraving illustrates a machine employing a wheel of



this kind, of very simple construction, and apparently well adapted to accomplish the end desired. It is the invention of Mr. S. A. Woods, whose wood-planing machine and wood-molding machine were described on pages 90 and 135, current volume.

The working parts are constructed upon a triangular iron frame, upon the top of which is suspended a swing frame, the back end having a driving shaft (forming the hinge) with tight and loose pulleys; from this, power is transmitted to the arbor upon which is secured a solid emery wheel. The arbor on which the saw is placed is so arranged that universal motion is readily obtained to accommodate any sized saw or shaped tooth desired. The wheel is held away from the saw by means of a coil spring, under the swing frame. The frame is pressed down, bringing the wheel in contact with the saw with one hand, and the saw turned on the arbor with the other; thus the slightest touch can be given to the tooth of the saw without injury. The position of the operator is such that he can look directly across the tooth of the saw, and judge correctly when it has received the finishing touch. A device can also be attached for sharpening straight or mill saws (not shown in the cut). The speed given to the emery wheel is from 1,800 to 2,000 per minute.

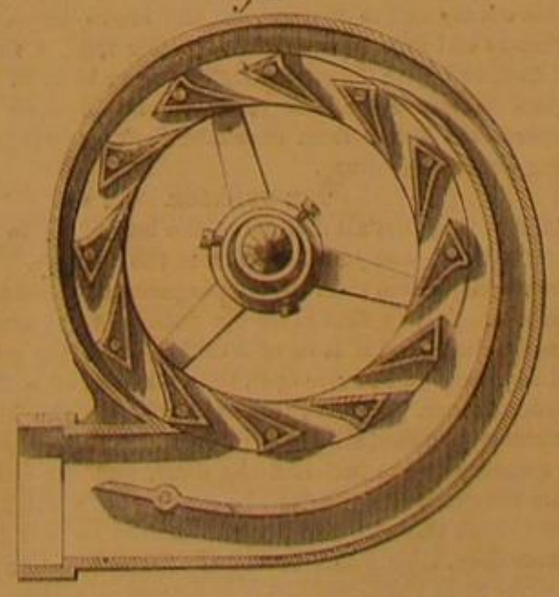
A number of these machines are now in use, and, we are informed, giving excellent satisfaction.

Patented May 4, 1869, by S. A. Woods, 91 Liberty street, New York, and 67 Sudbury street, Boston, Mass., where machines may be obtained, and letters for further information may be addressed.

SNYDER'S IMPROVED TURBINE WHEEL.

This invention consists in a peculiar form and construction of the buckets in turbine wheels, the form adopted being distinctly shown in Figs. 1 and 2—Fig. 1 being a plan of the wheel, and Fig. 2 being a perspective view of the interior portion or wheel proper.

Fig. 1



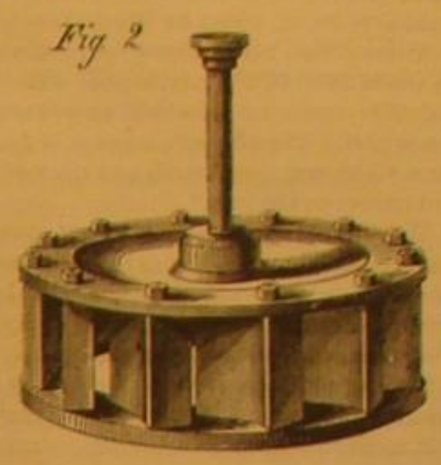
It will be seen that the general form of the buckets is that of a triangular prism, the most acute angle of the triangle being toward the interior of the wheel.

The wheel is of the kind known as center discharge, and the water is carried to the buckets by a scroll, which scroll is divided by a partition, so that one half of the water, as it enters the gate, is carried half way around the wheel before it reaches the buckets and acts there with full force.

The outer edges of the faces of the buckets, which receive the impact of the water, are curved somewhat abruptly inward for a short distance, and then extend in a true plane to the point of discharge. The discharge takes place through the bottom of the wheel, as shown in Figs. 1 and 2. The back faces of the buckets are perfect planes, and the spaces between them are somewhat narrowed toward the point of discharge.

Fig. 3 is a perspective view of the wheel when placed in the scroll, also showing the method of supporting the lower bearing of the

Fig 2

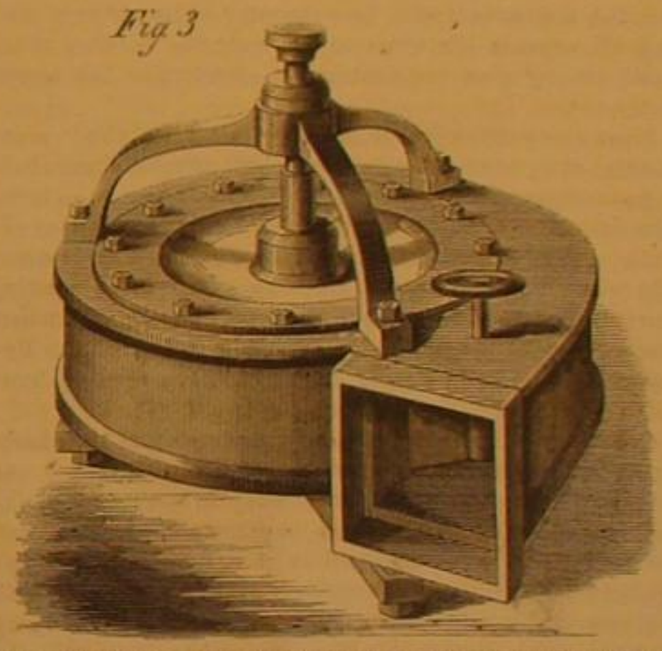


upright shaft, and the attachment of the wheel to the shaft.

It is claimed that the construction of the buckets described, secures the full force of the water against the extreme leverage of the wheel, and that thereby its power is much increased over that of other forms of turbines.

Patented, through the Scientific American Patent Agency, May 25, 1869. Further informa

Fig 3



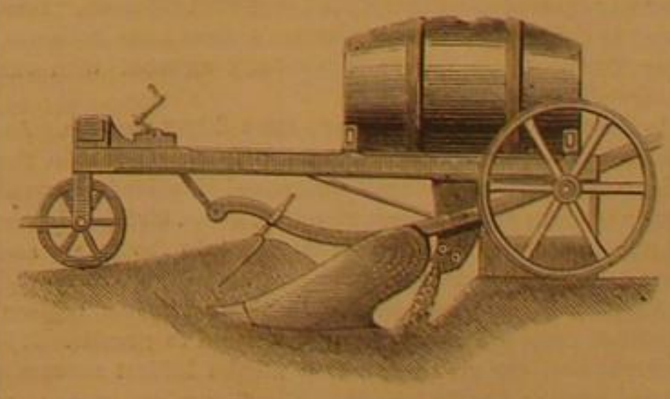
tion and circulars may be obtained by addressing the patentee, William H. Snyder, Phelps, Ontario Co., N. Y.

Dyer's House Closet.

The chief novelty about this closet is that, instead of being placed in the ground floor of the house or up a yard at the back, it is carried up to the roof.

The inventor claims several advantages for this position—first, that it is inoffensive, all the noxious fumes escaping through the natural ventilation of the roof; second, that it is desirable that the closet should always be in the house, and therefore accessible without inconvenience in any weather, and by night as well as by day.

The peculiar form of the receptable also (a long straight tube of about 9 inches in diameter) is stated to possess great



advantages. First, the surface that can give off noxious fumes is greatly diminished. Second, that surface is always covered by urinary deposit, and the fæces are thereby prevented from disseminating the germs of disease. Third, by means of the orifice at the bottom, the contents of the tube can be removed at any time without offense to the residents. Fourth, the valuable manure which is wasted by the cesspool system is carried away in an undiluted state, and may be applied to the ground at once by means of subsoil plows which entirely conceal the deposit. Fifth, it is claimed that this is an inexpensive mode of storing human excreta, as the labor of removal is much diminished, being chiefly performed by natural gravitation.

The closet is placed at least 8 feet above the floor of the attic, and the ceiling of the closet is perforated, and communi-

cates with the vacant space in the roof. The tube passes through the back wall of the house, and descends to within 4 feet of the ground. At the bottom of the tube is fitted a perfectly tight draw valve. When the tube is full, or at stated periods, an air-tight tank is brought round to the back of the house, a gutta-percha hose of sufficient length is fitted to the valve, which is then opened. The column of feeal matter, six sevenths of which is fluid, some 30 feet, 20 feet, or 10 feet in hight, then rushes into the tank. The valve is then shut down, the hose removed, and the joints of the valve are washed with diluted carbolic acid. The liquid manure is then conveyed beyond the limits of the city, and is distributed in properly constructed casks which are affixed to Liernur's subsoil plow, of which an illustration is given

These plows, being driven over some of the exhausted soils in the vicinity of the city, will at once restore to them the valuable manures of which they have been despoiled for years past. The offensive manure is then effectually hidden from sight, and from smell, and the "wilderness will be made to blossom as the rose."

We are informed that it is intended to form a company to supply the whole apparatus to houses and to remove the soil at a fixed rate per annum, and also to lease a large area of barren land which is to be reclaimed by the aid of the valuable manure now worse than wasted.

The invention has been patented by Mr. J. Dyer, of Melbourne, Australia.—*Mechanics' Magazine.*

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

A Final Zoic Catastrophe.

Messrs. Editors:—In your issue of Feb. 12 (page 110), is an extract from Prof. H. Wurtz, in which it is stated that through the agency of marine animals, that secrete carbonates from the ocean water, the carbonic acid of the atmosphere is passing "into solid forms, permanent and forever unavailable thereafter," and that soon, geologically speaking, the atmosphere will be exhausted of its carbonic acid, and all organic life come to an end; the burning of the fossil coal by man postponing the catastrophe but temporarily, etc.

Since the publication of Mr. Lyell's "Principles," many theories of igneous and cataclysmic catastrophe, formerly in vogue among geologists, have fallen into disrepute, as being founded on imperfect or fragmentary knowledge of the facts. In the progress of discovery one side of a cycle comes into view, and the "great machine seems to be running down." But further research discloses another side, where forces of equal potency are "re-winding it." Had the Professor looked a little deeper, he might have seen evidence that the crust of the earth, even, has two sides to it.

In some localities, carbonic acid derived from the atmosphere, is, by the agency of marine life, being deposited and locked up in the layers that are forming on the *outside* of the earth's shell. But similar beds of calcic and magnesic carbonates, which were deposited in past ages, are in other localities being acted upon by the heat from *within* the shell, and converted into igneous silicates; the carbonic acid being liberated and poured into the atmosphere through the fissures, vents, and craters of several hundred volcanoes.

This flow of carbonic acid, which is a constant accompaniment of volcanic agency, often takes place at great distances from the actual crater, and continues for ages after volcanoes have become extinct. In Auvergne the springs are charged with it. In California, I have seen the granites, and other igneous rocks, as soft as putty from the percolation of acidulated water through them. M. Fournet reports encountering emanations, while opening the mines of Pontgiband, that often burst into the galleries with explosive force, roaring like the steam from a boiler, filling the lower parts of the mines and pouring into the valley in sufficient quantity to suffocate horses, geese, etc.

From the Grotto del Cane, or from similar excavations, this gas has been flowing since the days of Pliny. "But the quantity evolved there is trifling," says Prof. Silliman, "compared to that which escapes constantly from Lake Solfatara, near Tivoli, whose surface is violently agitated with the gases boiling through it."

In the Island of Java there are some fifty volcanoes. Accordingly the flow of carbonic acid is so great, that in the celebrated "valley of poison," the ground is said to be covered with skeletons and carcasses of tigers, goats, birds, and even of human beings, that have ventured into the valley and been suffocated by the gas.

Very likely, at great depths, in these volcanic regions, stratified rocks are now being transformed to granite. It is believed that the granitic rocks of all the loftiest mountain chains, such as the Andes, Alps, Himalayas, etc., were once ocean mud, containing the usual proportion of carbonic acid; and that the carbonates have been changed to silicates, and the included carbonic acid returned to the atmosphere, since England was inhabited by pachyderms, bats, opossums, and monkeys. (Lyell's Manual, p. 231—Appleton & Co., 1864). In the central Alps nummulitic and even newer tertiary strata are found transformed to gneiss, a sort of half granite.

Thus the carbonates secreted from the Eocene sea by the little nummulites, have "rendered up again the treasure of carbonic acid in their marble grasp," by the action of just such a "fervent heat" as that which is now transforming the rocks, and slowly elevating the land in volcanic regions. (Dana's Manual, p. 721–725).

Belts of submarine volcanoes seem to be performing a similar operation upon marine deposits which contain the corals, crusts, and shells of existing species. Such beds are being buried deeper and deeper. Vast accumulations of "ashes," pumice, and cinders, are thrown up from below by eruptions, and then reduced to mud and spread out by the waves; alternating with floods of lava. Thus calcareous deposits are buried, and tend to become the inferior and underlying strata, where they will in time be transformed and decarbonized by the heat.

But this continual volcanic exhaust and depletion of the earth's liquid interior produces collapse; and, consequently, a lateral tension in the crust, which slowly bulges upward in a long wrinkle. This involves exposure to the denuding forces. First, by the dash of waves; afterwards by the action of rains, torrents, glaciers, etc.; the surface rock is scraped off again, and the gneiss, granite, etc., exposed.

In various places all these different operations are being slowly performed. Mountain chains are in the bed beneath the waves of the sea. Those who suppose that the earth is dead, and getting cold, are mistaken. So late as the middle of the Eocene tertiary period, nummulites and other marine animals luxuriated in the sea, on the very spots now occupied by the Alps and Himalayas. There was no more promise *then* that they would rise to their present altitude, than there is *now* that similar mountain chains will come up from the depths of the sea during the coming ages. "The Zoic Catastrophe," therefore, cannot be deduced from the facts of Science.

J. W. Pike.

Windham, Ohio.

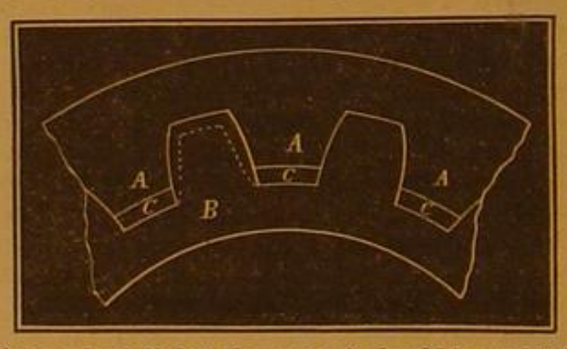
Chilling Cast Iron.

Messrs. Editors:—It is well known that the surface of iron castings is extremely hard, and that this hardness sometimes extends nearly, or quite through, when the casting is very thin, or when a certain quality of iron is used, termed "charcoal iron," such as is used for malleable articles.

On thick castings, made of good machine iron in a common sand mold, this crust is quite thin, hence when a thick, hard surface is needed on any portion of such castings, it is necessary to use a metallic mold at that point. These partial metallic molds, termed "chills," are fitted up with much care, and are so placed in the sand mold as not to mar the true symmetry of the casting.

In the casting of car wheels a "chill" constitutes the whole outer rim of the mold; it is simply a massive iron ring, the inner face of which is, of course, the exact mold or counterpart of the tread and flange of the wheel. If a little charcoal iron is mixed with the common iron, the surface will harden deeper in proportion to the amount used. This susceptibility of cast iron to harden when brought in contact, in a melted state, with cold iron, is a characteristic of great utility.

Some care is necessary in using "chills" on certain castings. In chilling the cogs of wheels, for instance, the cogs of the chill, A, should not extend quite to the base of the



cogs of the wheel, B, but the space, C, should be molded with sand, then the chilled surface will take somewhat the form indicated by the dotted lines; in this way the full value of the chill is obtained without impairing the strength of the rim of the wheel. Another advantage of chilled cogs is that they may be made nearly as perfect as cut ones, because the cogs of the chill may be formed in a gear engine as perfectly, of course, as the teeth of any gear wheel, and the chill is free from other imperfections of a sand mold.

F. G. Woodward.

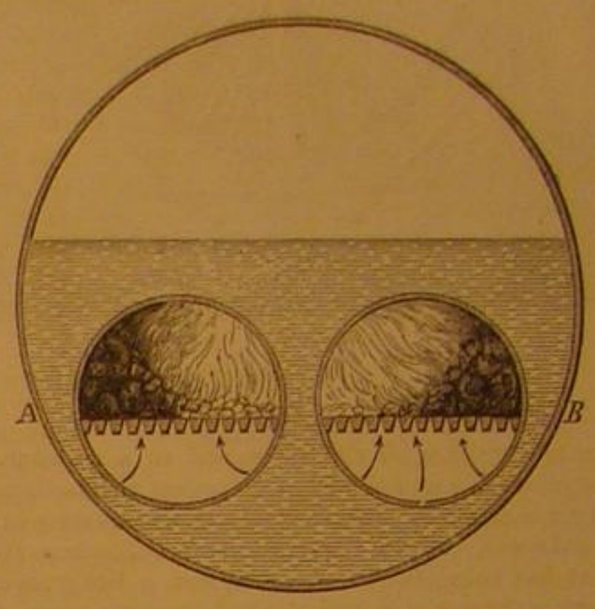
Firing under Steam Boilers.

Messrs. Editors:—Seeing an article in your journal, headed as above, I beg leave to offer you my experience both in this county and in Europe, on the above subject, and if engineers and firemen will give it a fair trial, I think they will find, as I have done, a saving of from 10 to 25 per cent in *fuel*, besides much less labor for the fireman and less danger to the boiler from expansion and contraction while under working pressure.

THE FURNACE.

After seeing that all fittings of the boiler are in the best possible order, turn your attention to the furnace. There is more required here than the simple process of feeding the fire with fuel. In the first place the nature of the coal should be ascertained, and if it be of a coking kind the grate bars will require it to be more open than for coal of a light and gaseous nature. Adjust the grate surface to the heating or absorbing surface of the boiler; this will greatly depend upon the quantity of the fuel and the draft, and the quantity of steam required. If the draft be good, work a thick fire, but do not break the coal excepting it cannot be got in at the furnace door, taking care to feed the furnace on one side, not covering more than one-half of the grate at a time. When that is sufficiently coked feed the other side, putting plenty on at a time, leaving the fuel at the middle of the furnace much lighter and thinner than at the sides, and keeping the grate bars well open. The placing of the coal on one side at a time will prevent the formation of a great portion of the smoke which would otherwise result, and produce a more steady heat. The coal so placed will partially damp the side of the furnace on which it is placed; therefore the necessity of stoking the furnace when the steam is up. By this method of firing, the gas generated will be given out slowly. The greatest quantity of air will pass through that portion of the grate where the fuel is most consumed and where the coal has not been made small by breaking, leaving the interstices wide; and as the oxygen of the air will be in sufficient quantity if this mode of firing is adopted to unite with the gas as it is extracted from the coal, a continuous flame of gas will be kept up and smoke prevented.

When one side of the furnace so fired is sufficiently coked raise the burning fuel gently with the poker but do not break it into pieces; at the next firing, place the coal on the other side of the furnace, and similar results will follow. Replenish first one side and then the other, and continue to do so in the working of the furnace, keeping out the cold air as much as possible. Keep the furnace door open no longer than is absolutely necessary, and place your coal before firing near to the furnace, that there may be no loss of time in charging the fire; all cold air coming in contact with the boiler lets down the temperature and does harm. With a double fire-box boiler, fire each furnace alternately in the manner above described, and as illustrated by the engraving, where A and B



represent the sides of the fires last stoked, and the gas given out from the new fuel mixing with the air which passes in the greatest quantity through the thin portion of the fire, as indicated by the arrows. Being thus mixed with air at a high temperature, the gases ignite, and comparatively thorough combustion is secured, preventing smoke and saving fuel. This mode of firing is applicable to most furnaces, whether single or double fire-box, or wholly beneath the boiler.

By all means avoid having a dirty ash pit. A pit nearly full of ashes is a sure sign of bad management, it is necessary to keep the ash pit of a furnace clean and cool and the air as dense as possible, as it is to feed the fire with fuel. If the ash pit be hot the heat will expand the air and the furnace will require greater quantities to pass for the required amount of oxygen which would be supplied by less quantities of cold air. When convenient, use water for the bottom of the ash pit, allowing it to remain to quench the ashes as they fall from the furnace; the evaporation will tend to keep the grate cool.

A great body of fire will evaporate more water with less proportion of fuel than a small and thin fire. The greater the intensity of the fire the more steam will be generated with the same amount of fuel. Where there are a number of boilers it is important that the duty of stoking should be properly attended to; and as smoke is a great nuisance easily prevented, its prevention is a duty which each engineer ought to fulfill.

Major Clegg.

La Crosse, Wis.

Liquid Fuel for Steam Engines.

Messrs. Editors:—I have read in the Scientific American many valuable articles on combustion, in which it has repeatedly been asserted that chemists prove by experiment that only 10 or 12 per cent of the total heat produced by the combustion of coal is utilized in the steam engine under ordinary circumstances. In connection with this subject, I would state that we have here in Washington, a couple of inventors that claim to do better in the production of heat than has yet been accomplished, as they have had published in every paper here that by their petroleum apparatus they can run a sixty-horse steam engine at the rate of 17 cents per hour; the combustion is so perfect they say that the flame extends the whole length of the boiler, say about 25 or 30 feet, and several feet into the smoke stack, and no smoke can be seen coming from the stack.

These are wonderful statements to any one who has been led to believe that, in all experiments in burning petroleum, the conclusions have always proved that petroleum is about eight times dearer than coal. As for the statement that no smoke can be seen escaping from the smoke stack, as a large black cloud of smoke extending far away in the distance can be seen, whenever the apparatus is at work, arising from said stack, it is rather ominous.

This apparatus consists in a tubular boiler, in which steam is passed through the tubes, and by its heat vaporizes the petroleum which is contained in the space between the tubes. The vapors are passed through a spongy mass and a metallic sieve, and are held in a receiver forming the outer jacket of the boiler. The gases or vapors are burnt at any convenient point, being conveyed through steam pipes. Another claim is that the steam is passed through the fire-place, and there decomposed and fed into the pipes jointly with the vaporized petroleum. This is in substance the whole apparatus, and

how the inventors ever formed the estimate of 17 cents per hour is beyond my knowledge, as they have never run it for even a whole day. If their statement is true then the experiments made through the patronage of the Navy Department must have been made by persons incompetent to carry out a correct experiment; if, on the other hand, the Navy experiments have been properly made, this 17 cents per hour statement must be taken with strong faith.

In regard to decomposing steam to burn it, it is generally conceded that no heat is gained, therefore this part of the apparatus can not add to its efficiency. It would seem then that this more than wonderful result is simply obtained by burning vaporized petroleum. This is rather a late day to bring such claim forward with the present knowledge of the usefulness of petroleum. C. COLNÉ.

Washington, D. C.

Water as a Fulminate.

MESSRS. EDITORS:—The active investigations going on at present concerning steam-boiler explosions seem to demand all the scientific knowledge and facts as far as known of the characteristics of water. I have examined it, and witnessed it, as a fulminate in two different conditions. In the one case, in the spheroidal state on a hot, metallic plate; in the other in a similar condition from a mixture of warm and cold air in a storm-cloud. In both cases it plays the part of a fulminate. When I drop water on a hot plate, below a red heat, it rolls about without making noise or steam. When the spheroid is rolled over the edge of the hot plate on to one of lower temperature it explodes. If, however, it be struck with a hammer while rolling about on the hot plate it goes off like a fulminate, resembling the crepitating noise of thunder, as heard by an observer immediately above the cloud in which it occurs.

In the case of spheroidal water, as noted in "Silliman's Principles of Chemistry," the author says "Water passes into this condition at 340°, and may attain it even at 288°. A grain and a half of water in this state at 392° requires 3·30 minutes to evaporate." If you drop the water on a plate of low red-heat it oxidizes the plate, and necessarily deoxidizes the water, freeing its hydrogen. Now it is well known that water in a spheroidal condition is ensconced in an atmosphere of its own vapor, and this vapor being a non-conductor, chemists say its formation abstracts the sensible heat from water, and leaves the temperature of the fluid at 205°; and this would seem to be a correct statement, as I find my spheroid to leave no watery track as it floats on its vapory cushion over the hot plate undisturbed, but as soon as it is struck with a hammer the watery trace becomes visible on the plate and on the hammer. This envelope of the spheroid must be of considerable tenacity, as indicated by its bursting and fulmination when struck with the hammer.

The book referred to says, "If a thick and heavy silver capsule is heated to full whiteness over the eolipile, it may by an adroit movement be filled entirely with water, and set upon a stand, some seconds before the heat declines to the point when contact can occur between the liquid and the metal. When this happens, the water, before quiet, bursts into steam with almost explosive violence, and is projected in all directions."

Now let us apply these known characteristics of water to its action in steam boilers, and see whether it can account for *some* of those terrific explosions too frequent of late.

As soon then as a heat of 340° accumulates in the boiler plate it produces the spheroidal state in the water in contact with it, and as long as that temperature is maintained, the spheroidal condition continues, and if all that boiler surface covered with water attains that temperature, its inclosed water immediately becomes a spheroid inclosed in its fulminate shell, ready to burst explosively as the drop in the eolipile, as soon as the temperature falls to the maximum steam-generating heat. In a tubular boiler of comparative great water surface to a given capacity of water room, such high temperature of boiler shell is soon acquired upon a cessation of motion in the engine; and *vice versa*, when the furnace doors are suddenly thrown open allowing a rush of cold air to the boiler shell, causing this tenaciously bonded fulminate to give out suddenly its pent up power, as do the insidious granules of gunpowder in the bomb-shell, when they are touched by that mysterious agent, fire.

The work referred to says "The quiescence of the spheroid of water, as it rolls to and fro over the heated plate, is due to the elastic force of its own vaporous atmosphere, as well also as to the repulsive action of hot surfaces." This is not a lucid explanation to my comprehension. I suggested to a high authority of science that electricity played a conspicuous part in the phenomenon, but was told it did not. I hold that heat, oxygen, fire, and galvanism, are only different forms or modes of that one mysterious element we denominate electricity, and that in the spheroid of heated water its positively-electrified repulsive power is balanced by the equally positively-electrified heated boiler shell; and that a change, or reduction of the electrical tension in the heated plate, rendering it negative to the spheroidal water, or, *vice versa*, by a reduction of the electrical tension in the spheroidal atmosphere of the water, will necessarily cause an explosion.

But lay the electrical theory aside, and take the simple fact of water "in a spheroidal state," as explained by M. Boutigny—the water in the capsule—the experiment of Perkins, and the water on the hot plate, and we have the evidence that water in a boiler may, and does, become spheroidal at a temperature of 340°, and must then float about upon its self-created atmosphere, exerting just as much repulsive pressure against the shell of the boiler, as does the heated boiler shell against the water, bringing the two forces into equilibrium; and that as soon as this balance of power is broken, by any of the causes always incident to such conditions, an explosion must follow. The atmosphere surrounding the spheroid suddenly expanding into a large volume of steam, while at the same instant its liberated heat converts the inclosed liquid into an additional volume of steam, and, unless such boiler is made with the same comparative power of resistance as a gun-barrel is made, it will burst; that is to say, if it has not a vent or opening like the gun-barrel, to let off the expanding force, and a sufficient resisting strength for the initial shock, an explosion must result.

Boiler explosions have always on examination appeared to me more like the explosion of a bomb-shell than one caused by the gradual augmentation of steam pressure over and above the resisting strength of the boiler. That steam boilers may explode from this simple cause of over-pressure, is not to be denied, but in all *such* cases they must at best be but poor magazines of power.

My article being already long, I will omit for the present the analogous fulminating characteristics of water spheroids as formed by the commixture of cold and warm air in the formation of a thunder cloud, and the electrical explosions they give rise to as they fall from the upper to the lower cloud.

Lancaster, Pa. JOHN WISE.

Running Locomotives a Mile per Minute.

MESSRS. EDITORS:—I observe in your issue, of February 26, C. P. L., of Minnesota, asks, "Are railroad locomotives with 6½ feet drivers capable of exhausting fast enough to allow them to run at the rate of one mile a minute?"

I answer this question—with conditions, "Yes." Those conditions being several in number, I will not enumerate all, but the principal ones.

1st. The size and weight of train, etc.

2d. Gradients, and state of rail, wind, and weather.

3d. Capacity of boiler for generating desired amount of steam.

4th. A proper proportion of area of passages or parts of cylinder and nozzles to exhaust, for free ingress and egress of steam before and after using.

5th. A good valve motion to use steam expansively and to the best advantage previous to link motion.

Various devices were used to work steam expansively, and among those first were the variable cut-off, etc. I once ran an engine (the Samson) on the Great Western Railway, of Canada, from Lynden station to London, 61 miles in one hour and twenty-five minutes.

The train of circumstances occurred thus: The accommodation west, Patterson Hall engineer, with engine "Firefly," ran off track at Lynden, when the engine "Samson," cylinders 16 by 22, 6 ft. 2 in. wheels, when new was ordered to relief, and at 12:15 P.M. left with two passenger cars and one box car for London, made nine actual stops, and slacked up once at Smith Creek Bridge, at Harrisburgh, and Paris, changed baggage, etc., on the branch of cross roads, and arrived in London at 1:40 P.M. being one hour and twenty-five minutes on the journey.

Mr. Brodie, late (if not the present) station master of London, was conductor, D. McCarthy, fireman, and the train was run at the solicitation of assistant Superintendent E. S. G. Colpoys, late of the Great Indian Railway, Calcutta. At one station (Beachville) the train was run by, a distance equal the length of it, and backed up for passengers, and the delays at stations occupied about fifteen minutes; besides, nine miles of the distance was up a heavy grade, and consumed 13½ minutes. WALTER S. PHELPS.

Muncie, Ind.

Absorption of Oxygen by Charcoal.

MESSRS. EDITORS:—In an article entitled "Spontaneous Combustion," in No. 16, of Vol. XXI, Dr. Jackson says that he has found that charcoal when freed from dampness absorbs oxygen very rapidly. Is there not in this peculiarity of charcoal a source of cheap extraction of oxygen from the air? Charcoal might be heated to a certain degree when it would absorb oxygen, it would then be made to yield it up; the gas could then be passed through water and received in tanks ready for consumption.

In these days of search for cheap fuel and light, may we not have an unlimited supply of oxygen in the air waiting to be extracted? May not this substance be as suitable as manganate of soda used in the *Tessié du Motay* system of extracting oxygen? Charcoal is cheap, and any chemist having a suitable apparatus can easily make the experiment.

This idea is thrown out for what it is worth, and I hope any one making the experiment will report the result in the SCIENTIFIC AMERICAN. C. C. S.

Washington, D. C.

Waste of Labor in Building.

MESSRS. EDITORS:—Apropos to your article under this heading, the writer noticed a device in use in Paris, Lyons, and Marseilles, which might be copied to advantage in cities with a good water supply.

The basement being constructed and sewerage and water connected, two wrought iron tanks come on the scene, about six feet square, and say two feet deep, covered with a stout wooden platform. Six upright timbers are fixed to serve as guides, as in an ordinary hoist. The tanks are attached by a chain passing over a pulley at the top of the uprights, the length of which is regulated from time to time, so that while one tank is on the ground the other is at the hight where materials are to be delivered. Each tank has a funnel opening at the top and a plug valve at the bottom. The water is led up in flexible hose to the place where the work goes on, and one tank being down and loaded, water is let into the upper one until the weight to be raised is counterpoised, when down goes the water and up comes the material, which, on arriving at the landing stage, is secured and unloaded. Meantime the plug valve has emptied the bottom tank it is loaded, and water being put into its elevated companion they change places as before. In this way blocks of stone, bricks, timber, tiles, and the workmen themselves go up and down rapidly, and without fatigue. The apparatus does not cost more than a derrick and tackle, and is easily taken down and moved from place to place.

There is a brake to prevent too rapid descent, the rounds placed at the sides to form a ladder, and other points which I have probably overlooked. VOYAGEUR

Toronto, Canada.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections for the month of January, 1870:

During the month, 372 visits of inspection have been made; 766 boilers examined, 714 externally and 207 internally; while 54 have been tested by hydraulic pressure. Number of defects in all discovered, 270; of which 23 were regarded as dangerous. These defects in detail are as follows:

Furnaces out of shape, 9; fractures in all, 21—1 dangerous; burned plates, 23—2 dangerous; blistered plates, 30—2 dangerous; cases of incrustation and scale, 42—1 dangerous; cases of external corrosion, 41—3 dangerous; cases of internal grooving, 3; water gages out of order, 8—1 dangerous; blow-out apparatus out of order, 2; safety valves overloaded and inoperative, 9—1 dangerous; steam gages out of order, 46—4 dangerous. These gages varied from—25 to + 12. Cases of deficiency of water, 6—2 dangerous; boilers without check valve in feed pipe, 6—6 dangerous.

It will be noticed in the foregoing report that there have been found 30 blistered plates, on two of these in one boiler were found six large blisters, which so reduced the strength of the material that it became necessary to renew the plates. All parts of the furnace and fire sheets of boilers should be examined at stated intervals with a view to detect these defects—they are not especially dangerous if attended to in season. Two boilers examined during the month were so badly weakened by corrosion and fractures that they have been condemned as unsafe and beyond repair. New ones are being supplied. We not unfrequently find boilers without hand holes. This is a great oversight on the part of boiler makers, and we especially call their attention to this matter. Several cases have come under our notice this month when the fire-box sheets were badly burned by collection of sediment in the water legs, no hand holes being provided by which this could be removed. Again, we not infrequently find boilers set in angles of the building, where if they are furnished with hand holes, they are inaccessible from the boilers being set so near, or in direct contact with the wall. In the construction and setting of boilers every facility should be given to make the matter of removing sediment free from unnecessary trouble.

Steam gages, it will be noticed are frequently found incorrect. This can only be detected by making frequent examinations and comparing them with a test gage. To show how liable boiler appliances are to be neglected, the attention of an inspector was recently called to a steam gage that had not varied in its indications for a month; on examination it was found that a stop cock in the pipe leading to the gage was turned so as to shut the steam entirely off from the gage. This cock being opened the gage was all right.

In another instance, where the steam gage was not working, examination ascertained the fact that the steam-gage pipe entered the boiler through the head, and then turned a right angle, descending perpendicularly below the water line; the pipe was filled with sediment at the lower end, hence the gage was useless.

We mention these cases to show how a little carelessness in fitting or working a boiler may be a source of danger. We have frequently urged the importance of providing boilers with all necessary fittings, also that engineers give them daily attention. Attachments are not placed on boilers to make the engineer less vigilant, but to keep him constantly on his guard.

We repeat what we have frequently said. Raise the safety valve slightly and carefully, allowing it to return to its seat easily and without concussion, this should be done daily at least. See that the steam gage is in working order, and if for any reason it is thought to be incorrect in its indications, have it attended to at once. Keep the gage cocks clean and bright, not allowing them to become foul and incrustated, and if provided with a water gage, see that it is in working order.

With vigilance in these particulars the dangers of *low water* and *high steam* will be entirely avoided.

Tunnel Photographs.

We are indebted to Messrs. Rockwood & Co., 839 Broadway, mechanical photographers, for a series of stereoscopic and other photographs illustrating the pneumatic railway under Broadway. As the works are entirely below the surface of the street, artificial light was employed, in the use of which the photographers have been very successful. The illumination was obtained by means of two large and powerful oxy-hydrogen calcium light. Photography has been brought to such perfection that even the bowels of the earth yield to it their mysteries, and Broadway has proved no exception. The pictures were taken with the entire travel of the street, omnibus, carts, carriages, and steam fire engines, all trotting directly over the head of the artist.

Step Support for Mill Spindles.

The main object sought to be obtained in the improved step support for mill spindles, of which we give engravings herewith, is to secure perfect truth in the perpendicularity of the mill spindle to the face of the bed-stone. The collateral advantages thus secured will be apparent to practical millers and millwrights.

The improvement consists in the arrangement of the step in the top of a vertically-adjustable tube or other sliding support, provided with vertical guides, and working through guide plates, to insure the vertical position and to prevent rattling; the said support being mounted on a rod rising up from the bridge-tree and jointed to it, so that the joint may compensate for the curve described by it, due to the one end of the bridge-tree being fixed and the other swinging around the fixed point, and the step may be raised in a right line.

Figs. 1 and 2 are, respectively, a side elevation and a section, by reference to which all the parts of this simple and excellent device may be readily understood.

A represents the husk-frame to which the bridge-tree, B, is pivoted in the usual manner; the end, opposite the pivoted end, being raised or lowered by the adjusting screw, C, as hitherto; but instead of placing the step on these bridge-trees, as has hitherto been practiced, the bridge-tree, B, is placed lower down than in the old method, and the step support, D, itself supported from the bridge-tree by the rod, F, is provided, as shown in the engravings.

The rod, F, is pivoted to the bridge-tree, as shown in the engravings, and engages with the broad lateral arms, I, on the interior of the support, D, the top of the rod, F, being formed into a crutch, as shown in Fig. 2.

The lateral arms, I, Figs. 1 and 2, extend across to vertical guide-plates, K, which being pressed against the arms by means of the screws, L, adjust the step support so that it shall move in a line exactly perpendicular to the face of the bed-stone, and also prevent rattling or clattering against the edges of the plates, G, through which the step support passes.

The step support is preferably made tubular, as represented in the engravings, and the step, E, of any approved construction, is placed at the top and held by screws, as shown in Fig. 2, or in any other suitable manner.

It will be seen that perfect truth in the perpendicular action of the spindle is thus secured.

Patented, through the Scientific American Patent Agency, February 1, 1870, by John Russell, of Round Prairie, Missouri. See advertisement in another column.

Fig. 1

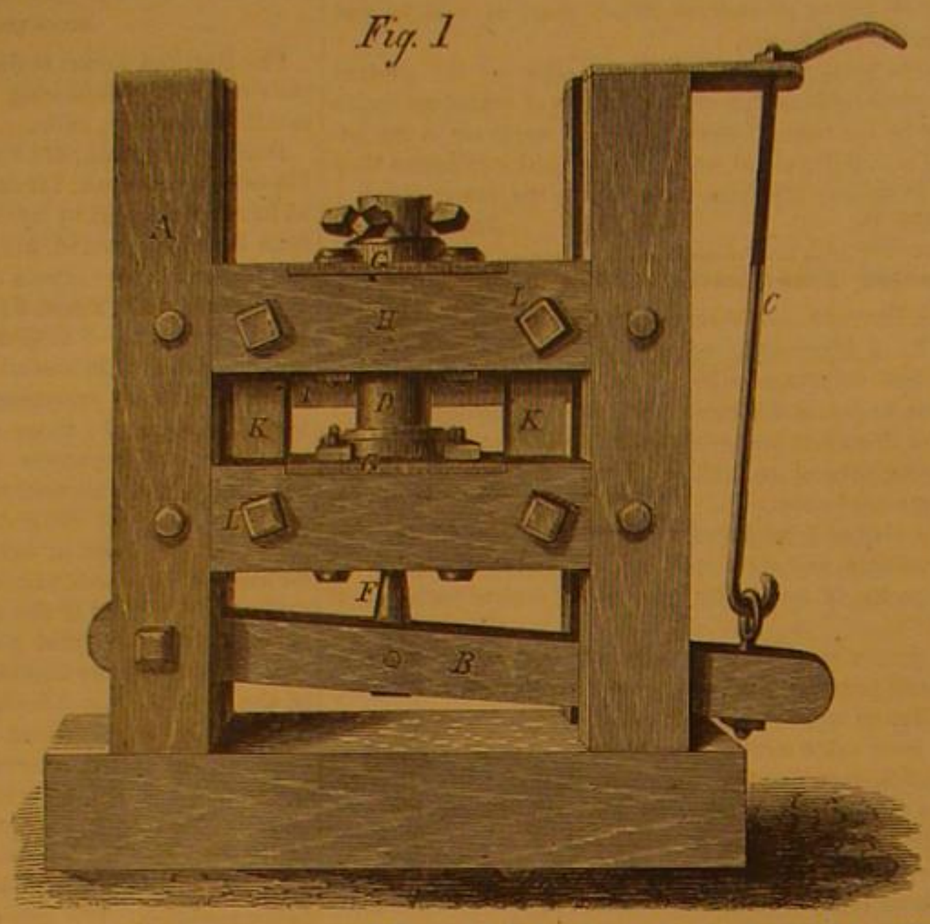
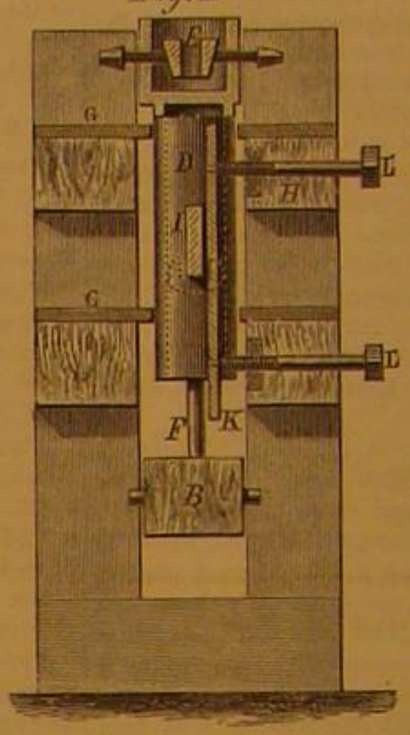


Fig. 2



RUSSELL'S SUPPORT FOR MILL SPINDLES.

Improved Form of Ax Blank.

This invention consists in rolling a bar of iron into the shape of a continuous series of blanks for ax heads, the fiber of the iron running lengthwise of the bar and ax head.

The blanks are formed by a pair of rolls provided with a groove or grooves, the contour of which corresponds to the desired form of the ax heads.

Fig. 2 represents a longitudinal section and plan view of the blank of a single-bitted ax as it comes from the rolls, and also a section of the blank ready for the insertion of the bit.

Fig. 1 is a section of a blank of a double-bitted ax as it comes from the rolls, and also a section of the blank prepared for the insertion of the bit.

A, Fig. 2, represents the poll of the ax and B the portions destined to form the eye, and C the eye.

Instead of the thick portion at A, Fig. 2, which forms the poll of the finished ax, the blank for a double-bitted ax is formed as at A, Fig. 1, so that when the two halves are bent together for the insertion of the steel, the junction at A holds them in position until the first steel is inserted and welded. The junction at A being then severed, the second steel is inserted, the first weld holding the parts in place during the latter operation.

Fig. 1

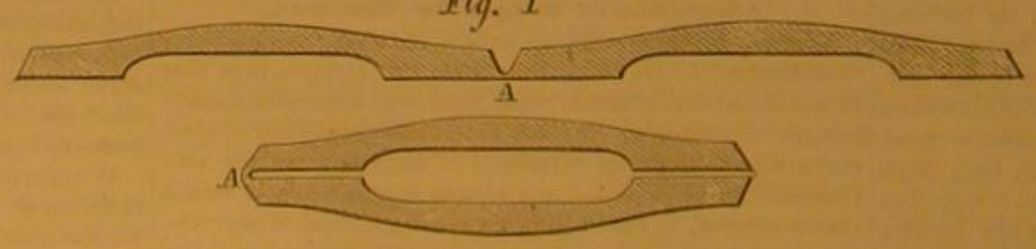
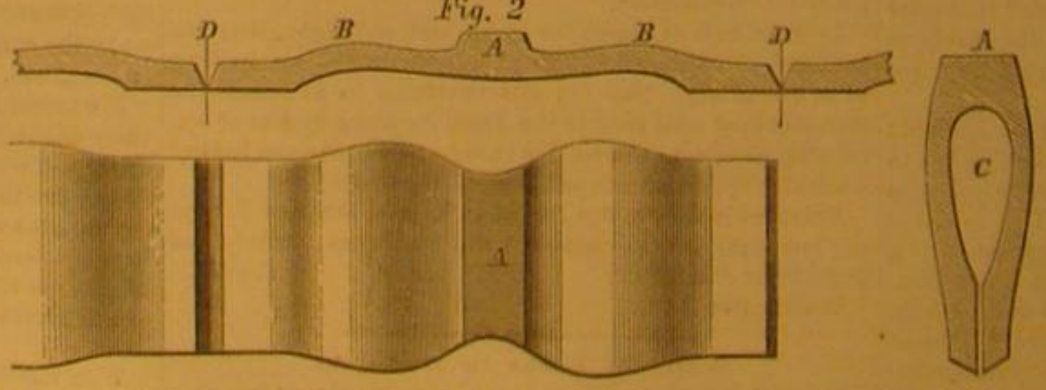


Fig. 2



JOPE'S NEW METHOD OF ROLLING AX BLANKS

The advantages of this method will be readily seen and appreciated by manufacturers of axes. Blanks thus formed can be readily bent into the form desired, will draw out more readily under the hammer, and are not liable to crack in the eye of the ax.

A common way of forming the blanks, is to take the ordinary sized bar, say 3 × ¾, or other suitable size, for the kind of ax required, and cut it into lengths of say 7 inches, so that the pieces to start with are 3 inches wide, 7 inches long, and ¾ of an inch thick.

These pieces are placed in a furnace and heated to nearly a welding heat. This heating is very irregular, causing the loss of many pieces in pressing and bending. The pieces are then taken from the furnace and one end placed between dies formed on rolls that revolve only half way round.

After pressing one end under the dies the piece is turned, and the other end pressed under, thus forming the ax blank. In this operation, the blanks are never made exact; they may run heavy or light on the edge which forms the eye, one side being thick and the other side thin. One end may be hotter than the other and therefore spread more when the pressure comes on it, so that when bent it necessitates more labor with the hammer.

Another method is to forge the blanks. There is also another way—"rolling them"—which has been patented. In this method the bars are welded into such a shape that when two pieces are cut or sawed off they form the ax blank. In this method two welds are required, and the fiber runs crosswise of the ax; while in the method of Mr. Jope there is a *solid poll, only one weld*, and the fiber runs *lengthwise*, as it should in all axes, so that in chopping wood or using the ax, the blow comes on the end of the fiber and not on the sides, thus weakening the ax. Moreover the iron can be rolled at a uniform heat, and every blank will be exactly like its fellow with each blank cut nearly, or altogether, off to the length required. Thus much time and labor will be saved in subsequent operations, and the blanks can be rolled out nearly at the same cost as ordinary bar iron, the saving in running machinery and in waste of material would seem to render this a valuable improvement.

Patented October 12, 1869, by G. W. Jope and Wm. Bunton, Pittsburgh, Pa.

Natural and Artificial Mechanism.

In every department of mechanics, working models have deceived the inventors. The laws that regulate motion differ widely from those that regulate chemical action. That which is true of an atom in its properties of combination, is true of any number of atoms—from the smallest experiment to one managed on the most extensive scale. The chemist in his laboratory, from his test tube and crucible, can give you the formula for any imaginable quantity. Not so with the machinist. His disturbing influences are not the atomic relations of the elements of his material. For construction, he has to use substances such as nature and art furnish, and subject these to the action of external forces which increase rapidly with their size and velocity. It is exceedingly difficult to estimate the amount of these forces; and as nature arranges the fibers of each plant, and machinery of each animal, after a different plan, to meet the forces that are opposed to it; so must the mechanic plan all his arrangements, from the smallest machine to the most stupendous engine, to harmonize with the laws of matter.

In whatever movement that is attempted in the animal construction, there is a concentration of forces directed through appropriate apparatus sufficient for the intended result. The nature of the force, its amount, and the magnitude of the result have such a relation to each other, and vary so much in different animals, that the instruments, by which the force is made effective, are necessarily varied in form and complexity In all their relations to the end, however, they are perfect.

When man attempts to construct a boat—which we will introduce as an example of adapting means to the end—and this boat is to be driven by forces developed within itself; and if along with capacity for freight he wishes to insure great speed, he experiments on various forms of hulls and kinds of propellers. Every line from cutwater to sternpost is duly considered. The parting of the water at the bow, and the closing at the stern, with all the varieties of displacement at different speeds, enter into the investigation. Calculations, running from the tub-shaped argosies of olden time down to the sharp models of the present day, are made with the greatest seeming accuracy. Paddle wheels and submerged propellers are next considered; and all the science of the scholar, and experience of the practical boatman, are brought to aid in the choice, and to determine the form. Tables of experiments are examined. With certain models results have been obtained, varying with the propeller used. Every particular of power, number of revolutions, weight carried, conditions of temperature, wind, and water, are noticed, and data obtained, it is supposed, that will warrant the construction of another boat of greater magnitude, with the same relative proportions from which results may be expected, corresponding with the increase of size. The boat is constructed, and falls far short of the anticipation. The proportions between the inertia of the water and model boat are not the same as between the water and the larger vessel; yet the latter is but the magnified counterpart of the former, with the disadvantage of available power not being equal to increase of weight. A small boat may be driven with great velocity, without its propellers scarcely making any wake in the water, after the manner of insects skipping over the surface of pools; for the resistance of the water is great, compared with the extent of surface of the moving body applied to it, and the weight to be overcome. A large vessel cannot carry such a proportionate extent of propelling surface, and here the calculations founded on the results of a model fail. If the amount called for by the enlarged plan were practicable, that is, if material were light enough, and sufficiently strong to carry it out, still there would be a disproportion in results. With the increased resistance of the water that must be rapidly displaced by an immense body urged with great velocity through it, and the water, to which the propeller is applied, being no more resisting for the larger boat than for the model, a velocity must be given to the propeller, to make the inertia of the water, on which it strikes, sufficient to overcome the resistance of the advance of the boat; and this to a degree proportionate to the speed to be attained. It will be seen at this view, that difficulties are to be encountered that make experiments on boat-models of less importance than is generally supposed. Although large steamers have made greater speed than small, the rate is far from being in direct proportion to size and power of engine. A very small boat, one that can be carried on a two-horse wagon—engine, boilers, and all—will easily make eight miles an hour. The *Great Eastern* cannot make three times that speed. Until the whole moving apparatus of one of these large vessels bears the same relation to its weight, and submerged size and power, that the tail and muscles do to the swiftest fish, rapid movements through the water by boats must be an imperfect attempt to rival the machinery of nature.—*Beecher's Magazine.*

A London chemist—Dr. Andrews—has announced a discovery which, if confirmed, is of the first importance, namely, that the gaseous and liquid state of matter are continuous. His experiments have chiefly been made upon carbonic acid, confined in fine glass tubes, and subjected to various pressures up to that of 110 atmospheres; they show that from carbonic acid as a perfect gas, to carbonic acid as a perfect liquid, the transition may be accomplished as a continuous process, and that the gas and liquid are only distinct stages of a long series of continuous physical changes.

Razor Paste.—Take putty powder 1 oz., oxalic acid ½ oz., and honey enough to mix with these so as to make a stiff paste. Apply it to the strop, and wrap the remainder in tin foil.

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NEW YORK, SATURDAY, MARCH 19, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

*The Pedespeed.....183
*Improved Fan Blower.....183
Visit to a Steel Manufactory.....184
Soft Solder Silver Plating.....184
Nickel Plating.....184
An Interesting Review of the American Patent System.....185
*Products of the Pine Forest.....186
*Woods' Saw-Gumming and Sharpening Machine.....187
*Snyder's Improved Turbine Wheel.....187
*Dyer's House Closet.....187
A Final Zoic Catastrophe.....188
*Chilling Cast Iron.....188
*Firing under Steam Boilers.....188
Liquid Fuel for Steam Engines.....188
Water as a Fulminate.....189
Running Locomotives a Mile per minute.....189
Waste of Labor in Building.....189
Absorption of Oxygen by Charcoal.....189
Hartford Steam Boiler Inspection and Insurance Co.....189
*Step Support for Mill Spindles.....190
*Improved Form of Ax Blank.....190
Natural and Artificial Mechanism.190
The Proposed Sale of the Yosemite Valley.....191
Co-operation among Inventors.....191
The Use of Salt in Agriculture.....191
Something about Gases.....191
New Mechanical Movements.....192
Proposed Plan for Publishing Patent Office Specifications and Drawings.....192
Editorial Summary.....192
Congress Extending Patents.....192
Applications for the Extension of Patents.....193
Answers to Correspondents.....193
Recent American and Foreign Patents.....192
Progress of American Inventions in Europe.....194
List of Patents.....194
Rotating and Fixed Turrets.....195
New Books and Publications.....196

PROPOSED SALE OF THE YOSEMITE VALLEY.

The proposition to sell a portion of the Yosemite valley to certain persons, as pre-emptors of the land, is again before Congress, and has been reported upon favorably by the committee appointed to consider the subject. As this valley belongs to the people of the United States, the question appears to be between two squatters and all the rest of the inhabitants as to who shall finally obtain control of the grandest scenery on the face of the earth. It is a matter of so much importance that we think proper to devote some attention to it, for the sake of entering an earnest protest against any sale or cession of the territory to private speculators.

The valley of Yosemite was discovered in 1851, by a party of white men hunting for stock which the Indians had stolen. They recovered a portion of the stolen property, and returned with marvelous accounts of the extraordinary scenery of the new region which they had found about midway between the summit and the base of the Sierra Nevada mountains. Notwithstanding the enticing character of these accounts very few persons ventured into the valley, on account of the difficulty of access, and the distance from any base of supplies.

Mr. Hutchings, one of the present claimants was one of the first to explore the place, and, in 1859, J. C. Lamon moved into the valley and settled on the land now claimed by him. According to all accounts Mr. Lamon appears to be a *bona fide* settler, entitled to compensation in case of removal. He has resided on his claim for more than ten years, and has been engaged in setting out fruit trees and raising vegetables, but has never kept an hotel or house of entertainment.

On the 13th of June, 1864, Congress passed a law by which the United States gave to the State of California the Yosemite Valley and the land within one mile of the walls thereof, and the Mariposa Grove of Big Trees, to be held in trust forever as a pleasure resort for the people of the United States. The State of California accepted the trust in the spirit in which it was given, and at once appointed Commissioners to make surveys and lay out suitable roads for the accommodation of visitors. Two of the Commissioners are well known in the East—they are Professor J. D. Whitney, the eminent geologist, and Mr. Frederick Law Olmsted, of the Central and Prospect Parks. These gentlemen made elaborate reports to the Legislature as to the work to be done and the proper way to begin it. Galen Clark, who lives near the valley, was appointed its guardian by the Commissioners, and all expenses were paid by the State. In 1864, while the bill ceding the valley to California was pending, Mr. Hutchings bought out some parties who had built rude huts, and has since put up a frame hotel, with accommodations for thirty guests. His claim is situated about half way up the valley, and extending entirely across it. The Commissioners tried to compromise with these claimants by giving them leases of the premises for ten years at a merely nominal rent. The offer was rejected, and suits of ejectment were commenced, but they have never been pushed to final judgment, as the parties were anxious to procure legislative interference. The whole question finally came before the California Legislature, and that body, in the most unaccountable manner, passed an act giving each claimant one hundred and sixty acres of land in the valley, providing the Congress of the United States would give its assent—such assent being necessary to a clear title. The Governor of the State, to his credit be it said, vetoed the bill, but the Legislature, renowned in the history of the State for its venality, re-enacted it over his veto; and in this manner the claimants find their way to Washington, and a desperate struggle will be made to confirm the spoliation so disreputably begun in the West.

The land was first surveyed in pursuance of the act ceding it to the State. No portion of it was ever declared open to preemption; all that the Government promises to squatters is, that, in case the land comes into market, actual settlers shall have the first claim to buy it. This land never was in the market, and it was never intended to sell any portion of it.

There is no doubt that Mr. Lamon, who went to the valley and tilled the soil as an actual settler, is entitled to compensation. All he at one time asked was $12,000, and $8,000 more would satisfy the claims of the other parties.

It would be infinitely better to pay the $20,000 and eject these persons than to give them the best portions of the valley, and thus open it to the entrance of the worst class of speculators, gamblers, and disreputable characters. What would the inhabitants of Europe say if the valley of Chamouni were offered for sale, or if the Zermatt and Monte Rosa were in the market? Doubtless the same that must be said of us if we permit the Yosemite to pass into private hands.

The Yosemite valley is said to afford the finest scenery known to man. It is only accessible at the lower end by two trails that abruptly descend 2,000 feet. The walls for six miles are nearly vertical, and in some places are a mile in hight, and are composed of pure white granite. But the crowning glory of the place is the Yosemite Fall, which in three leaps falls 2,634 feet. There is no water-fall in the world to compare with this. Other falls are, the Bridal Veil, 940 feet; Vernal, 350 feet; Nevada, 700 feet; and Royal Arch Fall, 1,800 feet. The valley is only a mile and a half wide at the broadest part, and in most places is less than half a mile. This adds to the apparent hight of the perpendicular walls on either side. If private individuals were to obtain control of all these wonders, the inconvenience to the public, and the impositions to which all travelers would be subjected, would be insupportable.

The original law of Congress granting the valley to the people of the United States as a pleasure ground for their use forever, was one of the most enlightened acts of legislation on record, and it would be better to stand by the original bill. If the State of California is weary of the trust, then let Commissioners be appointed by Congress, to whom shall be confided the important responsibility; under no circumstances and on no pretense, ought the property to pass into private hands.

CO-OPERATION AMONG INVENTORS.

We have recently had suggested to us by sanguine correspondents, that a grand coöperative scheme among inventors to establish a central bureau or college of invention would be of great public benefit. This institution would, according to the plan proposed, receive its endowment from contributions of inventors to furnish a building and apparatus, and remunerate a paid court of experts to test and decide upon the merits of inventions.

This scheme might perhaps seem at first sight to have some merit. It has, however, the great drawback that it is wholly impracticable.

The inducement relied upon to obtain contributions, is a future personal benefit to the contributor. This would not be sufficient unless the donor were guarateed, or supposed himself to be guaranteed the promised benefit. At best, the benefit would be contingent upon his making an invention of such doubtful value that he himself could not decide upon its merits; or that those engaged in the business or department of industry in which the improvement is proposed and to whom he can have access, are unable to decide. An invention, the value of which is so doubtful as this, can be safely said to have no value.

But supposing that every invention may possess more or less merit, and that each inventor could be guaranteed that upon sending a model or drawings and specifications to the "Inventors' Coöperative Central Bureau," an examination would be duly made, and a report with reasons for the decision arrived at duly forwarded to him; how few would accept such a decision as final, provided it was adverse?

In our own practice as Patent Solicitors, we often meet with men who, when we pronounce their devices neither new nor useful, are offended and straightway make application to some one less scrupulous, who encourages them to proceed, takes his fee, and does *not* get them a patent; or, if they get a patent, it is done by so cutting down claims as to render the patent not worth the paper upon which it is printed.

Commissioner Fisher, in his last report, says most truly, that inventors "are lacking in legal knowledge. They desire a cheap solicitor, and do not know how to choose a good one. They are pleased with the parchment and the seal, and are not themselves able to judge of the value or scope of the grant." Thus they fall into the hands of sharks, who, as Commissioner Fisher again says most forcibly, "are more desirous of obtaining a patent of any kind than one which will be of any value to their clients."

One of our correspondents has anticipated such an emergency, and suggests a higher court of experts, to whom appeals can be made, and whose judgment shall be final. But alas for the weakness of human judgment! Those not satisfied by the decision of an inferior court would not be any more satisfied with the opinion of the court of appeal, provided it should also decide adversely; and so discontent and murmuring would arise, and instead of the anticipated coöperation there would be breaking up into factions, each of which in its endeavor to get control of the institution would not hesitate to pull down a stone from its walls, until final ruin would wind up the entire concern. Moreover, this method of testing inventions would be, in the average, far more expensive than for each inventor to test his own invention in connection with those qualified to pass upon its merits; and it would be attended with such delays and annoyances as would render it at once and permanently unpopular.

The only way in which money can be obtained for a benevolent object without compromising success is as a free gift, with no contingent personal advantage pledged to the donor; and in most cases it is better that even all control over funds thus donated should pass from the givers and become vested in responsible trustees. In this way colleges and universities are endowed, and the great difference between such gifts and those by which the funds for the Inventors' Bureau are proposed to be obtained, is that they are free gifts for the good of others, not gifts contingent on some personal good to be subsequently received.

But while we deem this scheme of coöperation as utterly impracticable, there is a way in which inventors and mechanics may coöperate with universal benefit. This scheme is set forth in an article on page 345, Vol. XIX., in which we advocated the establishment of a national collection of new inventions, to be placed on view so that all who wish may examine and inform himself upon any point by the payment of a small fee. Such an institution would be of present and permanent value, and it might easily be established by a properly organized association of inventors.

THE USE OF SALT IN AGRICULTURE.

Whether common salt is of any value to plants, is still a mooted question, and one that finds advocates on both sides. The luxuriant growth of marsh meadow grass is taken as a proof that salt water must be favorable, and farmers attempt to imitate this state of things by putting salt on the grass without reflecting that all other conditions are omitted in the experiment. They are generally astonished to find that the grass is killed, instead of being promoted in its growth. It is a remarkable fact, that this same salt marsh grass, on analysis, is found to contain very little soda, but to have its full complement of potash. This would seem to indicate that it had grown in spite of the salt, rather than in consequence of it. According to some recent researches, made in France, potash is a hundred times more valuable to plants than soda. It is true, that small quantities of soda have been found in plants, but, generally, under circumstances that seem to point to its accidental rather than essential presence. Direct experiments have shown that salt is injurious to tobacco and to the sugar beet. An examination of the plants growing near salt springs and salt marshes, shows that the vegetation is of a limited and peculiar character. All of these observations point to the conclusion, that the direct use of salt, as an artificial fertilizer, is only applicable to such plants as grow on the sea shore, or near salt springs, and not at all to the usual grass and cereals of our farms. The whole system of manuring farms is based upon the principle to restore to the soil the constituents that are removed by the crops. As the crops carry away no soda, it follows that none is necessary to their growth. There is another objection to the use of common salt, and that is the chlorine contained in it. This element is decidedly injurious, as has been shown by the experiments of Wolf and others. Public opinion in Germany has set so strongly against the use of salt, that, in the famous mines of Stassfurt, where vast quantities of artificial fertilizers are manufactured, the exclusion of chloride of sodium, or common salt, is now considered necessary, and the value of a manure is made to depend upon its percentage of potash.

We have been led to make these observations after perusal of an able lecture on "Salt and its uses in Agriculture," by Professor Gossmann, of the Mass. Agricultural College. Dr. Gossmann concludes his remarks as follows: "The safest and cheapest way of supplying salt to your farm lands, if at all desirable, is to feed it to your live stock, for natural channels of distribution are always the best."

SOMETHING ABOUT GASES.

The most attenuated condition of matter known to man is that of a gas. It is true that there is supposed to exist a kind of matter pervading not only all the inter-planetary regions, but the inter-molecular spaces of all bodies, whether solid, liquid, or gaseous. The name given to this hypothetical state of matter is ether, and if its existence be granted, its tenuity is so great that it has no sensible weight. Its existence is only a matter of inference.

The satisfactory manner in which the hypothesis of the existence of such an ether accounts for the transmission of light and heat, has led to its very general adoption in modern works on physics; and there seems nothing improbable in the idea that there may be states of matter, the density of which, when compared to the lightest of known gases —hydrogen—should be even less than that of hydrogen, as compared with mercury, the heaviest fluid known to exist at ordinary temperatures.

Admitting this, does not, however, relieve us from the consideration of other difficulties pertaining to the hypothesis of an etherial inter-planetary medium. If such a medium exists, and if, as has been surmised, this medium be simply ordinary matter attenuated to such a degree as we have above described, it must possess the same physical properties as belong to gases.

Such inquiries are, however, speculative, and the object of the present article being to discuss in a popular manner some of the leading physical characteristics of gaseous bodies, we will turn our attention from hypotheses to demonstrated facts.

Gaseous bodies were formerly supposed to be of two kinds, permanently elastic gases and vapors, or such as were reducible, like steam, to the liquid form, by the loss of heat

and the increase of pressure. Professor Faraday, however in a series of magnificent experiments, proved that such a distinction had no foundation whatever. He not only liquefied but solidified many gases that had been deemed permanently elastic, and these experiments have been repeated and extended by other investigators, until the belief now obtains that no particular state, whether solid, liquid, or gaseous, is specific to any kind of matter, and that these states depend solely on the relations of the molecules of bodies to heat.

The converse of these experiments, that is, the changing of solids and liquids to a gaseous state, has been performed with nearly every known solid or liquid, and the colors which these gases impart to the blow-pipe flame, and the colors and positions of the peculiar lines or bars, formed by passing the light of such colored flames through a prism, and throwing the beam of refracted light upon a screen, have been found to indicate the nature of different substances with the utmost delicacy. This method of determining the presence of substances by the examination of the effect which the presence of their vapors produces upon the light emitted by burning alcohol, gas, solar light, etc., is called spectrum analysis; and the instrument employed in making such researches is called the spectroscope.

An entirely new department of chemistry has grown out of the extension of the use of the spectroscope to the examination of the light emitted by the heavenly bodies, and such examinations have led to the belief that the elementary substances as we know them by close examination in the chemical laboratory, are distributed throughout the universe.

One of the most prominent physical characteristics of gases, is their great elasticity. It is this property upon which the usefulness of steam as a motive power in a very great measure depends. In fact, gases and non-viscous liquids are the only perfectly elastic bodies.

The theory of the elasticity of gases is comprised in what is known as *Mariotte's Law*, which is "that in an elastic fluid subjected to compression, and kept at a constant temperature, the product of the pressure and the volume is a constant quantity;" or, in other words, the volume is inversely proportional to the pressure. This law does not, however, hold good for all pressures, nor for all gases. In those most difficult to liquefy, as oxygen, nitrogen, or their mixture in atmospheric air, etc., the law holds good, but in such gases as chlorine, steam, and others that can be liquefied under such pressure as can be practically brought to bear upon them, departures from the law are observable, increasing as the gases approach liquefaction. Such variations are, however, of little practical importance, and the law as enunciated is sufficient for all ordinary purposes of computation.

Another prominent characteristic of gaseous bodies is their affinity for water. Water absorbs all gases to a greater or less degree. The colder the water and the greater the pressure the more gas will be absorbed, and *vice versa*; but the volumes of different gases which water and other liquids will absorb, vary greatly. Gases are also absorbable by solids to a large extent, wood charcoal and animal charcoal being some of the most powerful solid absorbents.

But perhaps the most remarkable property of gases is that which gives rise to what is called diffusion. The heaviest gases when placed in contact with the lightest, do not remain separate like oil and water, but mingle and diffuse each through the other in defiance of gravity. This even takes place when the gases are separated by a porous diaphragm. A common experiment, illustrating this truth, is to fill a glass jar with carbonic acid and invert over it a jar filled with hydrogen, which is twenty-two times lighter than carbonic acid. In a very short time equal quantities of both gases will be found in each jar. This has led to the enunciation of the law that every gas comports itself toward every other gas as though it were a vacuum. Thus the presence of dry air in a vessel does not prevent, though it will somewhat retard the entrance of any other gas. As much of the latter will enter with the air present as would be the case if the air were exhausted.

Regnault was the first to prove that although the expansion of each gas is nearly equal for equal increments of heat when rising from different temperatures, all gases do not expand alike for a given increase of heat. We have said the expansion of each gas is nearly equal for equal increments of heat. For practical purposes this expansion may be considered as absolutely equal, as the differences are but slight, and only determinable by accurate experiment. The most important application of this law of expansion, is made in the steam engine, when steam is used expansively.

The distinction between vapors and gases has been, as we have said, virtually abandoned; but the term vapor is still commonly applied to such gases as are most readily reduced to the liquid state. Though it may seem to some an innovation to talk of steam as a gas, yet it is a gas, possessing the physical characteristics of all other gases, and must be considered as such to attain a perfect comprehension of its action as a motive power.

NEW MECHANICAL MOVEMENTS.

Perhaps no department of study is more improving to the inventive faculty than the study of mechanical movements—those minor machines which, combined, produce the various motions to be found in complicated machinery.

The mechanical powers, as they are called—*i.e.*, the lever, the inclined plane, the wedge, the screw, the wheel and axle, and the flexible band or rope—may properly be reduced to three—the lever, the inclined plane, and the band. For the wedge and screw are only modifications of the inclined plane, while the wheel and axle is a modification of the lever.

These three fundamental elements are therefore the basis of all mechanical movements, that is, combinations to produce certain movements of parts of machines. There are already a great number of these in use, and a still larger number which have never been much used, but there is little doubt that there are a great many more which are possible. The search for these gives rise to some of the most beautiful mechanical problems, as well as some of the most difficult. The solution of one of these was given on page 372, Vol. XVIII.

We propose now to enunciate a few such problems upon which our inventors may try their skill, premising that, as in the higher mathematics, the solution of a problem demonstrates its impossibility if it be impossible; so, if it can be satisfactorily shown that the problems here given are any of them impossible, that shall be considered as a proper solution.

Problem 1.—Required to convert the rotary motion of a pulley into a horizontal intermittent rectilinear motion, first in one direction and then in the opposite direction, without the use of a pitman, pulley, toothed wheel, cam, cam groove in a pulley, or a flexible band, the first rotary motion to be constant and uniform. In other words, let it be required to move a piece of metal, wood, or other material, to a certain point where it shall pause, and then again move on a certain distance and again pause, and so on successively as far as desired, when it shall return to the point from which it originally started in the same intermittent manner and under the conditions above specified.

Problem 2.—Required to produce a variable rotary motion in a shaft driven directly by a belt from a pulley having a uniform constant rotary motion, without the use of anything but the one belt and the two pulleys; no cone pulleys or their equivalent to be allowed. All the motions to be continuous and in the same direction.

Problem 3.—From a reciprocating body to communicate reciprocation to another body, so that the second shall make four reciprocating movements for every reciprocation of the first; the motions of these bodies to be in lines parallel to each other, and the pieces to be connected by only three moving parts, which parts shall be neither wheels nor pulleys of any kind, and no inclined planes, cams, belts, or flexible cords, cranks, or bell cranks, to be allowed, and no radial motion from a fixed center in any piece employed.

This will do for the present. Some of these problems are, perhaps, too difficult for a beginning, but they are all capable of solution. It is not at all improbable that the effort to solve them will lead to some useful inventions. The author of them made two useful applications of ideas suggested while attempting their solution.

The solutions offered may be given in simple diagrams accompanied with such description as may be necessary.

PROPOSED PLAN FOR PUBLISHING PATENT OFFICE SPECIFICATIONS AND DRAWINGS.

The speech of Mr. Jenckes, of Rhode Island, in the House of Representatives, on the 9th inst., in support of the House joint resolution providing for the publication of the specifications and drawings of the Patent Office, and the subsequent debate upon the subject, has placed the salient features of the plan in such a light that the public generally may comprehend its advantages.

It is proposed to abandon the publication and distribution of the annual reports as they are now published, and instead to place in the capital of every State, and in every city where a circuit Court of the United States is held, if it be not held in the capital, a complete record of the transactions of the Patent Office; the specifications in full and the drawings in full. Then the inventor has simply to take rail or boat, and visit the capital of his State, and he will have the same means of investigating what are the inventions of the country as if he came to Washington in person.

It is also proposed to furnish an equally perfect record to each public library in any part of the United States, which shall pay for its uniform binding and its transportation to the locality where the library is situated.

It is further intended to make this distribution weekly, so that the latest information relative to patents may be accessible to the entire country.

The disadvantages of the present system are great. It is confessedly expensive, incomplete, inaccurate, and inadequate to meet the needs of inventors.

The advantages of the new system are as obvious as the disadvantages of the old. The distribution being not a matter of favor, as now, the filed drawings and specifications will form a complete as well as an accurate and reliable record. Under the present system the distribution is very imperfect, so much so that complete sets of the reports since their publication in 1844, are rare outside of Government Departments, though not so much so as to justify Mr. Banks' statement in the debate referred to. Mr. Banks said that "Of all the million volumes that have been distributed, I do not believe that there is within the United States in the hands of any private citizen, unless he have some special Government advantages, a complete set of this encyclopedia of inventions. The chairman of the Committee on Printing tells me that there is not in the Patent Office itself, nor in the Library of Congress even, a complete set; and I do not believe that such a set exists in any one of the one hundred and four principal public libraries of the United States, which contain ten thousand volumes and upward. Now what a senseless practice is the distribution of this work, at a cost of $235,000 a year, when the value of it is greatly impaired by the manner in which it is distributed."

We have a complete set of these reports, and they are of great service to us. They are constantly sought by large numbers of persons interested, who daily visit our office to consult them. It is true; however, that only complete sets are of much assistance, and that the drawings are often so defective in their lettering as to mislead; and they are altogether too meager to give such information as will form a basis for accurate judgment.

It is claimed that the new system will decrease the expenses of the Patent Office for printing $100,000 per annum, and it will also reduce the expenses of those who now have to go to Washington to pursue their investigations by requiring them only to journey a short distance to obtain the necessary information.

It is thought this plan would increase the confidence of capitalists and make them more ready to invest in really new and useful inventions, as they would easily be able to verify the value of an invention, so far as novelty is an element of value.

By means of the art of photo-lithography the drawings can be reproduced of half the present regulation size at an estimated cost of one dollar and fifty cents per hundred, and although the bill, in its present form, provides only for the publication of specifications and drawings after the publication of the report of 1868, it is estimated that all the drawings and specifications issued prior to 1870 might be reproduced is 300 volumes at a cost of $200,000.

Mr. Jenckes performed an act of injustice in his speech toward honest and honorable patent solicitors, in making no distinction between them and such as do not identify themselves with the interests of their clients. No one knows better than Mr. Jenckes that this is unjust, and it is probable that his zeal in the support of his measure, betrayed him into an unguarded expression.

We heartily advocate the passage of this resolution; but we would have the plan extended to the publication of the specifications and drawings of all the patents which have been issued up to the present date; and it ought also to be amended so as to admit of the purchase at cost by such parties as are willing to pay for it in advance of publication. Many copies could thus be sold without increasing the cost to the Government, and a much wider circulation be given to them.

CONGRESS EXTENDING PATENTS.

In the House of Representatives on Friday, March 11, the following measures concerning patents were enacted:

Reports were made from the Committee on Patents by Mr. Jenckes adversely on the following applications:

For extension of patents of J. Carhart, of New York, and of Charles A. Pitcher, for the manufacture of brooms.

Bills were reported from the same committee allowing applications for the extension of patents as follows:

By Mr. Jenckes—Patent of Walter Hunt for the manufacture of paper collars. Passed.

By Mr. Calkin—Patent of Timothy D. Jackson for improved annunciator or bell-telegraph for hotels, etc. Passed.

By Mr. Myers—Patent of Thomas Thompson for improved machine for folding paper. Passed.

Also, patent of William Montstown for improvement in revolving fire-arms. Passed.

Also, patent of John Edgar for self-regulating wind wheels. Passed.

Also, patent of Tobias J. Kindleberger for improvement in cider mills. Passed.

By Mr. Calkin—Patent of John Young for improved washing and wringing machine. Passed.

By Mr. Johnson—Patent of Jonathan Haines, for harveste or header.

After discussion by Messrs. Johnson and Cullom in suppo of the bill, and by Mr. Tanner in opposition to it, the bill w passed.

By Mr. Jenckes—Patent of Augustus R. Moen for improvement in the construction of basement, cellar, conduit, and other like walls, so as to render them impervious to water. Passed.

Also, patent of Robert Burns Goodyear for improvement in power looms.

Pending its consideration the morning hour expired, and the bill went over to the morning hour next Friday.

If this kind of special legislation by Congress is to continue, the statues relating to extension of patents might as well be repealed. Of what use is it to absorb the time of the Commissioner, who knows what he is about, in the examination of applications for extension, when a successful appeal from his decision can be made to Congress through the aid of expert lobbymen, thus practically taking the power of granting or refusing extensions out of the Commissioner's hands? We have always opposed this sort of legislation.

To Clean Paint.—There is a very simple method to clean paint that has become dirty, and, if our housewives should adopt it, it would save them a great deal of trouble. Provide a plate with some of the best whiting to be had, and have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take as much whiting as will adhere to it, apply it to the painted surface, when a little rubbing will instantly remove any dirt or grease. After which wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned looks as well as when first laid on, without any injury to the most delicate colors. It is far better than using soap, and does not require more than half the time and labor.

Picture frames or frames for loooking-glasses may be easily coated with bronze by a thin plate of liquid quartz upon which a fine bronze powder is dusted.

Messrs. Geo. P. Rowell & Co.,
Advertising Agents, No. 40, Park Row, New York, are authorized to receive advertisements for this paper at our lowest rates.

APPLICATIONS FOR EXTENSION OF PATENTS.

CASE FOR SEWING MACHINES.—William O. Grover, of Boston, Mass., has applied for an extension of the above patent. Day of hearing May 11 1870.

MAKING MOLDS FOR CASTINGS.—Robert Jobson, of Wordsley, England, has applied for an extension of the above patent. Day of hearing May 11, 1870.

OPERATING STEAM STAMPS.—Adella E. Ball and Edwin P. Ball, of Chicopee, Mass., administrators of William Ball, deceased, have petitioned for an extension of the above patent. Day of hearing May 11, 1870.

REAPING MACHINE.—William C. Martin, administrator of Jacob J. Mann, deceased, and Henry F. Mann, of Pittsburgh, Pa., have petitioned for the extension of the above patent. Day of hearing May 18, 1870.

NAIL MACHINE.—Daniel Dodge, Keeseville, N. Y., has applied for an extension of the above patent. Day of hearing May 18, 1870.

REGISTERS AND VENTILATORS.—Edward A. Tuttle, of Brooklyn, N. Y., has petitioned for an extension of the above patent. Day of hearing May 25, 1870.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

H. B., of Ky.—You are right in attributing the cracks in your boiler to unequal expansion, and also in the opinion that the boiler is unsafe. You do not say where the feed-water is admitted, but judging from your description we infer that it is at the bottom. If so, it is wrong. It ought to be carried in at a point opposite the middle of the upright flues. The water space between the inside and outside shells of the fire-box is too contracted. Instead of five eighths of an inch space between these shells there should be three inches. You can alter the boiler to correct this error by taking out some of the flues, but of course you will thereby reduce your heating surface.

F. W. of N. Y.—There would have been no danger of explosion in the boiler of your steam heater if the water had gradually blown out of it under a pressure of 6 lbs. to the square inch; but it would under such circumstances be liable to injury from overheating, and so become weakened, and incapable of withstanding even that low pressure. You should be careful to regulate the draft so as not to get up more pressure than that of the head which supplies the feed water.

C. B., of Ky.—To find the area of induction pipe to steam engine cylinders, multiply the speed of piston in feet per minute by the square of the diameter of the cylinder in inches. Two one-hundredths of this product multiplied by 170, gives the area of cross section of the induction pipe in square inches. To find the inside diameter, divide the area of cross section by the decimal 0·7854, and extract the square roo of the quotient.

J. G. B., of Miss.—Variations in the temperature of the human body are strong indications of disease, either local or general. In a state of health the human body keeps about the same temperatnre under all circumstances. Even when a person feels very warm from violent exercise, the thermometer shows little change in the temperature of the blood, unless the functions of the body are disturbed.

S. C., of N. H.—We have investigated the matter of engines made with cylinders curved in the line of the bore, and find that to properly elucidate the subject it would be necessary to make engravings. The subject is not of sufficient importance to justify this. We understand the cylinders are bored by a tool sliding on curved ways, and driven by means of shafts with universal joints.

R. S., of Conn.—You will have no difficulty in keeping swans, if you have a small piece of water for them to swim in. Their food is the same as that of geese. They prefer to build their nests on a small secluded island, and such an island if it does not exist naturally is generally provided, and a small house for the young erected thereon.

W. R. B., of Ind.—There is no gas with which you could safely mingle a mixture of air and the vapor of gasoline to increase the light, unless, perhaps, it might be hydrogen. It has been claimed that hydrogen with gasoline vapor is better than air, but we have some doubts about it.

R. S., of Tenn.—Gallic acid and tannic acid are extracted from nut galls, barks, etc. They are very nearly alike in composition. Tannic acid is the principle contained in barks which acts upon the gelatin of raw hides to convert them into leather.

H. & G., of Pa.—We have already expressed our doubts of the safety of high pressure steam heating pipes, in contact with wood, and our belief in the safety of low steam pipes. We refer you to discussions on this subject in our last volume.

C. Q. E., of Wis.—You are right. There is nearly always a difference in the price of gold and silver coin in favor of the gold. That is, a ten-dollar greenback will buy, more nearly ten silver dollars than ten dollars in gold.

W. J. Lobach, of Ky., and others.—We republished the recipe for recutting files by acids just as we found it recorded. We know nothing about it that we have not already given, and we do not believe in its efficacy.

T. D., of N. Y.—The drawing of the steam hammer you send us is not clear, and as we are unacquainted with the device, we cannot explain it.

H. G., of Minn.—The blistering of the silver coating in the process of electro-plating, probably results from too great power of battery.

D. J. W., Jr., of S. C.—The best thing to prevent guns from rusting is olive oil. It is well to stop the muzzle with a cork, or wooden plug.

J. G. W., of Ind.—The discovery you have made is not new. We are unable to say who made the same observation first.

R. T., of Texas—There are probably twenty processes for preserving meat in use; to which do you refer?

C. G. F., of Texas.—We shall be glad to hear from you on the subject of "Wooden Railroads."

W. H. G., of N. J.—The crystals you send are garnets of an inferior kind, and of no value.

T. F. M., of Pa.—You will find an answer to your query in another column.

J. K. S., of W. Va.—The subject of small cotton presses has been sufficiently discussed for the present. Your communication contains nothing additional to what we have published.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

1250 lbs. portable platform scales, $25; hay scales, 4-tun, $75. Send for free price list, No. 373. Edward F. Jones, Binghamton, N. Y.

American Boiler Powder.—A safe, sure, and cheap remedy for scale. Send for circular to Am. B. P. Co., P. O. Box 315, Pittsburgh, Pa.

Physicians of every school wanted to engage in an easy and lucrative office practice. For particulars, address W. C. Coburn, M.D., 568 Main st., Buffalo, N. Y.

Those desiring excellent copies of old daguerreotypes, tintypes, or card pictures, can have them made to their satisfaction by sending to John A. Whipple, 297 Washington st., cor. Temple Place, Boston, Mass.

Automatic 10-spindle drill, 5,000 to 20,000 holes a day in castors, etc. Tin Presses & Dies for cans. Ferracute Machine Works, Bridgeton, N. J.

A No. 2 Smith's molding machine for sale—new and in good order. S. Hartshorn, 62 center st., New York.

Unparalleled opportunity for agents, canvassers, and all others desiring lucrative employment. For circular, address Chas. H. Nye & Co., Postoffice Box No. 441, Stamford, Conn.

Wanted—Machinery for a wagon and furniture factory. Address E. D. Jones, Jefferson, Texas.

A new kind of Waltham Watch, for railroad men, has just been introduced. It is described in Howard & Co.'s Price List. See advertisement on last page.

A Dickinson Engine Lathe for sale cheap—good as new. Address W. H. C. Dodd, 807 Broad st., Newark, N. J.

A Master Machinist of thorough and successful experience in designing and constructing work of the best class, will be ready to enter upon an engagement in May or June. Address, till April 1st, Box 298 Worcester, Mass.

Inventors of non-wasting hydrants send description and terms to John Gibson & Co., Plumbers, 7th and Main sts., Cincinnati, Ohio.

Wanted.—Brass Spinners address C. Ahrens & Co., 24 and 26 Webster st., Cincinnati, Ohio.

Pat. watch opener and key, 15c., 2 for 25c. E. M. Kimball, Toledo, Ohio.

Steam Engine and Boiler for sale cheap, 6-H. P. horizontal, nearly new. Address J. H. Cory, Elizabeth, N. J.

Second-hand lathes, planers, drills, and all kinds of tools for sale by Charles Place & Co., 60 Vesey st., New York.

Wanted—Second-hand Engine and Boiler, about 40-H. P. Address Otis W. Booth & Co., 111 Water st., New York,

Right For Sale.—Action and Reversion Water Wheel (self-governing). Will vent large or small volumes of water. Will retain its power under back water. Address William E. Hill, Erie, Pa.

Partner or Foreman Wanted—In a well-established steam wagon factory, at Kansas City, Mo. Address, with references, Oliver Case & Co.

Spools of all kinds, and spiral shade tassel molds made by H. H. Frary, Jonesville, Vt.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

Peck's patent drop press. For circulars, address the sole manufacturers, Milo Peck & Co., New Haven, Ct.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line

Kidder's Pastilles.—A sure relief for Asthma. Price 40 cents by mail. Stowell & Co., Charlestown, Mass.

Needles for all sewing machines at Bartlett's, 569 Broadway, N Y.

For tool making, buy 15-in. engine lathes with taper attachment, made by the Pratt & Whitney Company, Hartford, Conn.

Pat. paper for buildings, inside & out, C. J. Fay, Camden, N. J.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For first-quality new 14, 17, and 20-in. screw lathes, milling machines, and one-spindle drills, at small advance from cost, apply to Geo. S. Lincoln & Co., Hartford, Conn.

Hackle, Gill Pins, etc., at Bartlett's, 569 Broadway, New York.

"Winn's Portable Steam Brick Machine," makes more and better brick than any other machine in the world. Address Wright & Winn, Lock Haven, Pa.

Perforated Zinc and Sheet Iron for separators, smut machines grain dryers, tubular wells, malt kilns, etc. R. Aitchison & Co., Chicago

T. F. Randolph, Steam Model Works, Cincinnati, Ohio.

For the Best Upright Drill in the World, address Wm. M. Hawes & Co., Fall River, Mass.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

To Rent—East River water front, stores and vacant lots suitable for manufacturing or mercantile purposes, together or separate. Daniel W. Richards & Co., 92 Maiden st.

Portable Pumping or Hoisting Machinery to Hire for Coffer Dams, Wells, Sewers, etc. Wm. D. Andrews & Bro., 414 Water st., N. Y.

Two 60-Horse Locomotive Boilers, used 5 mos., $1,300 each. The machinery of two 500-tun iron propellers, in good order, for sale by Wm. D. Andrews & Bro., 414 Water st., New York.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

Keuffel & Esser, 71 Nassau st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

WATER WHEEL.—Samuel Martin, York, Pa.—This invention consists of certain improvements in turbine water wheels, tending to increase their efficiency.

EXPANSIBLE CORE FOR CASTING IRON, GLASS, ETC.—Anson Balding, Wheeling, W. Va.—This invention has for its object to enable the cores around which hollow articles are cast, to be contracted, after filling the mold, so as to facilitate the removal of the cores from within the casting.

DITCHER.—James Calliham, Baton Rouge, La.—This invention consists of an apparatus for digging a ditch and throwing up a levee at one and the same time; said apparatus being operated by steam engines, which it carries, and is drawn forward by a steam engine placed upon a separate truck, which carries a steam boiler for supplying all the engines with steam.

GLAZIER'S POINT DRIVER.—M. D. Converse, London, Ohio.—This invention relates to a semi-annular V-shaped chamber, in which the triangular points, used for setting glass, are placed, said chamber being shaped in conformity with the brads or points, and being combined with a feed spring that keeps the points at the spot where they are required for use, and with a slide and guide by and through which the points are driven, one by one, into the sash.

STUMP MACHINE.—J. Higgins, Friendship, N. Y.—This invention has for its object to furnish a simple and convenient machine for drawing stumps, and other purposes, where great weight is to be raised short distances.

COTTON-SEED PLANTER AND FERTILIZER DISTRIBUTOR.—Henry C. Harris, Fort Valley, Ga.—This invention has for its object to furnish a simple, convenient, reliable, and effective machine for planting cotton and other seed and for distributing guano and other fine fertilizers.

HAND CLOTHES WASHER.—Peter Falardo, Newark, N. J., and George H Snow, New Haven, Conn.—This invention has for its object to furnish a simple, convenient, and effective hand washing machine, with which the clothes will be washed by squeezing out the water from the clothes, which clothes are at once again wet by water from the machine.

WINDOW-SHADE HOLDER.—Edward J. Robinson, Syracuse, N. Y.—This invention has for its object to furnish an improved holder for that class of window shades that roll up from the bottom, which shall be simple in con, tion and convenient and effective in use, holding the shade securely in any position into which it may be adjusted.

CLOTHES WASHER.—Rev. F. M. English, Evansville, Ind.—This inven tion has for its object to furnish an improved machine, which shall be so constructed as to wash the clothes and heat the water in which they are washed, which will do its work thoroughly and well, and without injury to even the most delicate fabrics, and which may be used with equal facility for various other purposes.

SADDLE-GIRTHING ATTACHMENT.—Eugene Spedden, Astoria, Oregon.—This invention relates to improvements in appliances for girthing saddles to horses and other animals. It consists of the combination with the saddle and the girth, of a set of pulley blocks, cord, and cord-holding clamp, under such arrangements that the rider may increase or diminish the tension of the girth, while in the saddle, and accomplish the same more easily than in the common way, by reason of the advantage due to the use of the pulley blocks and cord. The adjustment may also be made while on the ground equally as well.

FERTILIZER SOWER.—T. J. West, Alfred Center, N. Y.—This invention relates to improvements in machines for sowing plaster, lime, ashes, manure, and all other fertilizing substances, and consists in an arrangement, on an axle, mounted on wheels, and provided with a tongue or other means for hitching horses, of a long V-shaped trough, with a longitudinal opening at the bottom, and having one side arranged on pivots to be oscillated for widening or narrowing the opening, in which trough is placed a reciprocating rod, actuated by cams on one of the wheels, and provided with pointed or saw-tooth-shaped agitators, propelling downward through the discharge opening, and provided with flanges, projecting from the sides, by which the lumps and clods of the fertilizing substance will be pulverized and caused to feed uniformly through the discharge opening.

BLANK BOOK.—George H. Reynolds, New York city.—This invention relates to a new method of binding blank books, and all other books which are to be used for a considerable length of time, and in which great strength and durability are the chief objects. The invention consists more particularly in a novel system of arranging an endless upright string for holding the strapping to the back of the book, and in the manner of disposing such string. The invention also consists in the use of transverse strings, which are applied to the outside of the strapping and interwoven with the afore-mentioned upright strings.

RATCHET AND PAWL.—John H. Durran, Aurora, Ill.—The object of this invention is to prevent the end of a pawl from working on the edge of a ratchet wheel, and from thereby wearing off the contiguous surfaces, while the pawl slips or works loose on the ratchet. The invention consists in providing the pawl with spring clamps by which it is held away from the edge of the ratchet wheel, so as not to wear the same.

STOVES AND GRATES.—E. C. Loud, Springfield, Mass.—This invention has for its object to so construct those stoves which have pivoted grates, that the swinging sides of the grates will be opposite to concave surfaces, so that the grate can be considerably agitated to disturb the fuel, without danger of dropping any coal into the ash box, and without danger of wedging coals or cinders between the edge of the grate and the stove frame.

SCROLL SAWING MACHINE.—G. M. Nickason, Ellenville, N. Y.—This invention relates to a new arrangement of a sliding frame for all kinds of reciprocating saws, so that the stroke allowed to the saw will be regulated by the thickness of the stuff to be sawed, to prevent useless waste of power. The invention also relates to a new application of adjustable spring power, for drawing the saw up, after each stroke.

COMBINATION TEAKETTLE.—G. Landrine, Jersey City, N. J.—This invention relates to a new and useful improvement in culinary utensils, and consists in combining with an ordinary teakettle a boiler and a steamer.

VEGETABLE CUTTER AND PEELER.—George Lutz, John Schalthels, and Michael Florentin, Newark, N. J.—This invention relates to a new vegetable cutter of that kind on which the articles are cut into long, narrow strips, and has for its object to provide an automatic peeling attachment and devices for adjusting the width and thickness of the strips cut.

HALTER.—Wm. M. Harris, Dixon, Ill.—This invention relates to improvements in halters for horses and other animals, and consists in connecting the tie strap to a ring suspended in a bight of the throat strap, and passing it through another ring in the bight of the lower nose strap, to slide freely in the latter ring, and in passing the bights or loops of both these straps through other rings before attaching the tie strap ring to them, the said rings being connected by a strap extending from the nose strap to the throat strap, under the center of the lower jaw; the said arrangement is designed to apply the restraining force of the tie strap on the nose, the throat, and top of the head, in a way to confine the head in a cramped position, calculated to temporarily disable the animal, when making efforts to escape.

PRESS FOR HAY, COTTON, AND OTHER SUBSTANCES.—Samuel Miller Mount Union, Pa.—This invention consists in double ratchet vertical hoisting bar applied to a press, which is operated by means of a lever and pawls, upon a rocking block.

FELTS.—Simon P. Siver, Danbury Ct.—This invention relates to improvements in felts for the manufacture of hats and other articles, and consists of an improved mode of producing felts with plain grounds, spotted with pieces of felt worked into the ground and differing from the same in color, to impart ornamental surfaces of variagated colors, of more permanence than when stamped on.

BARBERS' CHAIR.—Anthony Abel, New York city.—This invention relates to a new and useful improvement in the mode of raising and lowering the backs of barbers' and other chairs, whereby the adjustment as to hight is made in the most gentle and perfect manner.

ROCKING-HORSE.—Jesse A. Crandall, Brooklyn, N. Y.—This invention relates to a new rocking-horse, which is operated by means of springs concealed within the body, and by levers connecting the said springs with the pivoted supporting standards, or legs.

SAW GRINDING MACHINE.—George Walker, Middletown, N. Y.—This invention relates to improvements in machines for grinding long saws, and consists in an improved arrangement of apparatus for holding the saws while grinding, from springing under the action of the stone and the pusher or feeder. It also consists in an improved arrangement of the presser, for adjusting the plates to grind thinner towards the back; and it also consists in an improved automatic belt shifting apparatus.

CHURNS.—Floyd Hamblin, Madrid Springs, N. Y.—This invention relates to improvements in churns, and consists in the arrangement on a horizontal shaft, within a suitable case, of two or more rows of scoops or cup-shaped paddles in spiral lines in opposite directions around the shaft, and in connection therewith, a series of parallel cream-breaking bars, around the space above the paddles, against which bars the cream taken up by the paddles, will be thrown with sufficient violence to break the small particles, whereby the formation of the butter will be accelerated. The object of the scoop or cup form of the paddles is, besides the advantage of the greater agitation they impart, to force the air into the cream in a greater measure, which is found in practice to be the case. And the object of the arrangement of the spiral lines in opposite directions is to impart a forcible movement of the cream from end to end of the churn, at the same time that the agitation due to the movement in the direction of the rotation is going on.

MILL STONE DRESS.—G. W. Loy, Nacogdoches, Texas.—This invention relates to improvements in mill stone dress, and has for its object to provide an arrangement of the furrows calculated to give greater draft in the bed stone from the center, about one third the distance to the skirt where, in the dress as commonly arranged, it is less than in the remaining portion, in which latter part are arranged the long furrows tangential or nearly so, to the eye of the stone, the direction from the said eye being opposed to the direction of motion of the running stone. The invention also comprises several modifications of the furrows and lands for adaptation to stones of different sizes, and for grinding different kinds of grain; also certain modifications of the furrows adapted for the bed stone when used as the runner. The upper stone is provided with a curved dress possessing some of the characteristics of the dress of the bed stone.

FAUCET.—Francis M. Bachman and Samuel Ricker, Fredericksburgh, Pa.—This invention has for its object to furnish an improved faucet, which shall be so constructed that it will entirely prevent leakage through it, and will enable the cask to be easily and quickly tapped without the loss of any of the liquid however great may be its pressure.

PROCESS FOR BLEACHING PAPER STOCK AND OTHER SIMILAR SUBSTANCES.—J. W. Goodwin, Petersburgh, Va.—The nature of this invention relates to improvements in bleaching paper stock, the object of which is to provide a means for accomplishing the same more quickly, in a better manner, and at less expense than can be done by the means at present in use. It consists in first submitting the substance to be bleached to the action of dilute nitric acid, well heated; second, boiling it in alkali in an open vessel; and finally submitting it to a bath of chloride of lime and sulphuric acid.

FLUE FOR DRY HOUSES.—Wiley B. Hix, Rome, Ga.—This invention has for its object to furnish an improved flue for use in a dry house for drying fruits, vegetables, lumber, and other substances, which shall be simple in construction and effective in operation, allowing the heat to be regulated and controlled at will.

POLE-ASCENDING APPARATUS.—George Fleming, New York city.—This invention relates to improvements in apparatus for ascending telegraph and other poles, and consists in an arrangement of rigging for hoisting masts up by the side of the poles, on the top of which masts are carried pulleys and cords, the latter hanging to the ground by which cords with pulley blocks are swung over the arms of the poles, through which pulley blocks the cords of platform are rove by which a person may be drawn up. The invention also consists in an improved rigging for attaching to the top of the pole for suspending the pulley for the platform for use when the pole has no arm at the top over which the cord can be swung.

TIRE UPSETTING MACHINE.—P. G. Ayres, Lindsay, Canada West.—This invention relates to improvements in machines for upsetting tire and metal bars, and has for its object to provide a simple and efficient apparatus, especially adapted for readily applying and removing the tires. The invention comprises a main bed of cast metal with a vertical fixed pillar, a sliding bed with another pillar, a pair of clamping dogs, a pair of supporting links for the pivots of the dogs, and an eccentric operating lever.

FLAT-IRON HEATER.—G. O. Honks, Addison, Vt.—This invention relates to a new and useful improvement in the mode of heating flat or smoothing irons for ironing clothes, and consists in a rectangular-shaped box open at the bottom side with apertures for the admission of the flat irons, and with shutters for each arranged in a convenient manner.

CAR COUPLING.—Wm. J. Evans, Homer, Iowa.—This invention relates to new and useful improvements in car couplings, whereby a simple and efficient device may be obtained by which the cars may be coupled self-setting-ly when the said device has been properly set. The invention consists in the arrangement, with a coupling pin, having a vertical guide, of a hinged setting lever, for holding the pin above the opening for the link and for being tripped by the link to let the pin fall when the link has passed in. Also in an arrangement with the same of a balancing tongue to hold the links in a horizontal position so as to enter the mouth of the drawhead of an approaching car.

CAR WHEELS.—John N. Farrar, Pepperell, Mass.—This invention has for its object to furnish an improved wheel for steam and horse cars, engines, etc., which shall be strong and durable, and, at the same time, so constructed as to avoid the constant jarring and noise now attending railway traveling, and reducing the liability of accidents from breaking of wheels, etc., and also in a great degree preventing the battering of the ends of the rails by constant hammering of the car wheels.

BALANCED WATER ELEVATOR.—William L. Thomas, Wadsworth, Ohio.—This invention relates to a new and useful improvement in apparatus for elevating water, to be operated either by hand or other motive power, by means of which water may be elevated to any required hight, while the action of the working piston will be balanced.

PROGRESS OF AMERICAN INVENTION IN EUROPE.

The following Patents for American Inventions have recently been obtained in England through the Scientific American Patent Agency.

WATER AND GAS METER.—Joshua Mason, Paterson, N. J.—This meter consists of a cylinder provided with a plunger, and having a chamber at one end in which there is a valve chamber, containing a sliding valve, which consists of a rod with two circular disks or heads upon it, and a circular plate at one end. This plate is perforated to open communication between the valve chamber and the small chamber. The valve chamber is open at both ends and provided with three ports, communicating respectively with the supply pipe, the water passage to rear end of the cylinder and the discharge pipe. Two rods, parallel with each other, are attached to the plunger, and pass loosely through flanges or bent ends of two plates connected by a pin or pivot to one end of a rod which passes loosely through the valve, and has a head on its outer end. A toothed segment is suspended within the cylinder and gears into a pinion, through which motion is transmitted to a registering apparatus. When the inlet part is open the water passes alternately into the rear end of the cylinder, and behind the plunger, as the valve is changed by the action of a spring.

MANUFACTURE OF BAR IRON, AND MACHINERY FOR ROLLING THE SAME INTO VARIOUS FORMS.—James Montgomery, New York city.—The material is prepared for drawing down by composing the uppper or inner side of the bar of any good quality and any required thickness of homogeneous iron, to give strength and to admit punching of the nail holes of horseshoes. For the lower or entire portion of the bar a hard quality of iron is used, to render horseshoes more durable. This quality of iron is produced by arresting the process of puddling at that stage which leaves the product of a hard, granular character. A bar of this hard iron and one of tough quality are piled together, heated and welded by rolling. These bars are then drawn out and formed into blanks for horseshoes by suitable machinery. Faggots for axles are formed by placing in contact the ends of bars of iron and steel, around mandrels, and supporting their central portions at some distance asunder by means of I-shaped bars. One end may then be heated and rolled, or both ends may be heated simultaneously and completed in a single rolling. The rolling mill has an engine at each end, with a fly wheel having a hollow shaft through which air is forced to keep the journals cool, and otherwise of peculiar construction. Rotation is imparted to the rolls from the fly-wheel shafts by belts and pulleys, one of which is fixed to the fly-wheel shaft and the other to one of the rolls. The rolls are geared together as usual. At each end of the mill a driving belt passes loosely around the pulleys, and only communicates motion when tightened by a steam piston tightening device. One engine may be employed to drive the rolls one way, and the other to give them reverse motion. The dies employed are removable and adjustable so that they may be made of any suitable shape to point or head spikes, etc., and so that they may be readily reshaped and repaired. Suitably formed dies produce railway or other spikes at one operation.

FAN BLOWER.—Patrick Clark and J. R. Shotwell, Rahway, N. J.—This invention is fully described and illustrated in another column of this issue.

JOINT FOR RAILROAD RAIL.—Joseph Adams, Fairhaven, Vt.—In the neck of the ordinary T-rail a tongued or grooved joint is formed, and this joint extends extends entirely through the neck. A stay of any desired length is made to fit into the neck of the rail, and a supplementary rail is added to the other side, the lower portion of which fits into the neck of the rail like the former, but its upper portion extends up and around the outside of the rail, and its upper edge is sufficiently elevated, to take the tread of the wheels of the locomotive, cars, or trucks so that the ends of the rails will be, in a measure, relieved from pressure, and the wear and disagreeable jolt occasioned by the striking of the ends of the wheels against the the ends of the rails will be avoided. The stay and the short rail are firmly bolted to the rail by bolts which pass through slots so as to allow for the expansion and contraction of the rail.

ESCAPE VALVE FOR STEAM BOILERS.—Jas. C. Cochrane, Rochester, N. Y.—This invention consists of a hollow metal cylinder, with a valve seat in the head thereof, communicating with a tube extending to the bottom of the boiler. A valve is placed in this cylinder, and consists of a metal spindle and piston—preferably made hollow—and on the spindle above the piston is a projecting bulb or cone. The lower end of the spindle is made to fit easily into the tube, so as not to prevent the flow of water or steam. When the cylinder extends above the boiler, a cap is placed over it and firmly fixed to the head of the boiler. In the top of this cap is an aperture to match the bulb of the spindle, so that when the piston is pressed up, the bulb will enter and fill the aperture, and the valve is then closed. The head of the cylinder is made tight with packing, so that no steam can pass except through the tube. The lower part of this tube is made funnel-shaped, and pierced with holes up to low-water mark. This tube may be made shorter so as only to reach down to low-water mark, and then no holes would be pierced in the sides of the tube. When the water in the boiler is above low-water mark the pressure of the steam will cause the water to rise into the valve chamber and close the valve, and *vice versa*. A whistle may be used if desired.

LEVER ESCAPMENT FOR WATCHES.—Julius Hietel, John W. Hietel, and John L. Geissler, Philadelphia, Pa.—This invention consists in constructing the lever of a watch escapment of two arms, which are connected at their outer ends by a spring, and fitting it around the staff, which has a groove formed in it for the reception of the short arm. The application and arrangement of this self-regulating spring lever will, when the watch is shaken, allow the ruby pin to pass, and will therefore permit the balance to turn freely under the influence of such shock or motion so as to prevent the breaking of the ruby pin or pivots, frequent in ordinary lever escapements, and at the same time it avoids the complication of the chronometer escapement.

PUDDLING IRON.—Charles Hewitt, Trenton, N. J., assignor to A. S. Hewitt, New York city.—This process consists in mixing cast iron divided into coarse granules, varying from one fifth of an inch in bulk, with oxide of iron, then melting, stirring, and boiling them together. The process is completed by boiling the iron, thus obtained in a puddling furnace.

LIQUID METER.—James P. Smith, Cleveland, Ohio.—This invention consists in the combination of a conical and needle valve, and their adaptation to the ingress and egress pipes of a liquid meter. The liquid enters the body of the meter through a pipe projecting into the body of the meter, larger than the egress pipe, so that the body of the meter is kept full of liquid under pressure. A cone is placed in the inner end of the ingress pipe, the stem of which passes through guides to secure vertical motion. To this valve is attached an arm carrying a needle valve, slightly tapered, which enters a small pipe, so that however much or little the inner end of the ingress pipe may be opened by the inward pressure of the water, the mouth of the small pipe will be opened in exactly the same ratio; and the amount of water entering the ingress pipe is exactly proportional to the amount escaping from the mouth of the small pipe. By measuring the latter, the amount discharged by the former is determined.

REVERSIBLE PARASOL.—Joseph E. Banks, New York city.—This invention consists in so arranging the ribs, stretchers, and cover of a parasol that when spread the ribs will project at right angles from the stalk, forming a flat top with central conical extension above or below the flat part. The stretchers and ribs are connected with two runners, by either of which the frame may be spread, one being connected to the stalk near the top, and the other below. The lower one is most convenient for this purpose, the upper one being fixed by a spring or other device. The frame, or parachute may be closed by moving the runners in either direction on the stalk. The spring catches are arranged to facilitate the movements of the runners over them in either direction. The frame, with its runners, is reversible, so that the central conical projection of the cover which was upwards will be downwards when the parasol is opened.

DRILLING APPARATUS.—Samuel Lewis and William McFarland, Brooklyn, N. Y.—This invention is fully described and illustrated on page 385, Vol. XX., of the SCIENTIFIC AMERICAN.

ACTUATING SHIPS' PUMPS.—Almon Koff, Southport, Conn.—This invention was fully described and illustrated on page 20, Vol. XXI., of the SCIENTIFIC AMERICAN.

GUN LOCKS.—Randal D. Hay and James M. Hill, Crooked Creek, N. C.—A hollow case or guard is hinged to the side of the lock, so that when closed up against the side of the lock, the top will project over the nipple. This guard is moved out of the way of the hammer, in discharging the gun, by a lever, bell-crank, and link, actuated by the trigger, so as to throw the guard out of the way of the trigger. Springs throw the guard back again after the hammer is raised, and the gun is thus prevented from being accidentally discharged.

FRICTION MATCHES, AND MATCH BOXES FOR HOLDING THE SAME.—Wm. H. Rogers, New York city.—These matches are made by combining any of the ordinary friction match compositions with gutta percha, or caoutchouc, which makes a flexible match cord. The second part of the invention is a metallic case like a pencil case, to contain the flexible match, out of which it is slid as wanted. This case is also provided with a cap to extinguish the match, when it is no longer wished to keep it ignited.

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Issued by the United States Patent Office.

FOR THE WEEK ENDING March 8, 1870.

Reported Officially for the Scientific American.

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Patent Solicitors, No. 37 Park Row, New York

100,487.—BARBER'S CHAIR.—Anthony Abel (assignor to himself and Adam Schwab), New York city.

100,488.—TIRE-UPSETTING MACHINE.—P. J. Ayres, Lydon, N. Y.

100,489.—FAUCET.—F. M. Bachman and Samuel Ricker, Fredericksburg, Pa.

100,490.—BOOT-LASTER.—Lewis Barnett (assignor to himself and J. D. Boal), Leechburg, Pa.

100,491.—BED BOTTOM.—Wm. Bowen, Dayton, Mich. Antedated March 1, 1870.

100,492.—COFFEE-CLEANING MACHINE.—J. W. Brady (assignor to M. W. Brady), Catonsville, Md.

100,493.—COFFEE-CLEANING MACHINE.—J. W. Brady (assignor to M. W. Brady), Baltimore, Md.

100,494.—PRINTING PRESS.—James M. Brownson, Brooklyn, N. Y.

100,495.—CORN PLANTER.—S. B. Buck, Elyria, Ohio.

100,496.—FRUIT JAR.—Ira Buckman, Jr., Williamsburgh, N. Y.

100,497.—DESULPHURIZING ORES.—Elizabeth A. Burns, Meadow Lake, Cal.

100,498.—CRIMPING MACHINE.—Wm. Butterfield (assignor to himself and T. E. Roberts), Boston, Mass.

100,499.—CULTIVATOR.—Horace Carr, Wooster, Ohio.

100,500.—CULTIVATOR.—Horace Carr, Wooster, Ohio.

100,501.—CULTIVATOR.—Horace Carr, Wooster, Ohio.

100,502.—MORTISING MACHINE.—F. G. Chapman, Chicago, Ill.

100,503.—MACHINE FOR POLISHING WOOD.—F. G. Chapman (assignor to Dennis Beach), Chicago, Ill.

100,504.—BRACELET.—D. D. Codding, North Attleborough, Mass.

100,505.—SASH BOLT.—J. C. Cooke, Bridgeport, assignor to De Witt C. Sage, Middletown, Conn.

100,506.—PAPER CUTTING MACHINE.—A. W. Currier, Grand Rapids, Mich.

100,507.—SLATE FRAME.—Charles B. Dickinson, New York city.

100,508.—SCHOOL DESK AND SEAT.—J. D. Diffenderfer, Lewisburg, Pa.

100,509.—STOP FOR BILLIARD WIRES.—E. O. Dow, Chicago, Ill.

100,510.—RATCHET AND PAWL.—J. H. Durran, Aurora, Ill., assignor to himself and Wm. Lombard, Brooklyn, N. Y. Antedated Feb. 26, 1870.

100,511.—WATCH REGULATOR.—Julius Elson, Boston, Mass.

100,512.—STEAM AND WATER SEPARATOR FOR STEAM ENGINES.—C. E. Emery, Brooklyn, N. Y. Antedated Feb. 18, 1870.

100,513.—WASHING MACHINE.—F. M. English, Evansville, Ind.

100,514.—GUN CARRIAGE.—John Ericsson, New York city.

100,515.—RAILWAY CAR COUPLING.—W. J. Evans (assignor to himself and Charles Warner), Homer, Iowa.

100,516.—MEDICAL COMPOUND OR OINTMENT.—G. D. Field, New Orleans, La.

100,517.—WINE AND CIDER MILLS.—W. K. Foltz and W. A. McCool, Ashland, Ohio.

100,518.—HORSE HAY FORK.—R. S. Frame, Washington, Ohio. Antedated Dec. 31, 1869.

100,519.—HIDE MILL.—J. P. Friend, Peabody, and B. R. Annable, Salem, Mass.

100,520.—TANNING.—A. D. Fullmer, Buffalo, N. Y.

100,521.—DIE FOR FORMING SHOVELS.—H. O. Ganyard (assignor to Ami Hills), Rochester, N. Y.

100,522.—HANDLE OF FOLDING UMBRELLA.—Louis Gehlen, New York city.

100,523.—PROCESS OF PULPING AND BLEACHING PAPER STOCK.—J. W. Goodwin, Petersburg, Va. Antedated Feb. 26, 1870.

100,524.—BEEHIVE.—Henry Grems, Westmoreland, N. Y.

100,525.—SADIRON HEATER.—Gordon O. Honks, Addison, Vt.

100,526.—COTTON SEED PLANTER AND FERTILIZER DISTRIBUTER.—H. C. Harris, Fort Valley, Ga.

100,527.—ICE CHAMBER FOR REFRIGERATOR.—J. W. Hazlett, New York city.

100,528.—EVAPORATING SALT BRINES AND OTHER LIQUIDS.—Jacob Heim, New York city.

100,529.—STUMP EXTRACTOR.—Johnson Higgins, Friendship, N. Y.

100,530.—FLUE FOR DRY-HOUSE.—W. B. Hix, Rome, Ga. Antedated March 2, 1870.

100,531.—STEAM GENERATOR.—G. P. Hunt, United States Navy.

100,532.—GRAIN AND STRAW-CARRYING ATTACHMENT FOR SEPARATORS.—Byron Jackson and B. F. Jackson, Woodland, Cal.

100,533.—LAMP SHADE.—W. H. Johnson, Springfield, Mass.

100,534.—CARBURETING AIR.—Charles Lawrence, Cincinnati, Ohio.

100,535.—CORRUGATIONS OF BOOT AND SHOE UPPERS.—Wm. Lee, New Haven, Conn. Antedated Feb. 26, 1870.

100,536.—STOVE GRATE.—Erastus C. Loud, Springfield, Mass.

100,537.—MILLSTONE DRESS.—G. W. Loy, Nacogdoches, Texas.

100,538.—WIND-WHEEL.—Charles Mahler, San Francisco, Cal.

100,539.—BASE BURNING FIREPLACE HEATER.—John Martine, Philadelphia, Pa.

100,540.—COMPOUND FOR THE MANUFACTURE OF WAX FLOWERS.—Mary Jane McColl, Chicago, Ill.

100,541.—BEVEL-JAWED VISE.—Austin Z. Mason (assignor to R. B. Robins), Adrian, Mich.

100,542.—INSTRUMENT FOR COUPLING RAILWAY CARS.—Abner McOmber and Mina Ward, Schenectady, N. Y.

100,543.—RAILROAD CAR HEATER.—William Meller (assignor to himself and Joseph Sutton), McKeesport, Pa.

100,544.—COFFEEPOT.—Sante Mento, Alliance, Ohio.

100,545.—MEAT-POUNDER BLOCK AND CHOPPING BOWL.—G. B. Mill, Buffalo, N. Y.

100,546.—PRESS FOR HAY, COTTON, ETC.—Samuel Miller, Mount Union, Pa.

100,547.—REVOLVING HARROW.—H. H. Monroe, Thomaston, Me.

100,548.—PREPARING BUTTON-HOLE TWIST.—Robert Morrison, Yonkers, N. Y.

100,549.—LIGHTNING ROD.—David Munson, Indianapolis, Ind.

100,550.—DAMPER ACTION FOR UPRIGHT PIANO-FORTES.—G. W. Neill (assignor to Chickering & Sons), Boston, Mass.

100,551.—SCROLL SAW.—Governeur M. Nickason, Ellenville, N. Y.

100,552.—FANNING MILL AND GRAIN SEPARATOR.—Harrison Ogborn, Richmond, Ind.

100,553.—PURIFYING ACETIC ACID.—T. L. Olden, Brooklyn, N. Y.
100,554.—WOOD PAVEMENT.—A. Warner Platt, New York city.
100,555.—GRAIN DRILL.—Hiram Pulse, Waldron, Ind.
100,556.—LOCK.—Daniel B. Read and J. H. Clapp, Providence, R. I., assignors, by mesne assignments, to C. C. Dickerman, Boston, Mass.
100,557.—STOVE-PIPE DRUM.—Edmund D. Roberts, Hartford, Conn.
100,558.—WINDOW-SHADE HOLDER.—E. J. Robinson, Syracuse, N. Y.
100,559.—GASOMETER.—Thomas F. Rowland, Green Point, N. Y.
100,560.—SLED BRAKE.—G. W. Sanborn (assignor to J. W. Sanborn), Gilmanton, N. H.
100,561.—SELF-CLOSING FAUCET.—Carl Schultz and Thomas Warker, New York city. Antedated February 21, 1870.
100,562.—CALKERS' MALLET.—Samuel C. Searles, Wilmington, Del.
100,563.—FELTED FABRIC.—S. P. Siver, Danbury, Conn.
100,564.—TOY MONEY BOX.—F. W. Smith., Jr., Bridgeport, Conn.
100,565.—RIDING SADDLE.—Eugene Spedden, Astoria, Oregon.
100,566.—FURNACE FOR SMELTING, AND FOR OTHER PURPOSES.—John Thomas (assignor to himself, William Bacon, Harrison Groves, and Hugh Chaytor), Middlesbrough, Eng. Patented in England, July 18, 1868.
100,567.—BALANCED WATER ELEVATOR.—W. L. Thomas, Wadsworth, Ohio.
100,568.—SEAL LOCK.—Gustave Ulman (assignors to C. R. Goodwin), Ivry-sur-Seine, near Paris, France.
100,569.—BED BOTTOM.—W. W. Wait, Richmond, Ind.
100,570.—MACHINE FOR MAKING HORSE SHOES.—Edwin Wassell, Wood's Run, Pa.
100,571.—STOVE SHELF AND DRYER.—J. J. Watson (assignor to himself and Hiram Watson), Coatsville, Pa. Antedated March 1, 1870.
100,572.—VAPOR BURNER.—Henry Wellington (assignor to himself and T. P. Doane), Chicago, Ill.
100,573.—FERTILIZER SOWER.—T. J. West (assignor to himself, J. L. Russell, and A. C. Frisby), Alfred Center, and Joel Morekess, Andover, N. Y.
100,574.—MACHINE FOR MAKING HORSE SHOES.—Chas. W. Wettengel, Pittsburgh, Pa.
100,575.—LOOM CAM.—George O. Wickers, Lawrence, and Thomas J. McClary, North Andover, Mass.
100,576.—STEAM PUMP DEVICE.—Martin Wilcox, Sacramento, Cal. Antedated December 30, 1869.
100,577.—SASH HOLDER.—James Wilkinson, Albany, N. Y.
100,578.—LANTERN.—Arnold Withmar, St. Louis, Mo.
100,579.—METHOD OF LAYING OFF PATTERNS FOR STITCHING ON LEATHER.—William P. Wolfington, Louisville, Ky.
101,580.—INLAYING METALLIC SURFACES.—E. G. Wright, Boston, Mass.
100,581.—BOLT MACHINE.—John R. Abbe, Providence, R. I. Antedated March, 1, 1870.
100,582.—UMBRELLA.—Edward Adams, Boston, Mass.
100,583.—VEGETABLE AND FRUIT PEELER.—E. D. Averell and Joseph Malan, Brooklyn, N. Y.
100,584.—CARRIAGE WHEEL.—James R. Baird, Vincennes, Ind.
100,585.—EXPANSIBLE CORES FOR CASTING IRON, GLASS, ETC.—Anson Balding, Wheeling, West Va.
100,586.—MUSTACHE GUARD FOR DRINKING VESSELS.—E. W. H. Bass, Quincy, Mass.
100,587.—COMPOUND TO BE USED AS AN ARTICLE OF DIET.—C. G. Baylor, Quincy, assignor to E. S. Tobey, Richard Soule, and Chas. Soule, Boston, and Louisa D. Baylor, Quincy, Mass.
100,588.—PAINT COMPOUND.—Ezra Blakeley (assignor for one half to Peter Pierson), Neponset, Ill.
100,589.—RAILROAD CAR VENTILATOR.—Isaac Bonnell, Jr. (assignor to himself and H. G. Lumbard), Chicago, Ill.
100,590.—BRICK MACHINE.—G. C. Bovey, Cincinnati, Ohio.
100,591.—WATER-PROOF FABRIC.—Thomas Bracher, Rahway, N. J. Antedated February 26, 1870.
100,592.—REDUCING GEAR FOR STEAM ENGINE INDICATORS.—H. L. Brevort, Brooklyn, N. Y.
100,593.—BLIND.—W. E. Brock, New York city.
100,594.—ADJUSTABLE WINDLASS.—John S. Brown, Schenectady, N. Y.
100,595.—PUMP.—James Byran, New York city.
100,596.—LET-OFF AND TENSION DEVICE FOR SPOOLS OF BRAIDING MACHINES.—James D. Butler, Lancaster, Mass. Antedated February 26, 1870.
100,597.—DITCHING MACHINE.—James Calliham (assignor to David M. Calliham), Baton Rouge, La.
100,598.—PRINTING PRESS.—Adam Campbell, Brooklyn, N. Y.
100,599.—ANIMAL TRAP.—Henry C. Case, Pekin, Ill.
100,600.—SCHOOL DESK AND SEAT.—Wesley Chase, Buffalo, N. Y.
100,601.—LAUNDRY INDICATOR.—Robert Clarke, Macon, Ga.
100,602.—WRENCH.—A. G. Coes, Worcester, Mass.
100,603.—HAND RUBBER FOR WASHING CLOTHES.—G. F. J. Colburn, Newark, N. J.
100,604.—MACHINE FOR PICKING CURLED HAIR.—N. L. Cole, (assignor to himself and A. N. Upham), Norwich, Conn.
100,605.—BRAD SETTER.—M. D. Converse, London, Ohio.
100,606.—FLOATING SHIP.—G. W. Corey and T. Losie, New York city. Antedated Feb. 28, 1870.
100,607.—PRESS.—Dexter Curtis, Madison, Wis. Antedated Feb. 26, 1870.
100,608.—COMPOSITION FOR PRESERVING TIMBER AND WOOD.—Edward J. De Smedt (assignor to N.Y. Improved Anthracite Coal Co.) New York city.
100,609.—WELL BORER.—S. H. Dickerson, Hudson, Mich.
100,610.—MACHINE FOR MAKING SASH.—S. C. Ellis, Jersey City, N. J.
100,611.—COMBINED HAY KNIFE AND PRUNING HOOK.—D. Fasig, Rowsbury, Ohio.
100,612.—BALANCE SLIDE VALVE.—James Fitzgerald, Brooklyn, N. Y.
100,613.—POLE ASCENDING APPARATUS.—George Fleming, New York city.
100,614.—CORD HOLDER FOR WINDOWS, ETC.—G. S. Gladding, Cuester, Conn.
100,615.—HARVESTER RAKE.—William F. Goulding, Providence, R. I.
100,616.—DOOR RETAINER.—Charles T. Gravatt, Philadelphia, Pa.
100,617.—MACHINE FOR REFITTING CONICAL VALVES.—C. F. Hall, Brooklyn, N. Y.
100,618.—ELASTIC PROTECTOR FOR HORSES' FEET.—W. H. Hall, Boston, assignor to himself and Joseph W. Haskins, Charlestown, Mass.
100,619.—VARIABLE CUT-OFF VALVE GEAR.—Wm. Harsen, Green Point, N. Y.
100,620.—FARM GATE.—Calvin Hart, Farmington, Ill.
100,621.—PAPER-BOX MACHINE.—C. B. Hatfield, Philadelphia, Pa., assignor to himself, Horace B. Hellman, Joseph Willcox, and H. B. Willcox.
100,622.—SELF-WAITING TABLE.—W. W. Hawley, Mount Morris, N. Y.
100,623.—WATER GATE.—Marshal Hays, Fostoria, Ohio.
100,624.—PLOW.—Daniel Heiges, Cashtown, Pa.
100,625.—SLIDE VALVE.—Abraham Hemingway, New York city.
100,626.—CARRIAGE SPRING.—Benj. T. Henry, New Haven, Conn.
100,627.—BOBBIN FOR SEWING MACHINES.—J. B. Herreshoff, Bristol, assignor to G. A. Williamson and Samuel T. Shattuck, Providence, R. I.
100,628.—ASPIRATOR FOR PREVENTING OVERHEATING OF GRAIN, ETC.—T. A. Hoffman, Beardstown, Ill.
100,629.—TREATING BLOOD FOR THE PREPARATION OF FERTILIZERS, AND FOR OTHER PURPOSES.—H. A. Hogel, New York city, assignor to himself and C. G. Bruce.
100,630.—MACHINE FOR PUNCHING THE LEAVES OF ELLIPTIC SPRINGS.—George Hopson, Bridgeport, Conn.
100,631.—HOLLOW GRATE FOR STEAM BOILER.—C. E. Hutson, Commerce, Mo.
100,632.—HEAT-RESISTING MATERIALS FOR SAFES, BANK VAULTS, ETC.—Theo. Hyatt, New York city.
100,633.—DEVICE FOR PACKING AND TRANSPORTING EGGS.—Benj. Illingworth, Freeport, Ill.
100,634.—CHECK FOR GAS BURNERS.—J. H. Jennings, New Bedford, Mass.
100,635.—SPRING BED BOTTOM.—T. W. Johnston, Richmond, Me.
100,636.—FURNACE FOR DRYING SAND.—I. D. Johnson and A. V. Hartwell, Chicago, Ill.
100,637.—LAMP CHIMNEY.—Edward Jones, South Boston, Mass.
100,638.—TABLET, TOKEN, OR CHECK, TO BE USED IN LIFE INSURANCE.—H. A. Jones, Brooklyn, N. Y.
100,639.—PEANUT CLEANING AND POLISHING MACHINE.—J. M. Keating, Norfolk, Va.
100,640.—MUCILAGE HOLDER.—James M. Keep, New York city.
100,641.—STOVEPIPE DAMPER.—William J. Keep, Troy, N. Y.
100,642.—CLAMP.—G. D. Lambert, New Haven, Conn.
100,643.—MOTIVE POWER FOR CARRIAGES.—S. L. Langdon, New Orleans, La.
100,644.—PADLOCK.—T. Lanston, Washington, D. C.
100,645.—FLUTING MACHINE.—T. Leavitt and E. L. Howard, Malden, Mass.
100,646.—CARRIAGE AXLE.—W. A. Lewis, Joliet, Ill.
100,647.—TREATING LIQUOR CONTAINING GELATIN OR GLUE.—Orazio Lugo, Baltimore, Md.
100,648.—WATER WHEEL.—Samuel Martin, York, assignor himself and B. F. Manifold, Lower Chanceford, Pa.
100,649.—FLATIRON POLISHER AND HOLDER.—W. B. Mason, Boston, Mass.
100,650.—HORSE HAY FORK.—J. M. McDonald, McCoysville, Pa.
100,651.—SAFETY MECHANISM FOR HOISTING APPARATUS.—W. H. Merrick, Philadelphia, Pa.
100,652.—COMPOUND FOR STUFFING LEATHER.—J. Merrill, Boston, Mass.
100,653.—LAMP BURNER.—Rufus Spaulding Merrill, Cambridge, assignor to himself, William B. Merrill, and Joshua Merrill, Boston, Mass.
100,654.—MACHINE FOR TURNING BALLS OR MANDRELS.—William Newsham (assignor to Morris, Tasker & Co.), Philadelphia, Pa.
100,655.—CULTIVATOR.—Walter Notman, Deerfield, Ohio.
100,656.—CARD RACK.—Leverett H. Olmsted, Brooklyn, N. Y.
100,657.—DISH WASHER.—Merrill S. Orton and P. B. Stiles, Galesburg, Ill.
100,658.—PAPER BOX.—Bennett Osborn, New York city.
100,659.—EMERY WHEEL.—J. L. Otis, Leeds, Mass.
100,660.—SAWING MACHINE.—Andrew G. Park, Leon, N. Y.
100,661.—COMBINED LATCH AND LOCK.—Frank P. Pfleghar (assignor to himself and McLagon & Stevens) New Haven, Conn.
100,662.—CLOTHES DRYER.—Russell Phillips, Boston, Mass.
100,663.—MODE OF SUSPENDING MIRRORS TO FURNITURE.—Levi Pierce, Charlestown, Mass.
100,664.—DITCHING MACHINE.—Willard Pierce, Truxton, N. Y.
100,665.—UNION COUPLING FOR PIPES.—R. M. Potter, Jersey City, N. J.
100,666.—TELEGRAPH POLE.—E. Freeman Prentiss, Philadelphia, Pa.
100,667.—POTATO DIGGER.—Wm. R. Prince, Parkersburg, West Va.
100,668.—MANUFACTURE OF ILLUMINATING GAS.—A. C. Rand (assignor to William J. Nichols, Alden B. Rand, and Richard H. Brown), New York city.
100,669.—REVERSIBLE SHIRT.—Charles O. Richter, New York city.
100,670.—DYE VAT.—T. E. Rogers, Dexter, Me.
100,671.—LUBRICATING THE TRAVERSING GUIDE IN MACHINES FOR FEEDING CARDING ENGINES.—Bozil S. Roy, Olneyville, R. I.
100,672.—MORTISING MACHINE.—Anton Schmackers, Cincinnati, Ohio, assignor to Lane & Bodley.
100,673.—WATER-CURRENT MOTOR.—J. Q. A. Schoonover (assignor for one half to J. S. Totten), Lebanon, Ohio.
100,674.—STUMP EXTRACTOR.—Henry Schwartz, Fayetteville, Ohio.
100,675.—STOP MOTION FOR SPOOLING MACHINES.—Samuel Semple, Jr., Mount Holly, N. J.
100,676.—FRUIT TRANSPORTATION BOX.—Walter Shaw (assignor to himself, Jonathan Vincent, and Seldon R. Redman), Newfane, N. Y.
100,677.—HEEL OF RUBBER BOOTS AND SHOES.—F. M. Shepard, New York city.
100,678.—SOLE OF RUBBER BOOTS AND SHOES.—F. M. Shepard, New York city.
100,679.—WOOD-SPLITTING MACHINE.—R. D. Silverwood (assignor to Wm. Silverwood), Baltimore, Md.
100,680.—SPOON HOLDER AND BELL.—Samuel Simpson Wallingford, Conn.
100,681.—APPARATUS FOR REFRIGERATING AND PRESERVING.—D. E. Somes, Washington, D. C.
100,682.—COOLING AND PRESERVING TANK.—D. E. Somes, Washington, D. C.
100,683.—APPARATUS FOR COOLING AND PRESERVING.—D. E. Somes, Washington, D. C.
100,684.—GAS MACHINE.—Theodor G. Springer, St. Louis, Mo.
100,685.—MACHINE FOR BENDING FELLIES.—D. A. Sprinkle, Leoti, Ind.
100,686.—TOOL FOR LACING BELTS.—J. M. Stamp (assignor to himself and Peter Johnston), Grass Valley, Cal.
100,687.—HAY AND COTTON PRESS.—George W. Swift, Memphis, Tenn., assignor to himself and E. G. Graham, De Soto county, Miss.
100,688.—ROOFING COMPOUND.—F. C. Tegetthoff, Cleveland, Ohio.
100,689.—MANUFACTURE OF ICE AND COOLING AIR, LIQUIDS, ETC.—Charles Tellier, Paris, France, assignor to Leopold Bouvier, New York city.
100,690.—GROOVING CHISEL.—H. G. Terwilliger, Scranton, Pa. Antedated February 28, 1870.
100,691.—SUN DIAL.—L. I. Trueg, St. Vincents, Pa.
100,692.—DAMPER.—J. P. Tuttle, Warren, Ohio.
100,693.—RAILWAY RAIL SPLICE.—Jacob Valentine, Bound Brook, Francis Harris, Jr., Elizabethtown, N. J., and C. Barnes, New York city, assignors to D. R. Pratt, New York city.
100,694.—SASH HOLDER.—A. Van Patten and J. F. Kelsey, Weyauwega, Wis.
100,695.—PLANING MACHINE.—Loudus B. Walker, Chicago, Ill.
100,696.—PLOW.—L. T. Webster, Northfield, Mass.
100,697.—SELF-CLOSING AUGER STOP COCKS.—Alfred Weed, Boston, Mass. Antedated Feb. 25, 1870.
100,698.—SPRING BED BOTTOM.—William Wells, Salem, Mass.
100,699.—CONSTRUCTION OF STOVE PLATES.—August Werret and John Kershaw, Canton, Ohio.
100,700.—FLOOR CLAMP.—George Wood, Philadelphia, Pa.
100,701.—COLLAR AND HAMES.—J. L. Wooden, Greensburg, Ind.
100,702.—PUMP.—Wm. Wright, New York city.
100,703.—MUFF AND COLLAR BOX.—Henry Fowler, Detroit, Mich., assignor to Jason Crane, Bloomfield, N. Y.
100,704.—DOVETAILING MACHINE.—Henry H. Bashore, Philadelphia, Pa.
100,705.—CONSTRUCTION OF CHIMNEYS AND FLUES.—Joseph Kleckner, Mottville, Mich.
100,706.—CEMENT TO BE USED IN SEWERS AND DRAINS, AND FOR CONSTRUCTING FLUES AND OTHER PARTS OF BUILDINGS.—J. Kleckner, Mottville, Mich.
100,707.—RAILWAY SWITCH.—Joseph J. Shaeffer and Curtis C. Steinmetz, Middletown, Pa.

REISSUES.

3,869.—WATCHMAN'S TIME DETECTOR.—Jacob E. Buerk, Boston, Mass., assignee of John Burk.—Patent No. 51,052, dated January 1, 1861; patented in France, Oct. 29, 1856; reissue 2,054, dated August 22, 1865.
3,870.—TUMBLER WASHER.—G. D. Dows and Calvin Dows, Boston, and G. S. Cushing, Lowell, Mass., assignees, by mesne assignments, of Albert Hallowell.—Patent No. 57,565, dated February 13, 1866.
3,871.—PACKING CASE FOR TOBACCO.—S. F. Hess, Rochester, N. Y.—Patent No. 99,188, dated January 25, 1870.
3,872.—APPARATUS FOR THE MANUFACTURE OF GAS.—W. J. Nichols and A. C. Rand (assignees, by mesne assignments, of L. D. Gale, assignors to W. J. Nichols, A. B. Rand and R. H. Brown), New York city.—Patent No. 26,028, dated November 8, 1859.
3,873.—MANUFACTURE OF GAS.—W. S. Nichols and Alonzo C. Rand (assignees, by mesne assignments, of L. D. Gale, assignors to W. J. Nichols, A. B. Rand, and R. H. Brown), New York city.—Patent No. 26,030, dated November 8, 1859.
3,874.—CORN STALK CUTTER.—G. W. Cole, Farmington, Ill.—Patent No. 39,214, dated July 14, 1863.
3,875.—WATER WHEEL.—William Foos, John W. Bookwalter, Mary A. Leffel, Springfield, Ohio, and Lamar Foos, New Haven, Conn., assignees, by mesne assignments, of D. K. Krastz.—Patent No. 20,921, dated July 13, 1858.
3,876.—HORSE HAY FORK.—J. K. O'Neil, Kingston, N. Y.—Patent No. 55,528, dated June 12, 1866.
3,877.—LIME KILN.—C. D. Page, Rochester, N. Y.—Patent No. 22,239, dated December 7, 1858.

DESIGNS.

3,881 and 3,882.—"BEDOUIN" OR "ARAB."—Thomas Dolan, Philadelphia, Pa. Two Patents.
3,883 and 3,884.—TACK HEAD.—George A. Field (assignor to the Albert Field Tack Company), Taunton, Mass. Two Patents.
3,885.—TOP PLATE, BARREL BRIDGE, AND COCK FOR WATCHES.—Fayette S. Giles (assignor to Giles, Wales & Co.), New York city.
3,886.—BARRED BRIDGE, RATCHET-CAP BASE, AND ARBOR CUP OF WATCHES.—F. S. Giles (assignor to Giles, Wales & Company), New York city.
3,887.—TRADE MARK.—O. C. Maxwell, T. L. Neal, and C. L. Long, Dayton, Ohio.
3,888.—CLOCK FRONT.—Nicholas Muller, New York city.
3,889.—TRADE MARK.—George C. Thilenius, Cape Girardeau, Mo.
3,890.—TEA SET.—H. Vasseur (assignor to Simpson, Hall, Miller & Co.), Wallingford, Conn.
3,891.—ICE PITCHER.—H. Vasseur (assignor to Simpson, Hall, Miller & Co.), Wallingford, Conn.
3,892.—CARPET PATTERN.—Hugh Christie, Morrisania, N. Y.
3,893.—SPICE MILL.—Wm. Haslam (assignor to Henry Troemner), Philadelphia, Pa.
3,894.—COLLAR BOX.—John R. Jerauld and Henry L. Holmes, Providence, R. I.

EXTENSIONS.

ORE WASHER.—W. L. Carter, of Marietta, Pa.—Letters Patent No. 14,388, dated March 11, 1856.

[Communicated].

ROTATING AND FIXED TURRETS.

To the Editor of the New York Times:

Please publish the following communication, which has been declined by the editors of the *Army and Navy Journal*, to whom it is addressed.

JAMES B. EADS.

ST. LOUIS, January 29, 1870.

Editor of the Army and Navy Journal:

SIR:—Your editorial contributor of the article published in your journal on the 1st of January, and entitled "Rotating and Fixed Turrets," seems to know that the defects of the monitors are becoming so well understood that their claim to be considered *invulnerable* cannot be supported either by their record or by the intrinsic merits of their design. He evidently thinks but one way is left to save the system from public disfavor and that is by clamoring about the ignorance of those who have the temerity to doubt its superiority over every other.

Your contributor makes no denial of the justice of my criticisms when applied to the monitors provided with *base rings*, supported as they were by proofs from official reports; but admits that "the original small craft which served us so effectually during the war, possessed defects, which in later structures have been nearly overcome, and which in future structures may be wholly removed." He says, "these cardinal objections urged on Mr. Eads' system of naval defense, are wholly groundless as regards the *Dictator*. It was not this vessel, it appears, but the original batch of small monitors, which Mr. Eads criticised," and tells us "that these objections have been removed in the *Dictator* and *Puritan* classes, and consequently in the *Kalamazoo* class of turrets." He says: "The *base ring* which was attached to the small monitors because the thin turret plating was found inadequate, a matter to which Mr. Eads devotes much space, we deem it waste of time to discuss. All that need be said is that the *Dictator* and *Kalamazoo* class of turrets *were built* (these *italics* are mine) on a plan requiring no ring at the base."

From these extracts it is evident he abandons the attempt to defend the vessels provided with *base rings*. These constitute the *Monadnock*, *Canonicus*, *Passaic*, and *Yazoo* classes, nearly forty monitors, all of which he leaves *hors du combat*, and concentrates his entire energies in defending the monitor system with the turrets of the *Dictator* class, the *Puritan* class and the *Kalamazoo* class. I therefore leave "the original batch" to survey the field occupied by these invincibles. How many remain, then, of these undemolished and acknowledged representatives of the monitor system? Will your readers, after all this ado about how our *Kalamazoo* class of turrets "*were built*," and all the bombast about the *Puritan* class, and the *Dictator* class, credit the fact that excepting the *Dictator*, there is not at this time, and never has been, a turreted vessel of either class in existence?

I once read of an urchin at school (not "one of our young friends at West Point and the Naval Academy"), who, having his coat closely buttoned up, was asked, "Where is your shirt?" "Mother is washing it." "Have you but one shirt?" continued the astonished interrogator. To which the indignant lad replied, "Would you expect a body to have *a thousand* shirts?" When your contributor is asked, "Have you but one of these wonderful vessels?" I can imagine his indignation as he replies, "Would you expect a body to have *a thousand Kalamazoos?*"

I shall not quarrel, however, with him because of the paucity of his *Kalamazoos*, but will briefly proceed to examine the merits of his last remaining hope—the *Dictator*. I will first state, however, that the turrets of the *Puritan* and the *Kalamazoo* classes, which he takes so much pains to tell us, "*are composed* (my italics again) of two distinct cylinders of plate iron," have never been constructed at all.

The Department is even now maturing plans for completing as casemated ships the vessels constituting these classes which were commenced several years ago, and before the defects of the *Dictator* were fully manifested. I am informed that it has already decided to do this with the *Kalamazoo* The fact that their turrets were once contracted for, and that the Department compounded with the contractors and canceled the agreements while the work was in progress, together with its subsequent course in the premises, would seem to prove its want of faith in the system; but this will, doubtless, be all explained by your contributor. The motive which prompted him, however, to endeavor to lead the public to believe these turrets "were built" and "are composed," etc., when they are not yet built, together with certain questions of ethics, to which the use of these deceptive phrases give rise, I leave for him to settle with your readers, while I proceed to examine the merits of the *Dictator*. The impregnability of the joint between the base of the pilot house and the turret roof of the *Dictator* is thus set forth by your contributor: "We stated in our article that shot could not strike the base of the pilot house of the *Dictator* because the turret wall of that vessel (we might have added the turrets of the *Kalamazoo* class) is carried to such a hight that shot cannot thus strike." The top of her turret wall is 26½ feet in diameter. The pilot house placed in the center of it is not over ten feet. This leaves about 8 feet all round from pilot house to turret wall. The turret wall of the *Dictator* is projected only six inches above the turret roof, consequently a roll of the ship of four degrees would bring the top of the turret wall below the level of the base of the pilot house.

This protection would then cease to exist against shot moving in that horizontal plane, and this plane would be no higher than the guns of several English iron-clads already afloat. To make this boasted protection available against them at short range, it would be necessary that the contest be fought on a perfectly smooth sea. Even in such a sea, this six-inch belt would be too low to protect this joint against their guns if they were only a few hundred yards distant, for the elevation of three or four degrees re

quired by the distance would so increase the curvature of the trajectory of the shot as to insure its passing over the turret wall, it being only high enough, when perfectly level, to intercept projectiles intersecting the line of fire at an angle of less than four degrees. In attacking forts it must be manifest that this joint would be exposed to the direct fire of any gun four degrees above it.

Even in a calm sea, a gun on a level with it or even below it, would command this joint, if it were sufficiently distant to require a few degrees of elevation to maintain the trajectory above the line of fire to the requisite distance. It is therefore ridiculous to claim that this joint is impregnable against fortifications. To make it at all available against an enemy afloat involves the necessity of a smooth sea, and of the *Dictator* selecting and maintaining her own position in the fight. As she is known to be a complete failure in point of speed, making only seven knots per hour, of course this would be impossible with almost any English iron-clad afloat, none of which have a speed of less than nine knots, while several go at thirteen or fourteen. It is therefore evident that this six-inch belt projected above the turret roof is too insignificant a defense of the joint to merit serious consideration. My apology for devoting so much space to it is that it is claimed to be so important. If it must continue to form a characteristic feature in the monitor system it is essential for the advocates of the system to insist that the rules of the prize ring be adopted in naval engagements, and that it be expressly understood that hits on the pilot house below the belt shall be unlawful, and will entitle the monitor to claim the stakes.

Your contributor maintains that it is impossible for any heavy projectile to disturb the inertia of the *Dictator's* pilot house, weighing eighty thousand pounds, and held in place by a fourteen-inch spindle. He asserts, therefore, that it would not be bent over, and thereby endanger the rotation of the turret beneath it, nor be liable to be lost overboard by the fracture of the spindle. In support of my assertion to the contrary, made in my report to the Secretary of the Navy, and ridiculed in your contributor's article on the *Mount Zaffer*, I quoted the report of Captain Drayton, of the *Passaic* (page 61, "Armored Vessels"), and proved by it that a half-spent ricocheting rifle shot (after breaking all of the eleven one-inch plates of the upper part of her turret) had sufficient force left to "mash in the pilot house" and "bend it over."

To avoid the inevitable conclusion that a direct blow from a heavy projectile can *bend over* and disable the forty-ton pilot house on the *Dictator*, if the shot described by Captain Drayton could bend over the twenty-four-ton pilot house of the *Passaic*, similarly secured, this able physicist gravely tells your readers that "The Commander of the *Passaic* had no idea of saying that the *pilot house*, as Mr. Eads appears to suppose, had bent over; the top of the wall had simply bent over by the effect of a glancing shot," and thinks "this singular error of Mr. Eads has probably been noticed by our young friends at West Point and the Naval Academy." Captain Drayton said: "The blow was so severe as to considerably mash in the pilot house, bend it over, open the plates," etc. These young gentlemen will probably think that, as Captain Drayton had already said, the pilot house was considerably "mashed in," it was surplusage to state in the same sentence that "the top of its wall had been bent over" also. Yet this is what your contributor would make them believe he meant to say. It is probable there are not twenty students at the Naval Academy who could not have told this conscientious writer (what he was evidently ignorant of), viz., that the report of the Commission appointed by Mr. Welles to examine and report upon the injuries to the *Passaic*, and published on page 83 of "Armored Vessels," would cover him with confusion for this attempt to distort the plain meaning of a gallant but deceased sailor. For the *words* of Captain Drayton are fully corroborated in that report. This Commission (composed of Captain J. C. Rowan, U. S. N., Charles W. Copeland, George W. Quintard, M. F. Merritt and Jos. J. Comstock) states that the shot in question "raised the pilot house half an inch and *started it over on one side*, breaking two bolts in the pilot house." The italics are my own, the words are those of the report.

Your contributor merits all the glory he has gained by this attempt to destroy the effect of the gallant Drayton's words, in this effort to sustain the ridiculous proposition that the inertia of forty tuns of iron cannot be disturbed by a cannon shot of such weight and velocity as was known to be practicable at the date of the *Dictator's* construction. Arguments, based upon such absurdities, must require unusual expedients to sustain them. If he still doubts that this comparatively light shot did really overcome the inertia of a twenty-four tun pilot house, after being told by one witness that it *bent it over*, and by five others that it *raised it half an inch and started it over on one side*, I can give him other official proof of the power of shot to move monitor pilot houses.

Being engaged from the inception to the close of the rebellion in designing and constructing armored vessels, I was kept promptly and confidentially advised by the Department of "the most important facts" connected with the performance of the monitors and other ironclads; and although charged by your contributor with being ignorant of the subject, may be able to refer him to some other reports that will also be new to him.

Your contributor lays a great stress upon the fact that the gun slides of the *Dictator* do not touch the turret wall, and consequently the disabling of the guns cannot occur from shot striking opposite their ends.

The Commission before referred to, speaking of an accident of this very kind, by which one of the *Passaic's* guns was rendered useless, and certain damages done to the joint at the base of the turret, says: "We would take the liberty of suggesting that this form of injury may hereafter be guarded by fastening a very heavy ring or band around the base of the turret to prevent distortion, and leaving sufficient freedom between the rails of the carriage and the turret, so that any slight distortion of the turret will not effect the gun carriages."

It appears that the suggestion of this intelligent Commission was not deemed large enough for the entire monitor navy, for we find only one half of it used on "the original batch," and the other in the Dictators, Puritans, and Kalamazoos that "were built" on a plan not requiring a base ring. The originals had the ring with the long gun slides, and the last three classes the short gun slides without the rings.

It seems not to have been noticed that one of the chief objects of this practical Commission, in recommending the use of a heavy band around the base of the turret, was to prevent the *distortion*, which those gentlemen foresaw was likely to occur to it if robbed of the eight important points of support in its circumference furnished by the four gun slides, which are placed about four feet apart in the base of the turret, and transversely over the main turret beam through which the vertical spindle passes.

When these should no longer touch the turret wall, it would have nothing except the ends of the main beam, bolted to its base at two opposite points in its circumference, to preserve its circular shape at the deck. These gentlemen doubtless thought that the turret would then be likely to lose the cylindrical, and assume the "partially oval form," if struck by even as small shot as that which mashed in the *Passaic's* pilot house. But they were merely "superficial observers," and had not been taught by your contributor that "a partially oval turret would work upon a broad flat ring as well as one that is cylindrical." They probably thought that a heavy shot at the base might bend the bottom of the wall in without moving the top of it in also, and thus cause an ugly leak, even if it did not stop the turret's rotation, and that its "distortion" might, to some extent, be guarded against by a heavy base ring.

The *Dictator's* turret is 24 feet in its internal diameter. Its wall is 15 inches thick, and it is not enlarged or in any way strengthened at the base. The turret walls of "the original batch" were eleven inches thick. The bands placed around their bases were five inches thick by twelve or fifteen inches in hight. Including this band, those turrets are consequently one inch thicker at the base than the *Dictator's*.

The *Dictator* has a series of similar five-inch bands, one above the other, incorporated into the construction of her turret, the lower one of them being six inches thick (one of the ten thin plates being cut short to allow for its extra inch of thickness). In my letter I proved from official reports that the base ring about the monitors failed to give adequate protection. The heaviest shot thrown against them were from ten-inch columbiads. These shot weighed only 128 pounds. Yet they were found sufficient to disable a turret sixteen inches at its base, including the base ring. Now is it not a most egregious absurdity to claim that the *Dictator's* turret, not as thick at the base by one inch, is invulnerable against fifteen-inch shot weighing three and one half times as much.

And is it not equally absurd to claim that this wall, resting on a flat, level surface, and in no way secured from being knocked into a "partly oval shape," except at only two points in its entire circumference of 83 feet, should have sufficient stiffness and inertia to prevent its being distorted more than two inches? For two inches is the entire distance existing between the turret wall of the *Dictator* and the ends of her gun-slides. This enormous space of two inches is the basis upon which their claim to impregnability is resting. The feeling of security which possesses your contributor on the gunslide question can only be equaled by the ostrich, who having thrust his head under cover a few inches, thinks everything is then absolutely safe.

Your contributor says: "Critics all point to the disastrous consequences of shot striking at that junction [the base of the turret]; but they do not appear to comprehend the practical merits of the expedient of rotating the turret on a flat ring, level and parallel with the deck." Of course they do not, without a great deal of study, because it is such a very intricate and difficult problem. It might be worked out, though, by the imaginary calculus, if it failed to be solved by the differential or integral. Equally incomprehensible is the proposition, to ordinary minds, that the base of the *Dictator's* turret is safer without a heavy ring to prevent its distortion than with it; and that a fixed turret, joined firmly to the deck "will, owing to the rigid nature of the connection, inevitably produce fracture and leak," from the impact of a heavy projectile, while the same shot would be harmless against the base of the same turret if it was not joined to the deck, but only stood "on a *flat ring*, level with the deck," that would allow the turret to assume the oval or cylindrical form, just as the force of the shot moved it. Neither leak nor harm to the gun slides, two inches distant within it, could possibly occur. "Casual observers" fail to see "the practical merits of the expedient" however, and the records of the "original batch" do not quite support these propositions.

One of the great merits claimed for the *Dictator* is her remarkable steadiness in a seaway. "The sea breaks over their low, flat decks powerless for harm," exclaims their enraptured advocate. He might have added, "and their guns are equally powerless," for the *Dictator's* ports, being but two feet ten inches above her low, flat deck, they must, of course, be kept closed at such times. In consequence of the small exposure of hull above water, a small quantity of armor will clad her sides, and for the same reason a small amount of leakage will send her to the bottom. If we cannot gain immunity from the enemy, who is rarely with us, without increasing the danger of foundering, which is always present, had we not better take our chances behind thinner armor? Perhaps, as suggestive a lesson in the science of naval defense as can be drawn from our late conflict, would be a comparative statement showing the actual loss of life on our armor casemated vessels, caused both by the fire of the enemy and the foundering of the vessels, and the loss of life from the same two causes in the monitors. I am confident that whether this comparison be made according to tunnage, weight of metal thrown in action, cost of the ships, or number of men engaged in them, the loss of life will be found to have been greater on the monitors than on the others; while there is not a sailor afloat or ashore but would deem death in battle far more preferable to the fate of those who went down on the ill-fated *Weehawken*.

The overhang of the *Dictator* is another one of the defects of this vessel, though it has been claimed as one of her greatest perfections.

The amount of impenetrability given by these three or four feet of timber backing projecting out from her sides, is obtained by a sacrifice of speed which makes her terrible ramming projection at the bow a most ridiculous appendage; for the possibility of using it, the vessel never having been able to make over seven knots per hour, is so funny as to "amuse our young friends at West Point and the Naval Academy." This ram, so curiously wrought, and of length sufficient to pierce the most powerful enemy through and through, is only dangerous to the friendly ship that tows her along, as she goes cruising on the high seas, and chasing the enemies of the Republic. A Mormon elder, about to mount a dilapidated steed, was asked what he intended to do with it? On replying that he intended to follow the Lord on him, his interrogator rejoined, "You will have to push that horse right smartly before you overtake him." The *Dictator's* chances for overtaking an enemy are nearly as good. Her contract guaranteed a speed of sixteen statute miles per hour for fifteen consecutive hours, but the greatest speed shown by her steam log, in the Bureau at the Department, is only seven knots, and that but for one brief hour. "*Sic transit*," etc. As the engine and boiler power of this ship is enormous, and as almost every one of the "original batch" (without exception, I believe), failed to make the speed guaranteed by their contracts, I can only account for the fact, in the *Dictator's* case, by the retarding influence of this peculiar appendage, the *overhang*, coupled with the laborious duty of carrying her dangerous ram.

In summing up the wonderful qualities of this perfect specimen of the monitor system, then, we find: First—That her invulnerable turret never has been under fire. Second—That turrets as thick as hers at the base have been injured at the deck joint with projectiles scarcely more than one quarter as heavy as fifteen-inch shot. Third—That her gunslides are only secure against the lighter class of projectiles. Fourth—That similar joints on the turret roof on other vessels have been injured, and the turret stopped by light shot, while hers is only provided with an additional protection that is not available except under the most favorable circumstances, and those circumstances beyond her control. Fifth—That pilot houses similarly secured, and only sixteen tuns less than the weight of hers, have been wrecked by small and half-spent glancing shot. Sixth—That her low speed is such as to make her a helpless hulk against the submerged rams of many war vessels now afloat. Seventh—That her low ports render her unable to return the fire of an enemy, who may chance to overhaul her in a rough sea. Eighth and lastly—That her low position in the water, and the warning fate of three of her predecessors, give assurance that eternal vigilance is the price of her safety against sudden foundering.

To continue thus persistently to mislead our countrymen into the belief that such a vessel is capable of coping with some of the English ironclads now afloat, when we dare not trust her at sea alone for fear of foundering, or that we have one single armored ship (*Kalamazoo* or anything else) that can stand against them, betrays either unpardonable ignorance, or a total want of patriotism.

I have been reluctantly drawn into this discussion to defend myself against the severity of your personal strictures, and have hastily thrown these facts and arguments together with no wish to depreciate the important services rendered by the monitors in our late conflict, nor in any wise to lessen the fame of their distinguished inventor. Their merits and his genius will find in history the high place deservedly won by them in the exigencies of the hour, no matter what system of naval defense be found best suited to the present wants of the age.

I have no leisure to notice the ridicule or criticisms which you or others may choose to apply to *my system*, nor have I the right to ask your space in defense of it, but trust I shall always find time and materials, and have opportunity granted, to repel personal charges of ignorance and misrepresentation, either direct or implied, when made in a journal of respectable standing. Your obedient servant, JAMES B. EADS.

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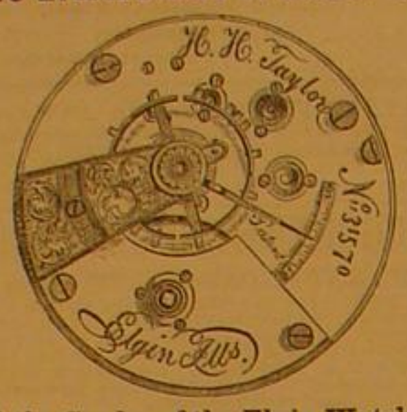

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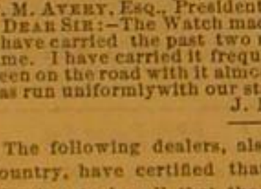

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SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXII.—No. 13. [NEW SERIES.] NEW YORK, MARCH 26, 1870. $3 per Annum [IN ADVANCE]

Improvement in Machines for Dressing Millstones.

The use of the black diamond or carbon diamond points in the mechanic arts is rapidly extending. It is found that when properly applied they are capable of cutting and drilling the hardest materials. This property has originated many attempts to practically apply such points to the dressing of millstones.

Machines for dressing burrs with the diamond points may be divided into two classes; those which produce their effect by the drawing or dragging of the diamond over the face of the stone, and those which employ revolving cutters, by which the cutting performed resembles fine chipping. Machines employing the draw-cut are forced to connect with it some device (usually a spring) for regulating the pressure of the point and rendering it approximately uniform. This introduces an important defect in their working; namely, that the tool enters all the hollows of the stone, and cuts them as well as the high portions, thus operating to perpetuate defects in the face of the stone, instead of simply cutting off the high portions and ultimately reducing the face to a perfect plane.

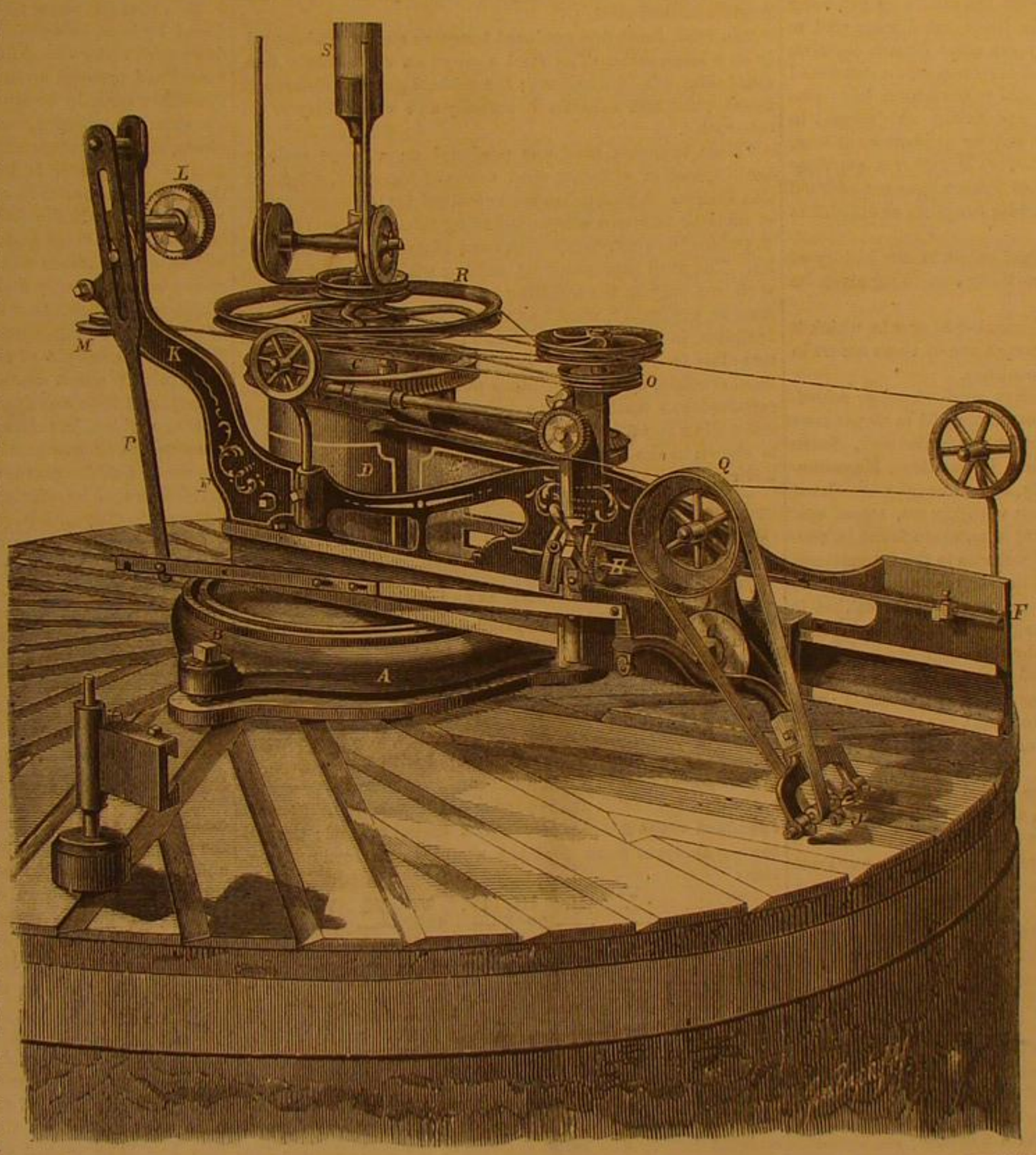
The objects sought in dressing millstones are to level their faces and impart to them a series of "cracks" or fine cutting edges. The positions of these cutting edges vary greatly in different styles of dressing stones, and a machine destined to supersede hand work must be adapted to perform any kind of dress preferred by individual millers, whose opinions vary widely on this subject.

The machine we herewith illustrate has this capacity combined with the principle of revolving cutters, moving constantly in a fixed plane at right angles to the vertical axis of the stone, whereby the high portions only are dressed, until the faces of the burrs are brought to a dead level. Thus all the defects hitherto attending the use of diamond millstone dressing machines are wholly avoided, and a dress imparted to the stone superior in every way to that obtained by the pick, and at a very much less expense. The first patent for the revolving cutter was granted to Mr. J. T. Gilmore, May 26, 1863, but this invention has been mostly withheld from the public since, from the fact that a patent was subsequently granted to a Swiss inventor, Mr. Golay, which resulted in litigation, and finally a compromise, by which we are informed the Golay interest is now wholly vested in the owners of this machine.

The way is now therefore opened for the introduction of this device throughout the country; the value of which is indicated by the fact that the Golay machine, involving the same general principle, but inferior in construction, has been widely introduced in Europe, and is in universal favor there. Darblay, the most extensive miller in the world, at Corbeil, near Paris, whose mills contain 116 runs of burrs, says: "I have eighteen machines, and I consider it the most notable progress ever made in our industry."

The most extensive miller in Glasgow—38 runs of burrs—says no practical miller would be without it for £100 per run if he once had experience of the great value of the diamond dressing machine. This is only a sample of the testimony of a large number of the most celebrated millers in Europe and Canada in favor of the Golay machine.

The Gilmore machine has, it is claimed, a form superior to any other, from the facts that it is in itself a tram; that it is automatic in its action, so that when set at work it will dress an entire stone without further attention; and that it does not require adjustment for each land on the stone. The latter peculiarity produces a perfectly plane face on the stone, as the face is made to conform to the fixed position of the principal vertical journal around which the arm carrying the cutter revolves; whereas if the base is changed during the dressing it must, more or less, be affected by the irregularities of the stone upon which it rests. The action of the Gilmore machine imitates therefore that of the lathe in working from fixed centers; and must not be confounded with that of any other millstone-dressing machine heretofore introduced in this country. The action of the machine will be understood by reference to the accompanying engraving, in which A represents the base of the machine set on three adjusting screws, B, for leveling the machine. This base supports a hollow, upright journal, C, which is inclosed by a sleeve, D, mounted on a suitable shoulder.



GILMORE'S REVOLVING DIAMOND MILLSTONE DRESSING AND FACING MACHINE.

The sleeve, D, is provided with a strong bracket, E, on the outer end of which is mounted the tool-supporting arm, F, having the power of making a horizontal sweep through the agency of a hinge joint not shown in the engraving. By this means the machine is enabled to execute a right or left hand dress as required. It will be seen that this arm is provided with ways, upon which the slide carrying the tool stock plays; the tool stock being pivoted to the slide at G. The fit, however, is made so tight that the tool stock is barely movable by the action of the screw, H, which screw is actuated by an arrangement of a ratchet-nut, lever, and pawl, I.

The action of the screw, H, is to give a slight rotation of the tool stock around the central pivot, G, whereby the end of the tool stock carrying the revolving cutters, J, is elevated or depressed to the depth required.

On one end of the arm, F, is formed a curved upright, K, for the support of the gear which imparts reciprocating motion to the sliding tool. This arrangement consists of a worm gear, L, actuated by a vertical screw behind K, and not shown in the engraving, which receives motion from the small grooved pulley, M, on the lower end of the screw. The pulley, M, receives motion from a small cord belt impelled by the grooved pulley, N, the cord belt first passing around the friction pulleys, O, placed over the hinge joint on which the arm, F, turns, so that when this arm is turned in any direction the cord is neither tightened nor slackened. The worm gear, L, imparts reciprocating motion to the slotted oscillating arm, P, which imparts motion to the tool holder in such a manner that when it backs out to make a new cut, it is raised enough to clear the face of the stone. In making the return stroke it is brought down to the work as positively as though it were screwed in a fixed position.

The revolving cutters are driven by a flat belt from the pulley, Q. The pulley, Q, receives motion from the grooved pulley, R, by a small cord belt passing over friction pulleys, in such a manner that the belt is neither tightened nor slackened by any motion of the arm, F, or by the reciprocating motion of the tool stock.

A presser bar, S, holds the machine in a fixed position by means of a vertical screw, and motion is given to the entire machine by means of a cord belt running from a grooved pulley, fixed to any convenient shaft.

A worm gear, rests on a shoulder, formed at the top of the journal, C, to which it is firmly fixed when the machine is at work. A worm, acting in this fixed gear, and actuated at proper intervals by a system of feed gear, gives the required radial feed.

We have found it difficult to describe this machine without giving it an appearance of complication which does not in reality attach to it. The whole arrangement is really very simple when one sees it in operation. The number of belts is only three—two cord belts and one flat belt. The arrangements of the cord belts, however, give a complicated appearance to the drawing.

The machine weighs only about one hundred pounds, and performs its work admirably, doing all that is claimed for it, as we can vouch from personal observation. It will dress a stone in from an hour to an hour and one half, according to the number of cuts per inch required, and the condition of the stone; and one man can attend two machines with ease. The cost of the carbon points is less than that of sharpening picks for the same amount of work, as is shown in the experience of those who have used them during the past two years.

The inventor informs us that revolving cutters were invented by him after ineffectual attempts to use the draw cutter in a machine which he patented but never attempted to introduce, in consequence of the defects in its operation, mentioned above as belonging to this class of machines. The effectiveness of the revolving cutters is something surprising, and the speed at which they are run is still more remarkable; the minimum speed being 15,000 revolutions per minute, and the maximum speed being 20,000. Twenty cuts from the skirt to the center of the stone can be made per minute, and the plane of the furrow can be dressed equally as true as the face. This cutter must, therefore, be regarded as the most effective tool known in the arts.

The present machine does all that is claimed for it, and the time lost in litigation has been improved in continuous efforts to bring the machine to the high point of perfection it has now reached. It now not only faces the stone to as perfect truth as a piece of metal or wood can be turned in a lathe, but it makes a dress by which it is said ten per cent more fine flour can be produced than with stones dressed in the old manner.

This machine is covered by a number of patents, extending from May 26, 1863, to Jan. 26, 1869.

A machine may be seen in operation at No. 23 Whitehall st., New York, where orders or letters of inquiry may be addressed to the inventor, Mr. J. T. Gilmore.

To Take Grease from Paper.—Gently warm the parts containing the grease, and apply blotting paper so as to extract as much as possible. Boil some clear essential oil of turpentine and apply it to the warm paper with a soft clean brush. A little rectified spirits of wine should be put over afterward.

[For the Scientific American.]

ON TUNGSTEN.

BY PROFESSOR CHARLES A. JOY.

Associated with tin occurs a black mineral of a partially metallic luster, sometimes in crystals of considerable size, to which the early miners gave the name of wolfram, from the German word *wolfrig*, because it behaved like a wolf among the other metals, and often appeared to devour them. Another mineral of a white color and extraordinary weight was also found in tin mines, and for a long time was looked upon as an ore of tin. Cronstedt called this mineral "tungsten," meaning in the Swedish language heavy earth, and no wonder, for it has a specific gravity of six, and is heavier than many metals.

The renowned Swedish chemist Scheele decomposed this tungsten mineral in 1781, and found that it contained a peculiar acid associated with lime, and the mineral was afterwards called, in honor of its discover, "Scheelite."

The original black mineral known as wolfram was analyzed by two Spanish chemists named d'Elhujar, in 1783, who found that it contained the same acid as the scheelite, combined with manganese and iron. The question now arose, what name it would be wise to give to the new element, and Berzelius favored calling it wolframium, others preferred tungsten, and a few scheelium. The latter name has been dropped and a compromise effected between the others by generally calling the metal tungsten, while the symbol employed to represent it is W. Within five years some French chemists have announced that the so-called tungsten was a compound body made of several elements, and they claim to have prepared a series of salts, chlorides, and oxides, as different in their properties as would be the similar compounds of iron, nickel, or cobalt. The announcement is rather a startling one; but as the leading chemists of France have not adopted the new notion, we must still consider tungsten as entitled to be called an element.

Thus we have given the principal points in the history of this interesting metal, and may now say something about its occurrence.

Tungsten is a rare metal. The number of ores in which it is found is exceedingly limited, though one of them occurs in considerable quantity in a few localities.

The mineral tungsten (*tung*—heavy, *sten*—stone) or scheelite, is chiefly tungstate of lime, containing 78 to 80 per cent of the acid. It is found in Cornwall, Cumberland, South America, Bohemia, Saxony, Sweden, Connecticut, Massachusetts, North Carolina, and Nevada, and is usually associated with crystalline rocks in connection with tin ore, topaz, apatite, molybdenite, and wolfram, but is nowhere found in considerable quantity. The mineral wolfram is the tungstate of iron and manganese, and is found in much the same localities as mentioned above, and often in large quantities, so that it would become the chief ore of tungsten in the event of that metal being extensively used in the arts.

Cupro-scheelite, or tungstate of copper and lime, is described by Professor Whitney as occurring in California; other minerals are stolzite (tungstate of lead), tungstite (tungstic ocher), and Huebnerite (tungstate of manganese)—all of them exceedingly rare.

It is an interesting fact that the metal indium has been found associated with tungsten in wolfram.

METALLURGY OF TUNGSTEN.

The metal tungsten has been prepared in various ways not however in a fused state, but is a dark gray powder or as a brilliant mirror or glass.

Junot, in 1853, obtained tungsten by electrolysis of a solution of carbonate of soda, treated with oxide of tungsten, and saturation of the liquid with prussic acid, and addition of cyanide of potassium and boiling. Thus prepared it was a brilliant silver-white metal.

Woehler prepared the metal by passing a mixture of chloride of tungsten, and dry hydrogen gas through a heated glass tube. A specimen prepared in this way, and now deposited in the cabinet of Columbia College has the following properties: It forms on the glass a brilliant, steel-colored metallic mirror, from which it can be separated in thin leaves; it is brittle and very hard, and has the specific gravity of 16·54, which is considerably lighter than that afforded by the metal prepared in another way; heated strongly in the air it burns to the yellow acid; it is not attacked by ordinary acids, not even by aqua regia, nor by caustic potash, but is dissolved in a mixture of potash and hypochlorite of soda.

Riche, in 1853, prepared tungsten by passing hydrogen gas over the acid, heated strongly in a porcelain tube; it was in the form of crystalline grains, which assumed a metallic luster when rubbed, and were hard enough to scratch glass; it could not be fused in the highest heat of the iron furnace, but yielded to 200 pairs of Bunsen elements; it was soluble in acids after continuous action for several days. Water has no effect upon it.

Bernouilli, in 1860, reduced tungstic acid by charcoal, but was entirely unable to fuse the dark gray powder to a metal in furnaces that melted porcelain and Hessian crucibles. He found the specific gravity of the metal obtained in this way to be 17·1 to 17·3, and when reduced by hydrogen to be 17·9 to 18·2—this latter determination would place tungsten next to uranium in the order of specific gravity, as follows: osmium, 21·4; iridium, 21·15; platinum, 21·15; gold, 19·3; uranium, 18·4; tungsten, 18·20.

Attempts to alloy tungsten with other metals, such as copper, lead, zinc, antimony, bismuth, cobalt, and nickel, were generally unsuccessful, and produced mixtures that were infusible. Iron alone can be mixed in all proportions with tungsten, but where there is more than 80 per cent of the latter metal, the alloy is difficult to fuse.

At the London Exhibition of 1862, Versmann showed a small button of the pure metal, which he claimed to have obtained by exposing about an ounce of the powder to the strongest heat of a Griffin's furnace. In this operation no graphite or Hessian crucible was found to stand. The fusion was accomplished at last by heating the metal for three hours in a crucible made of freshly-burnt lime. Despretz also fused tungsten by the aid of a galvanic battery composed of 600 pairs of Bunsen elements, to a mass resembling steel in its fracture, and of a sufficient hardness to scratch ruby.

The specific heat of the metal, according to Regnault, is 0·03342. It is not magnetic, is crystalline in texture; is harder than steel, according to some authors, and according to others is malleable, ductile, soft, with the color and luster of gold. From all of these observations it will be seen that authorities differ in reference to this rare metal, and it is probable that the perfectly pure element has never yet been prepared.

THE USES OF TUNGSTEN.

We cannot do better, under this head, than to quote from the admirable "Treatise on Metallurgy," by Crooke s and Roehrig, just published by John Wiley & Son, where the authors discuss the properties of tungsten steel:

"It was long known that the celebrated Damascus sword blades contained tungsten (0·05 to 0·1 per cent), and De Luynes employed an addition of tungsten for the production of artificial damasked steel.

"In 1855, Jacob first produced tungsten steel experimentally on a large scale. The steel showed an exceedingly fine, conchoidal, silk-like fracture; it combined great hardness and density, and was superior in tenacity and weldability to all other steel.

"Next, tungsten steel was produced on a large scale at Leoben, and in different steel works of Germany, England, and France. A patent has been obtained for the manufacture of metallic tungsten alloys (including tungsten steel) by Mr. R. Oxland, as a communication from Messrs. Jacob and Koeller. The steel is prepared by melting with cast steel or even with iron only (at the puddling process), either metallic tungsten, or, preferably, what has been termed the native alloy of tungsten, in the proportion of two to five per cent. The native alloy is obtained by exposing to strong heat in a charcoal-lined crucible, a mixture of clean powdered wolfram with fine carbonaceous matter; it is a black steel gray, spongy mass, resembling metallic tungsten. The composition of the alloy is shown in the following statement of the composition of wolfram:

Tungstic Acid.	Oxide of Iron.	Oxide of Manganese.
Tungten, 76·25	Iron, 17.75	Manganese, 6·00—100·00
Oxygen, 19·06	Oxygen, 5·07	Oxygen, 1·71— 25·84
		125·84

"Wolfram is sometimes used as an addition to the ore mixture for the production of pig iron. According to Bernouilli, when an intimate admixture of finely divided gray cast iron and tungstic acid is heated to a very high temperature, the graphitic carbon is burnt by the oxygen of the tungstic acid and steel is formed, which alloys with the reduced tungsten. No diminution in the amount of carbon was, however, perceptible when the experiment was repeated with spiegeleisen, or ordinary cast iron, carbon in the combined form being apparently unable to effect the reduction of tungstic acid. Siewert examined eight samples of so-called tungsten steel; the following analyses show that the samples contained no tungsten:

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Iron.....	——	——	95·85	——	96·37	——	——	——
Tungsten...	1·05	2·84	3·05	——	2·71	——	4.75	0·9
Manganese..	——	——	——	——	(trace)	——	——	——
Carbon.....	——	——	——	1.04	——	1·03	——	——

"No. 1 is tungsten steel from Vienna. Nos. 2, 3, 4, 5, and 6, such steel from Bochum. No. 7, hard tungsten steel from Döhlen. No. 8, soft tungsten steel from Döhlen.

"It is frequently maintained that tungsten steel, owing to its superior qualities, is particularly adapted for the manufacture of cutting tools, swords, and the fine machinery of watches, and that a small addition of it would improve the inferior kinds of steel. Appelbaum found the tungsten steel inferior to Huntsman's steel, but superior to common English cast steel; it could also be more easily welded without the application of artificial fluxes, and on hardening required a higher temperature than the English cast steel before cooling. Notwithstanding its reputed qualities, tungsten steel has not been generally introduced, probably owing to the high price and the scarcity of wolfram. Perhaps steel was sold as tungsten steel which did not contain any tungsten, or else its reputed qualities are somewhat exaggerated."

According to Siemens, if tungsten be mixed with iron or steel, the magnetic power of the metals is greatly increased. A one pound ordinary horseshoe magnet will sustain seven pounds, while a tungsten steel magnet of the same weight, will sustain twenty pounds. He also claims that the tungsten steel retains the magnetic property longer than the metal usually employed. This discovery points to the use of tungsten steel for magnetic needles and for magneto-electric machines, and in the manufacture of telegraphic apparatus and is one that ought to be more fully investigated.

Captain Caron, the amiable and accomplished engineer in charge of the Museum of Artillery in Paris, was kind enough to communicate to us the results of his experiments upon the alloys of tungsten, and to contribute some specimens for the cabinet of Columbia College. Although he had a furnace capable of melting steel with the greatest care, he was unable to fuse tungsten to a homogeneous button, and the specimen he gave to us was in the form of a dark gray powder. M. Caron found that the addition of tungsten increased the toughness of metal employed in the manufacture of rifles; it also imparted great hardness to steel. His efforts to produce better bronze and cannon metal were unsuccessful, as tungsten will not alloy with copper, tin, and gun metal, notwithstanding patents have been taken out in England for this purpose.

By fusing cement steel with five per cent tungsten he obtained a regulus so hard that turned steel was blunted in contact with it; the alloy was, however, malleable. M. Caron at that time (1865) seemed to think that tungsten steel was destined to become an important article of manufacture—a prediction that has not been fulfilled, as in the Paris Exhibition of 1867 we did not find this article playing the part that its friends had anticipated for it; tungsten colors, however, were largely represented, as were many of its salts, the uses of which are becoming better known, and may serve as the basis of a future article on this subject.

Previous articles on tungsten may be found in the Scientific American, New Series, Vol. III., 1860, pages 256 and 309; Vol. X., 1864, page 105.

[For the Scientific American.]

CIRCULATION OF WATER IN STEAM BOILERS.

BY CHAS. E. EMERY, ENGINEER.

If heat be applied to the bottom of a glass flask, which has been partly filled with water, containing a little bran, it will be seen that the water rises at the center, as its gravity is reduced by heat, being displaced by colder water, which flows downward along the sides and in at the bottom, and is there heated and crowded up in turn by cooler particles, so that all the water quickly becomes heated, and after a time reaches the state of ebullition, when the surplus heat passes off in steam, and the water currents continue as before. This movement of the water is known as "convection" or "circulation," and must exist in some form in all apparatus designed to heat fluids. If the bottom of a flat shallow pan, containing water, be heated uniformly at all points, the heated water and bubbles of steam will rise directly to the surface, and the cooler water can only find its way back between the bubbles, which is so difficult that if the heat be forced, the whole mass of water will be raised into foam, and the pan will "boil over." This is an example of retarded circulation. Similar action often takes place in steam boilers of bad design. The water is displaced from some part of the heating surface by bubbles of steam which, in extreme cases, become so hot as to allow the sheet to be overheated, and when the circulation is dull the steam bubbles prevent free access of water to the heating surface, so that its efficiency for producing steam is greatly reduced.

Circulation in a steam boiler is then an absolute necessity, and to secure it provision must be made for both ascending and descending currents. We propose to show also that it is necessary that these currents should have separate channels so as not to conflict with each other. Take the simplest plain cylinder boiler. If the fire be applied underneath, the water will rise in the center and flow down at the sides the same as in the flask, but if the heat be spread around the whole of the shell below the water line, it is easy to see that the ascending bubbles at the sides will hinder the down flow at that point and the circulation be, to say the least, retarded. Indeed it is not difficult to imagine that the heat would occasionally be so applied as to reverse the currents and cause the steam and hot water to move outward up the heated sides and the colder water to fall down in the middle. To secure this action is the object of a late foreign invention, which consists in putting within and below the water level of a boiler a concentric sheet-iron shell, which directs the currents up the heated sides and permits the water to return through large pipes attached to the middle of the shell—the space about the pipes forming a still-water reservoir for the collection of deposits.

In cylinder boilers containing tubes the water and steam rise between the tubes and move not only to the sides but also to the cooler rear end of the boiler; and then down the sides, and along the bottom till sufficiently heated to again rise. This has been proved by experiments. A similar action takes place in the Harrison cast-iron boiler and in the Babcock and Wilcox sectional boiler. In the Gerner boiler the steam and heated water rise and pass to the rear around an interior steam chamber, and the rear of the boiler being larger the water rises and flows to the front as it is heated with great velocity.

The drop flue boiler has been a favorite with many engineers, from the fact that the products of combustion descend from one series of flues through two others in the same boiler before reaching the chimney, and thus the coldest gases heat the coldest water—a fine theory, which fails to give any practical advantage from the fact that the system prevents proper circulation unless the boiler be forced to its utmost. These boilers give trouble also from unequal expansion—being hot at the top and cold at the bottom.

In marine boilers a passage for the descending water currents is provided by separating the nests of tubes which belong to each furnace. In the Hicks vertical boiler the ascending and descending currents are kept separate by surrounding the tubes inside the boiler with a short jacket, the water flowing over it and passing between it and the shell of the boiler and entering the tubes beneath it.

A number of boilers are made of tubes sealed at one end and opening at the other into a suitable chamber. In some cases the tubes are set vertically with the sealed ends downward, the circulation being secured by an internal pipe to carry down the cooler water. The fire-engine boiler of a Seneca Falls company, in New York State, is made in this way. On a similar principle Miller makes a boiler in which the tubes are inclined and the inner tubes are supplied from the

front side of a diaphragm in which they are secured and which separates the two currents—the steam and heated water coming out around the inner tube and rising to the surface of the water, and the cooler water going down the other side of the diaphragm, and entering the inner tubes. Two of these boilers are in use at the Beach Pneumatic Tunnel under Broadway, in New York city. Sargent has a similar boiler in which each tube is divided into two parts by a diaphragm running its full length. The oldest boiler of this form was probably made by the German engineer Alban, who used some ingenious means to separate the circulating currents in the connecting chamber, but left them to take care of themselves in the tubes.

BOILER INCRUSUATIONS.

[Condensed from the Engineer.]

Incrustation is injurious in three distinct ways: It increases the consumption of fuel, it injures the boiler, and can even compromise its safety. Incrustation less than one eighth thick allows the passage of only one quarter of the heat it would if the plate were clean. One way in which incrustation injures the boiler is by its requiring the fires to be forced, thereby furthering the oxidation, diminishing the strength, and tending to tear away the plates of the boiler. The very cleaning of the boiler tends to injure the plates and structure. The cleaning of the boiler of a large steamship costs from fifty to sixty pounds in labor alone. At the same time, there is no doubt that a thin incrustation protects the surfaces of the plates against corrosion, and that it often closes up the joints and prevents escapes.

The foreign matters contained in the water can be divided into three kinds: Those that remain insoluble and in suspension, forming a non-adhesive mud, which only incrustates on highly-heated surfaces. Secondly, the salts soluble in water, such as, for instance sulphate of potash, and the chloride of calcium, and the chloride of sodium, found so abundantly in sea water. These remain in solution, and only form deposits when in considerable quantities in the water; and this can be prevented by blowing off. The third class consists of substances relatively little soluble in water, such as carbonate of lime and sulphate of lime. With these, this degree of saturation is soon attained, and they are deposited in the boiler, either in powder, which falls into the interior parts, or in crystals covering the wetted surface. The soluble salts can thus be got rid of by simply renewing the water; the muds produced can be taken away pretty easily by washing; but the incrustations produced by this successive precipitation of insoluble, or only slightly soluble, salts can only be got off by the hammer and chisel. This is generally true, but the relative quantities present in different kinds of water modify these results.

It is a fallacy, exploded forty years ago, that explosions are produced by the sudden contact of the water with the red-hot plates, on the cracking off of the incrustation, causing either "an enormous development of steam," or "decomposing the water with an attendant disengagement of a great quantity of hydrogen."

The means of encountering incrustation are of two main kinds: The water can be purified before being fed in, or different apparatus, applied inside the boiler, can be used for the purpose. Before feeding it in, water can thus be purified by (1) chemical reactions; (2) by heating it; (3) it can be distilled by using the condensed steam as feed-water. In the case of the presence in the water of carbonate of lime, held slightly in solution in the form of bicarbonate, the state of solution being aided by the presence of a slight excess of carbonic acid, by saturating, by means of a sufficient quantity of lime, the excess of carbonic acid, the greater portion of the neutral carbonate will be deposited on account of the very slight solubility of that salt. This plan has been used in England, and also especially by the French Orleans and the North Railway companies. Carbonate of soda can also be employed for the preliminary purification of some waters. It is largely used in some of the Lancashire districts, but it has the inconveniences of causing priming and of favoring leakages.

As the carbonate and sulphate of lime are very slightly soluble at 120° or 130° Cent., and nearly absolutely insoluble at 140° to 150° Cent., the water can be sometimes purified by heating it. The feed-water heater adapted by M. Belleville to his water tube boilers, in order to prevent their being filled up with incrustation, works on this principle. The water, forced in by a pump, is thrown from below against the top plate of a large vertical cylinder, which communicates at the top with the steam collectors of the boiler, and at about the middle of its hight with the water collector. The water injected falls in rain into a chamber wherein flows the steam, on a plate partly occupying the transverse section of the cylinder. From thence it flows into the water reservoir, the level of which is about the same as that of the boilers. The water is heated to nearly the temperature of that in the boiler, and the salts dissolved are precipitated to the bottom of the cylinder, whence they are from time to time blown out.

As regards marine boilers, blowing off with low-pressure and surface condensation in tubular high-pressure boilers, are the only methods now used in practice to encounter incrustation. It is thus mainly in marine engine work that surface condensers have been adopted, though their success at sea is slowly leading to their use on land.

The processes employed within the boiler consists in—(1) blowing out; (2) mixing the water with substances modifying the incrustations either chemically or mechanically; (3) employing the circulation of the water for extracting the matters in suspension; (4) applying electricity against the incrustations. In the Imperial Marine the boilers are continually blown out. As regards the different substances introduced, a volume could be written about them, so numerous are they. In France very good results in preventing solidification have been obtained by the use of logwood shavings. The steam, though the boiler does not prime, is of a violet color, no doubt from its taking up a little water. Logwood is also employed in a liquid composition used on the Orleans Railway. One of the most legitimate means, because inexpensive and obtainable by construction, for getting rid of boiler deposits, evidently consists in utilizing the circulation and the natural tendency of heavy substances towards the bottom. Merely setting the boiler to a slight incline from the fire is, as we know, often very effective; and a conical vessel riveted to the bottom at a spot chosen for its slow circulation is often very useful.

The action of Baker's electric anti-incrustator is very capricious in preventing the solidification of incrustation. It is clear that it acts by electricity, and not magnetism; and evidently by frictional electricity, produced by the friction of the steam on the points of the star. Nothing should be neglected to obtain good feed water; and the chemical qualities of the water to be used should be determined before the form of the boiler to be used is settled upon; then the mode of getting rid of the incrustation is to be chosen—treating the water before its introduction into the boilers being almost always the best method.

[For the Scientific American.]

THE HOME OF THE PERFUMES.

We are in the south of France, on the coast of the Mediterranean, where the three cities of Nizza, Grasse, and Cannes form a sort of triangle. A rich, but yet a light soil; to the north, a range of mountains, which shut out of the cold blasts of north winds—these advantages, combine with a soft sky resembling that of Italy to make this the most charming and the most fertile part of France. It is, therefore, with a true national pride that the peasants of this district are wont to say: "Plant a walking-stick, and a flower will bloom from its handle."

Plants, which everywhere else are cultivated in gardens as ornaments, form here the main product of the soil. There are no gardens here, for the entire district is a bed of fragrant flowers. The jessamine, the tuberose, the orange blossom, the daffodil, the rose, the acacia, and many other plants are bud and bloom almost the year round. The exuberance of these lovely children of Flora affects the character of the inhabitants as well as their mode of living. A stranger is affected by the fragrance as if drugged by some narcotic.

The culture of these flowers is almost the exclusive occupation of the peasants. During the summer months all hands are busy among the flowers—weeding and watering. Old and young are occupied in gathering the leaves of flowers, of which it takes so many to make a pound.

The following statistics will show to what extent this business is carried on: The product of one year has been 1,475,000 lbs. of orange blossoms, 530,000 lbs. of roses, 100,000 lbs. of jessamine, 75,000 lbs. of violets, 45,000 lbs. of acacia, 30,000 lbs. of geranium leaves, 24,000 lbs. of tuberoses, 5,000 lbs. of daffodils, besides a large quantity of lavender, and many other flowers.

The quantity of perfume contained in this mass of leaves may be imagined, yet the peasants themselves do not understand the art of extracting the delicate odors from the flowers, among which nature has thrown them, and it is the chemist who has to continue the work. Thus we behold in the midst of these fields of flowers the signs of modern industry, the numerous tall chimneys of the different laboratories. It is the same here as everywhere else; the first producer has to content himself with but a small profit; and the landowners consider it a good business if they receive from the chemists one third of the total profit.

In these laboratories every spark of poetry connected with the beauty of flowers disappears. The leaves are turned into a solid mass; the balmy essence takes the place of the emblematic interpretations—a chemical process has finished the work.

Oils or greasy substances are impregnated with the odoriferous elements of the flowers by three different operations. Two of these depend upon the fact that oils or fats brought in contact with the flowers, absorb and retain their fragrance. If afterward these perfumed fats and oils are thrown into pure alcohol, the latter extracts the perfume from the oils or fats, and thus an essence is obtained.

These two methods of working are called in France "enfleurage" and "maceration." For the process of "enfleurage" a sort of a frame with shelves is used. Between the wooden shelves are glass tablets, upon which the purified fat is spread. Upon these are laid the fresh-picked flowers. Some forty to fifty of these shelves are piled up and left for twenty-four hours, after which time the old flowers are removed, and fresh ones put in their places. This process is continued until the fat is sufficiently impregnated with the odoriferous principle of the flowers; then the fat is melted from the glass at a moderate heat, and separated from the leaves which may have adhered to it, after which it is packed in jars and boxes, and is then ready for exportation.

"Maceration" is performed by soaking the flowers for a certain length of time in the fat or oil. Practice has shown that not all flowers will yield their perfumes in this way; some discharging their perfume with more facility than others. The acacia is particularly adapted for "maceration."

Of late years another process has been introduced, consisting in treating the flowers with various ethers, etc., but it is not yet in general use. Lastly, the odor of some flowers is obtained by distillation; but delicate odors are injured or dispersed by this operation.

The essence of orange blossoms obtained by "enfleurage" is far superior to that gained by distillation. Lavender is almost the only plant which does not loose by distillation.

Extracts obtained through "enfluerage" or "maceration" are the condensed odors of the living flowers, while by distillation we obtain only a second-class perfume.

It has been a question of considerable importance how to obtain the extracts of flowers of tropical countries. Experiments have been made in Algiers, but without favorable results. However pure the fat or oil used may be, it soon turns rancid in a hot climate. If the process of etherizing is brought to perfection, the flower culture of the south of France will doubtless diminish, for the tropics of America alone would furnish enough perfume to supply the entire western hemisphere.

I. C.

How to Cure a Cold.

Dr. G. Johnson, Professor of Medicine in King's College, London, in a recent lecture gives the following cure for a cold:

"The popular domestic treatment consists in the use of a hot foot-bath at bed time, a fire in the bed room, a warm bed, and some hot drink taken after getting into bed, the diaphoretic action being assisted by an extra amount of bed clothes. Complete immersion in a warm bath is more efficacious than a foot bath; but the free action of the skin is much more certainly obtained by the influence of hot air—most surely and profusely, perhaps, by the Turkish bath. The Turkish bath, however, is not always to be had, and even when available, its use in the treatment of catarrh is attended with some inconvenience. In particular, there is the risk of a too speedy check to the perspiration after the patient leaves the bath. On the whole, the plan which combines the greatest degree of efficiency with universal applicability, consists in the use of a simple hot air bath, which the patient can have in his own bed room. All that is required is a spirit lamp, with a sufficiently large wick. Such lamps are made of tin, and sold by most surgical instrument makers.

The lamp should hold sufficient spirit to burn for half an hour. The patient sits undressed in a chair with a lamp between his feet, rather than under the chair, care being taken to avoid setting fire to the blankets, of which an attendant then takes two or three, and folds them around the patient from his neck to the floor, so as to inclose him and the lamp, the hot air from which passes freely around the body. In from a quarter to half an hour there is usually a free perspiration, which may be kept up for a time by getting into bed between hot blankets. I have myself gone into a hot air bath suffering from headache, pain in the limbs, and other indications of a severe incipient catarrh, and in the course of half an hour I have been entirely and permanently freed from these symptoms, by the action of the bath.

Another simple and efficient mode of exciting the action of the skin consists in wrapping the undressed patient in a sheet wrung out of warm water, then, over this, folding two or three blankets. The patient may remain thus "packed" for an hour or two, until free perspiration has been excited."

A Milwaukee Steam Engine.

If our memory serves we have before heard of something like the following attempt of a Milwaukee inventor to avoid the use of the crank in steam engines. The papers of that city are making predictions that it will work a revolution in steam engineering. We copy the following description from the *Daily Milwaukee News*.

"The engine is very simple, and consists of a cylinder 12 inches long and 6¼ inches bore (in the one already built), with the shaft passing through the center of it. The cylinder is furnished with a piston at each end, precisely like the pistons of common crank engines; to these pistons are connected short rods, with a friction roller at the outside end working in the inside of an elliptical ring, which passes around the shaft outside of the cylinder; outside of the ellipse is another friction roller, connected to the piston by compensating levers in such a manner that when the pistons are moving towards the center of the cylinder, the rollers act on opposite sides of the ellipse, both pulling directly towards the center, thus causing them to move forward on the ellipse, and communicating a rotary motion to the shaft. After the rollers have passed forward to the shortest diameter of the ellipse, the steam is exhausted from the ends of the cylinder and let into the middle, between the pistons, pressing them outward, causing the rollers in the ends of the piston rods to act on the inside of the ellipse, and continuing the forward motion of the shaft until they arrive at the long diameter, when the steam is exhausted from the middle of the cylinder, and is again applied at the ends. The results obtained were surprising, and can hardly be credited by believers in the infallibility of the crank motion. The cylinder is about the size of the cylinder of an eight-horse crank engine, with a stroke of three inches for each piston, and the power evolved was at least 22-horse power, and some present at the trial placed it as high as 25-horse power, with a speed of 100 revolutions per minute, and 50 pounds of steam, consuming about the amount of fuel required for a 10-horse engine"

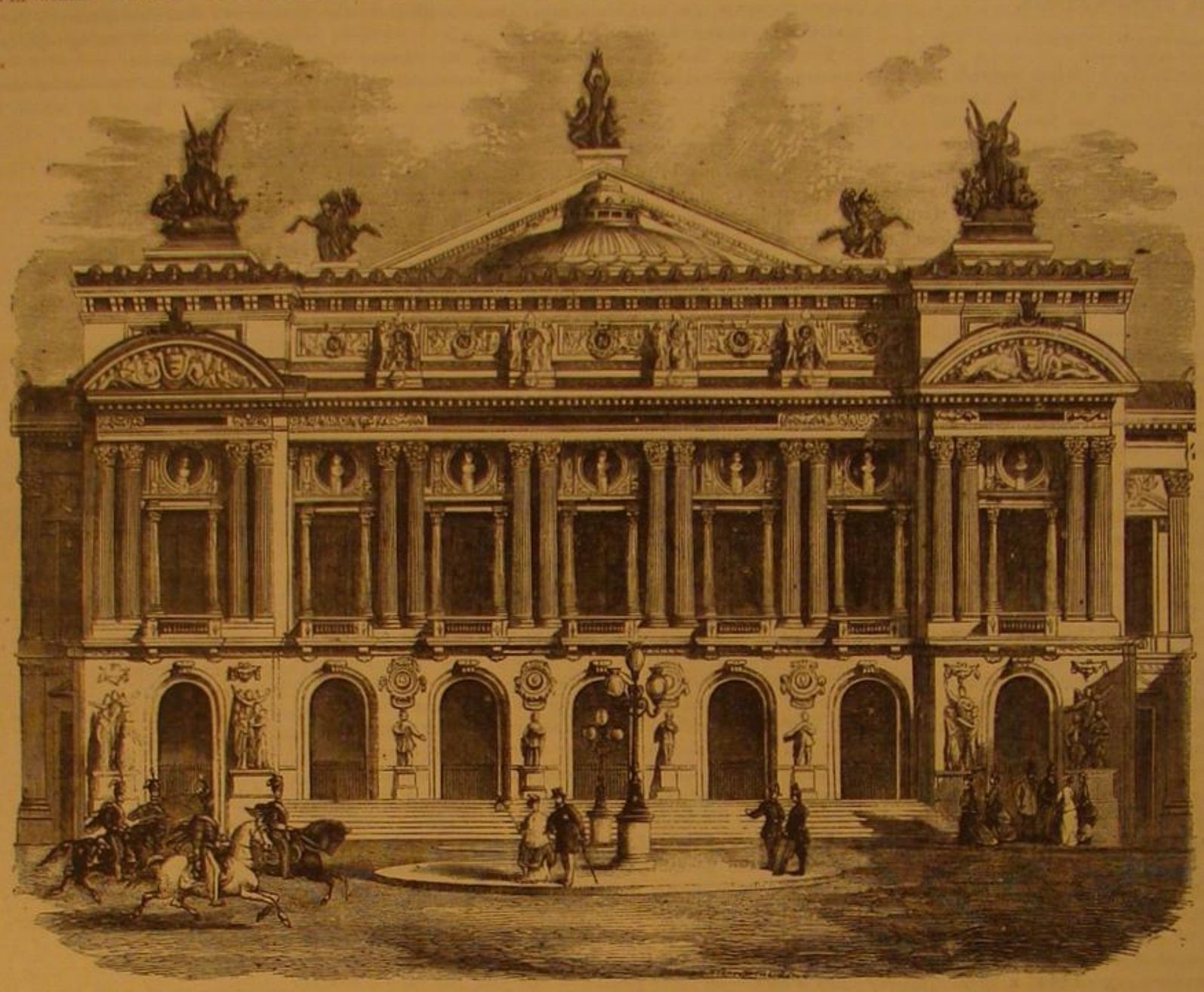
TO CLEAN OLD BRASS WORK FOR LACQUERING.—First boil a strong lye of wood ashes, which you may strengthen with soap lees; put in your brass work, and the lacquer will immediately come off; then have ready a pickle of aquafortis and water, strong enough to take off the dirt; wash it immediately in clean water, dry it well and lacquer it

THE NEW GRAND OPERA HOUSE, PARIS.

So much has been said and written about this remarkable structure, that our readers will be interested in the view of the building we give herewith. It was designed by M. Garnier, a young architect, who by this work has achieved a world-wide fame.

The building has been justly characterized as the finest architectural work of modern times. The view we give of it does not, however, give an adequate idea of its magnitude. The view is that of the façade, and the smaller engravings show some of the details of ornamentation.

The general plan of the building is that of a rectangle, 374 feet in depth by 196 in width. Its cost has been estimated at $8,000,000, one half of which was defrayed by the French Government, and one half by the municipality of Paris.



NEW GRAND OPERA HOUSE AT PARIS.

The order of architecture M. Garnier has chosen is Corinthian. In the basement there are five main arched entrances approached by a broad flight of steps, and two more at the wings which open upon the street level; between the doorways the wall is enriched with groups of statuary, and heads carved in relief upon medallions, wreath encircled, and with the name of the original below each medallion—the names of the great masters of music.—Above the basement rise eight pairs of Corinthian columns, executed in white stone. The intervening bays are occupied, each, by a window opening upon a gallery, the top of whose balustrade coincides with the bases of the columns. The gallery is available as a promenade. Smaller columns between the large range reduce the width of the windows, and support minor entablatures, with circular recesses containing each a gilded bust of a great musician. At the wings the larger columns support circular pediments, which are filled with sculptured groups in relief. The cornice over the row of main columns, extending along the whole frontage of the building, has inscribed upon it in gilded letters the words "Chorographie" and "Harmonie" upon each of the wings—upon the body of the building, "Académie Impériale de Musique." Above the cornice rises a deep frieze, bearing four groups of figures immediately over the columns supporting circles, within which the initial of the Empress is inscribed, the intermediate panels being enriched with a circular wreathed medallion filled with the letter N. The top of the frieze is completed with a series of classic masks, representing Tragedy and Comedy alternately, cast in bronze, and gilded. The wings of the building are surmounted with groups of statuary, at one end the Genius of Poetry, at the other the Spirit of Music. Above the frieze in the center of the building, and crowning the body of the theater, rises a decorated dome, whilst is seen a pediment forming the one face of a large roof which covers the stage and offices of the building. The apex is surmounted by a group, of which Apollo forms the central figure, whilst at the springing of the pediment stands on each side the presentment of Genius curbing in a rearing Pegasus.

On the side elevations of the opera house, the architectural details which characterize the façade, are preserved, the line is broken below by the presence of a semicircular pavilion on each of the lateral frontages. Here, too, is seen the side elevation of the large roof spanning the stage, so that a totally different aspect to that of the main façade is obtained. At the rear there is but a small pretense to architectural effect.

Every part of the building is fire-proof. The walls and staircases are of stone, the columns—five hundred in number—supporting them and the tiers of boxes are of marble from Mont Blanc. All that in an ordinary building would be of timber—the carpenters' work—is of iron. The only inflammable material will be the scenery—easily separable from the auditorium and its dependencies—and the paneling and drapery of the boxes. An alarm of fire—from which, even if proved false, such frightful results have ensued in public places—will certainly be accompanied by the minimum of danger, so numerous and capacious are the outlets.

The ceiling will, when finished, be composed of a vast number of plates of copper screwed one to the other in such a way as to be easily put together and taken to pieces again, and thus permitting the ceiling to be raised or lowered at will. The whole is divided into several sections, which are now being painted with allegorical representations of the hours of day and night, more than a hundred figures being included in the whole. The place in which the artist carries on his labor is situated in the grand cupola over the pit, and forms an immense rotunda, 120 feet in diameter, and 65 feet in hight.

The Invention of the Art of Printing.

The *Typographic Messenger* says: "While the majority of bibliographers concede to Gutenberg, of Germany, the inestimable honor of inventing printing from movable types, there are many others who contend that to Koster, of Holland, is due the merit of the invention, and that Gutenberg was but an improver upon Koster's idea. This difference of opinion has led to much investigation into the merits of the respective claimants for this distinguished honor, and the work of Mr. Humphreys', including, as it does, the latest facts on the subject brought to light, seems to indicate strongly that to Holland the world is indebted for the birthplace of the wonderful 'art preservative of all arts.' Copies of a work entitled the 'Speculum Humanæ Salvationis' (the Mirror of our Salvation)—claimed to be the first book ever printed in which movable types were employed—are still in existence, and are said to have been the production of Koster about the year 1430. This date has been arrived at from cotemporaneous circumstances bearing upon the subject, and which, if correct, places Koster's right in the matter many years prior to Gutenberg's earliest attempts towards the perfection of the invention.

"In disputing that Koster was the originator of the art of printing from movable types, some of the supporters of Gutenberg, while admitting that Koster issued the 'Speculum Humanæ Salvationis,' have contended that it was a block book, as Koster's occupation, previous to 1430, was that of engraving and printing such books; but a critical examination of the work in question has shown that fac-simile defects in particular letters have been detected throughout the entire work. A single instance, too, of an inverted letter, and several typographical errors in the substitution of similarly shaped letters for the correct ones (a fault that has been faithfully copied by too many of the latest imitators of their celebrated predecessor), show that the 'Speculum Humanæ Salvationis' could not have been an engraved book, or these discrepancies would not have been made.

"It is supposed that the first efforts of Gutenberg to introduce the invention of printing from movable types into Germany, took place at Mayence about the year 1436, although it does not conclusively appear that any productions of his press were issued previous to 1455 or 1546, the probable date of the publication of his Bible. It is reasonable to infer, however, that before the completion or even the beginning of that great work, minor experiments were made to demonstrate the success of his enterprise. Koster's supporters agree that Gutenberg received his first knowledge of printing from movable types from a workman (thought by some to be Fust), who had left Koster's service in Holland, and fled to Germany with tools and specimens of the workmanship of Koster. The mechanical excellence of Gutenberg's productions being so much superior to the earlier efforts of Koster, it is not improbable that in the material progress and success of the art in the hands of the former, Koster's still greater originality was soon lost sight of.

"While Gutenberg's name is more prominent than those of his associates, Fust and Schoiffher, as the master-mind of their great undertaking, it is more than likely that his stupendous work, the Bible, was issued by the latter two; it appearing that his interest in the business was brought to a lamentable termination by the foreclosure of a mortgage held against him by John Fust (Gutenberg's partner, and thought by some to be the uncle of Fust, Koster's workman), for moneys advanced to further and complete his ideas, and that Gutenberg, having up to the time of the foreclosure received no profit from his labors, was forced to retire just as his noble work was on the eve of a glorious consummation. It matters little whether to Koster or Gutenberg is due the credit of the most valuable invention ever produced for the elevation of the human race; but the genius of Gutenberg, as displayed in his wonderful achievement of the first Bible printed from movable types, is bound to perpetuate his name and works until printing is no more."

ACCORDING to a recent author, iridium, as used in coloring glass and porcelain, gives a tint of such intense blackness, that if charcoal does not make a white mark upon it, all other blacks appear brown by the side of it.

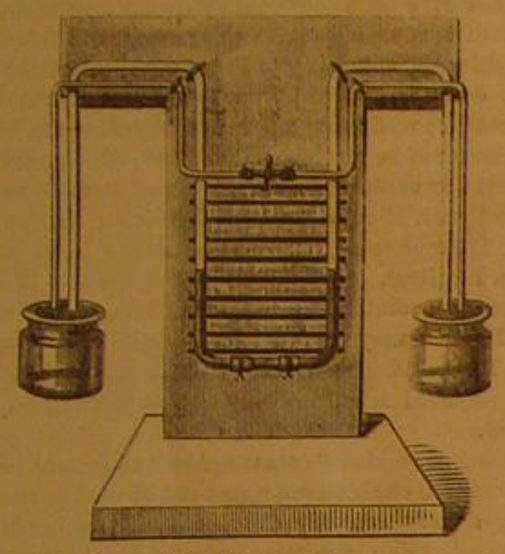
THE caisson for the Brooklyn end of the East River Bridge was successfully launched on Saturday, March 19, and will soon be in position.

A HOME-MADE DIFFERENTIAL THERMOMETER.

In the proceedings of the British Pharmaceutical Conference for 1868, Dr. Matthiessen's Improved Differential Thermometer with pendent bulbs is described and illustrated. This instrument is adapted for illustrating many fundamental facts relating to heat, and is now commonly employed in lecture experiments by our leading chemists and physicists.

We have much pleasure, says the *Chemist and Druggist*, in calling the attention of chemical students to a simple but effective modification of Matthiessen's thermometer, in which two wide-mouthed bottles and a few pieces of glass tubing are made to serve the purpose of the costly work of the glass-blower. The construction of this home-made apparatus is plainly shown in the following engraving.

The small bottles represent the glass bulbs of the original instrument. Each of these bottles is closed by a sound cork, through which two glass tubes pass. These tubes are bent into a series of angles by the aid of a gas flame, and their free ends are connected by pieces of india-rubber tubing. The ends of the smaller glass tubes do not meet, and their india-rubber connecting piece is furnished with a pinch-cock. The two wider tubes are also connected by a piece of india-rubber tubing. This joint is made merely to avoid the difficulty of bending a single length of glass tubing into the required form. Some colored liquid is introduced into the central portion of the main tube, and the whole arrangement is attached to a wooden stand bearing a scale formed of dis-



tinct horizontal lines. The hight of the apparatus is 1 foot 7 inches; the greatest width, 1 foot. Two-ounce bottles are used for the air vessels, and they are supported at the hight of about 5 inches from the ground, the main tubes rising 10 inches above the corks.

The instrument will not indicate general changes of temperature, but only differences between the temperatures of the two air vessels. If one of the air vessels is exposed to a higher temperature than the other, the air contained in it expands, and drives the colored liquid in the tube towards the cooler vessel. The relative hights of the two columns of liquid in the vertical portions of the tube are plainly indicated by the scale attached to the stand. By opening the pinch-cock, the pressure upon each column of liquid is equalized, and the level is thus adjusted for a new observation without loss of time.

The following instructive experiments, which our younger readers may repeat with profit, will illustrate the use of this sensitive instrument in physical research:—

LATENT HEAT.

I.—*Disappearance of Heat during Liquefaction.*—Place the air vessels of the thermometer in two tumblers containing water at the ordinary temperature. Having noticed that the level of the colored liquid is undisturbed, throw into one of the tumblers some sodium sulphate (Glauber's salt). The solution of the salt is attended by a reduction of temperature, which is at once made evident by the movement of the colored liquid towards the cooler vessel.

II.—*Latent Heat of Water.*—Fill a vessel with coarsely-powdered ice, and allow it to stand in a warm room until much of the ice has melted. Place the air vessels of the thermometer in tumblers containing equal quantities of luke-warm water. Then add to one portion of the warm water a weighed quantity of the unmelted ice, and to the other portion an equal weight of the ice-cold water. The rapid rise of the colored liquid, in the vertical portion of the tube next the tumbler containing the ice, will prove that a given weight of ice has a much greater cooling effect than an equal weight of ice-cold water.

III.—*Evolution of Heat during Solidification.*—By slowly cooling a solution of sodium sulphate, saturated at a high temperature, it is possible to obtain a cold supersaturated solution, which will crystallize suddenly on agitation. On plunging one of the air vessels of the thermometer into such a solution, which has been cooled down to the temperature of the surrounding air, the evolution of heat during the crystallization of the salt will be manifested by the movement of the colored liquid towards the cooler air vessel.

These three experiments illustrate fundamental facts relating to heat. When matter passes from the solid into the liquid state, heat disappears or becomes *latent*, and ceases to affect the thermometer; in other words, *sensible heat* is converted into *potential heat*. Conversely, when a liquid becomes solid, its potential heat is reconverted into sensible heat.

SPECIFIC HEAT.

IV.—*Oil and Water.*—Into two tumblers introduce equal quantities of warm water, and test the equality of temperature in the two portions by means of the thermometer. Now add to one portion a given weight of cold water, and to the other portion an equal weight of cold olive oil. Mix the liquids by moving the thermometer up and down. The mixture of oil and water will be found to be warmer than the water, although its bulk is sensibly greater. [The greasy bottle should be cleaned with a little benzole after this experiment.]

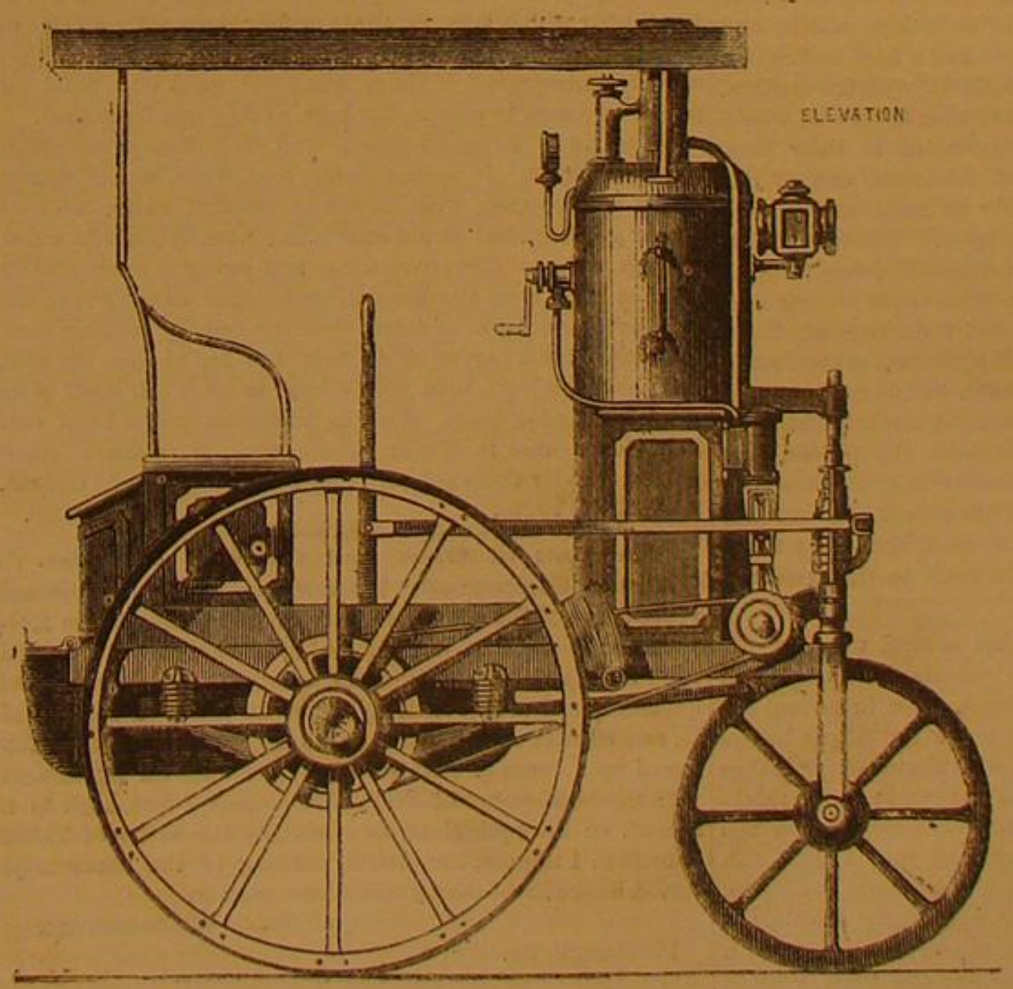
V.—*Zinc and Lead.*—Take equal weights of zinc and lead attached to threads, and having raised them to the temperature of 100° C. by immersion in boiling water, plunge them for a few seconds in equal bulks of cold water contained in two tumblers. On placing the air vessels of the thermometer in the tumblers, the movement of the indicating liquid will show that the zinc in cooling has parted with more heat than the lead.

VI.—*Relation of Combining Weights to Heat.*—Repeat the last experiment, but instead of taking equal weights of zinc and lead, take weights having the ratio of the combining weights of these metals (Zn=65, Pb=207). On plunging the air vessels into the tumblers of the warmed water, there will now be no disturbance of the indicating liquid; in other words, the thermometer proves that 65 parts of zinc and 207 parts of lead evolve sensibly the same amount of heat in cooling through a given range of temperature.

The last three experiments illustrate very forcibly the difference between heat and temperature. The temperature of a body affords no indication of the actual quantity of heat it contains. A pint of water may raise the mercury of an ordinary thermometer to the same degree as a gallon of water, but it is obvious that the larger volume of the liquid contains the greater amount of heat. Equal weights of different substances, in undergoing a similar alteration of temperature, evolve or absorb very different quantities of heat. These quantities of heat, expressed relatively to the quantity required to raise an equal weight of water from 0° to 1° C. are called the *specific heats* of the various substances. Now the specific heat of olive oil is much lower than that of water, consequently, in Experiment IV., the oil robs the warm water of comparatively little heat, and the resulting temperature of the mixture is higher than that of the mixture of warm and cold water in the other tumbler. Again, the specific heat of zinc is much greater than that of lead, consequently the mass of zinc used in Experiment V., gives out more heat in cooling than the mass of lead. The last experiment illustrates the important chemical fact that the combining weights of the elements are comparable quantities in their relations to heat. Thus, 23 parts of sodium, 108 parts of silver, 65 parts of zinc, 207 parts of lead, and 210 parts of bismuth, give out or absorb sensibly the same quantities of heat in passing through the same range of temperature.

ONE-HORSE ROAD STEAMER TO CARRY TWO PERSONS.

In the annexed engraving we give a design by Mr. L. J. Todd, Leith, for a little road steamer or steam velocipede, which will interest many of our readers. The main frame consists of a single angle iron. The boiler contains three



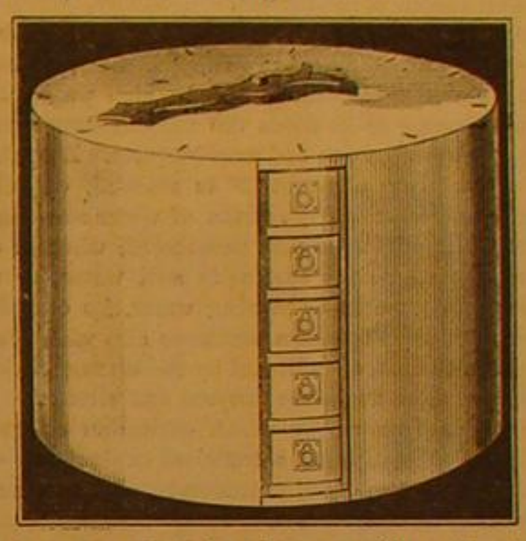
quarters of a square foot of grate surface, and about 16 feet of heating surface. The coal bunkers are situated on each side of the boiler. The driver's seat is made long enough to contain two persons, and is hinged at the top to form a locker inside. There is a tool chest at the back of the seat with hinged lid. The water tank is placed below the frame, and has a filler standing out behind. The driving wheels are four feet in diameter, and have steel tires one quarter inch thick; on to the boss of each driving wheel is fixed a grooved driving pulley fourteen inches in diameter. The main axle is cranked to clear the tank, and each driving wheel runs loose on it. The main bearing springs are fitted with rubber washers; there is also a brake on each wheel worked by a foot lever. On the main frame, to the forward side of each bunker, are fixed two plummer blocks which carry a double-throw crank shaft. The steam cylinders two and a half inches diameter by four inches stroke, are fixed to the top of each bunker; there is no reversing gear, but a single eccentric working forward and cutting off at five eighths. On each end of the shaft is fixed a friction cone carrying a grooved pulley six inches diameter, and from this pulley motion is communicated to the driving wheel by a half-inch gut cord, thus allowing the engine to turn with facility. The single leading wheel is carried in a fork fitted with a volute spring and rubber washer, and governed by levers as shown. The boiler is fed by a No. 1 brass injector placed through the foot plate. The engines are covered from the weather, and it will be seen that there is plenty of power to ascend a considerable incline. As regards speed, it could be guaranteed to run 100 miles per day of ten hours over any high road in England, which, with a good driver, might be considerably increased. In conclusion it may be stated that it is the duty of the man on the right to drive and steer, and, if necessary, work the brake, and the one on the left to fire the boiler and look after the water.—*The Engineer.*

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Universal Screw and Brad Box.

MESSRS. EDITORS:—A desideratum in all cabinet and coach makers' shops is an arrangement of boxes or drawers in which to keep screws, finishing nails, etc.



In the accompanying drawing, you will see the plan upon which I made a screw and brad box for my own use. And regarding the efficiency of the arrangement I can say it fully meets the demand. It is of a circular form, though not necessarily so; the casing inclosing any number of rotary shelves which have a post passing through their centers, the post working in the lower and upper circular boards of the casing. The shelves are separated to the required depth of the drawers. Facings or small strips reaching from the lower to the upper shelf, being fastened to each shelf, serve to brace the shelves, and also form side rails for the drawers, of which there will be as many on a shelf as there are of facings.

The post upon which the shelves are fastened, passes through the top board of the casing far enough to fasten a pointer on it. This top casing is numbered with the length of screws, brads, etc., etc., in such a manner that when the pointer—turning which of course turns all the shelves—strikes the length of screw or brad as numbered, the screw or brad drawer is at the vertical opening, which may be closed when not in use, by a door. For screws, of which one length has different thicknesses, there may be as many drawers used, one above another, as there are thicknesses of screws, and the drawers then numbered with the thicknesses. One circular row of drawers will serve for brads; the rest may be devoted to screws.

J. B., JR.

New Franklin, O.

Girdling Fruit Trees.

MESSRS. EDITORS:—Seeing in your paper of February 19th a notice from the Boston *Journal of Chemistry* on the recovery of fruit trees after being girded, I beg to inform you that in Europe the practice is quite common, and it is very common to serve individual branches so, every gardener knowing that a branch so served will be covered with blossoms the following year.

C. H. H.

Thomaston, Conn.

The Value of a Practical Journal.

MESSRS. EDITORS:—For years I have taken the SCIENTIFIC AMERICAN by subscription and through news agents, and since you cannot be insensible to the vast good and pleasure you render your readers, it may not be amiss for me to say

that the single number of March 5th furnished me with information that I would quickly have paid $15 for, in the articles, "Tyndall on Haze and Dust," and the answer under Correspondence to "S. T. T., of Md."

Your paper seems to stimulate thought as was written by Hon G. P. Marsh in "Man and Nature." He says: "In these pages, as in all I have ever written or propose to write, it is my aim to stimulate not to satisfy curiosity, and it is no part of my object to save my readers the labor of observation or of thought." Warren D. Parker.

Janesville, Wis.

Ice Formations.

Messrs. Editors:—Having carefully noticed several articles of late in your columns concerning "Ice Formations," I have intended each week to communicate some facts which have fallen under my own observation for several years past, but have postponed doing so for want of time.

Your issue of Feb. 19, page 129, contains a valuable collection of facts almost all of which corroborate my own observations and conclusions for years past, and convince me that these remarkable phenomena are simply the results of that one single exception in nature's laws which teaches us that all bodies *expand by heat and contract* from loss of heat, or as it is termed "*by cold.*"

It is well known that water is that exception, and is the design of an allwise provision to prevent our wells and streams from becoming a solid mass of ice, first commencing at the bottom and reaching to the surface.

This attribute of water manifests itself at about the temperature of 40° Fahrenheit, when its cubical measurement has reached its minimum in bulk, and from which point of temperature all changes up or down the thermometer causes it to expand and become more and more buoyant. If downward until the temperature of about 32° is reached, congelation commences; and wherever the strata of water reaching this temperature for the moment may be situated, whether on its way ascending towards the surface in still water, or while rolling along in streams or moving water, its congelation commences; and the expansion continues also with the loss of each degree of heat, as indicated by the thermometer, and the ice becomes more and more buoyant and strong.

This provision of nature by which expansion commences before congelation, is of itself a sufficient explanation of all the curious ice formations and protuberances from the surface of water during its congelation.

Many an hour I have sat and watched beside my glass aquarium, both in sunlight and shade, in a cold room, the formation of ice upon the surface and glass sides, from its incipiency until it had acquired two inches or more in thickness, before ice would commence forming upon the bottom, although the exposure was all the same and the iron bottom actually a better conductor to abstract the coloric from the water than the glass sides and atmosphere. Often I have seen shooting almost instantaneously from the highest points of the largest pebbles along the bottom, when the point of congelation is reached there, thin flat spires of ice, as thin as tissue paper, and about one eighth of an inch in width, and extending from one and a half to two and a half inches in a straight line, but always inclining nearly 45° with the horizon, and to the northward. These spires as soon as formed would in turn shoot from their edges, commencing at their base, flat branches of the same width and thickness, and of one half to one inch in length, and nearly at right angles, and all in the same plane with the main spire. These branches would be as near each other as seemed possible, thus forming a beautiful representation of the pointed ends of the fern leaf. In another moment the ice would form between these branches from the main stem to near their ends, thus presenting a beautifully radiated leaf-like formation with serrated edges; and in another moment this formation, apparently from its buoyancy, would become separated from the pebble, and shoot rapidly upward to the surface ice, or if at the opening made through the surface it would often protrude full half length above the surface as it came upward, then float flatly upon the water and immediately affix itself to the surrounding ice.

These formations were so rapid that several would sometimes be formed in the space of one minute, and what was occurring at this one point could often be seen in several different parts of the aquarium, which was about fifteen inches square, and twenty-four inches long, with about twelve inches of water. After the ice had reached about two inches in thickness on the sides and surface, it commenced forming on the bottom even more rapidly, and adhered to it. A gold fish about five inches long, which had been in it nearly two years, became completely surrounded, and apparently motionless. The freezing being allowed to progress until the center with the fish became one solid block of ice, and the glass sides as well as surface began to bulge from expansion, with every indication of fracturing; at this juncture the temperature of the room was raised and thawing commenced, when after about thirty-six hours the ice disappeared and the fish became as lively and healthy as before his cold bath, and lived nearly a year afterwards. I should have remarked that the thermometer indicated nearly three degrees higher temperature of the water at the bottom than at the surface during the leaf ice formations.

The last phenomena of different temperatures can always be noticed by using two thermometers in ice cold water in an ice pitcher or jar having floating ice, and with the water to the depth of eight to ten inches or more, as the bulb at the bottom will indicate from two to three degrees higher temperature than that near the surface.

With these remarks I conclude, by simply stating that the temperature of the ice in the aquarium, when solid, indicated only about six or eight degrees of cold as it is termed, or about 24° to 26° Fah. Horace L. Emery.

Albany, N. Y.

[With this interesting contribution from Mr. Emery we close the discussion of "Ice Formations," which seems to have elicited much attention.—Eds.

Errors in Regard to Gravitation.

Messrs. Editors:—In your issue of January 29th, current volume, Mr. B. F. Wilson treats facetiously the common errors in respect to the tendency of all bodies near the earth to fall toward its surface. He should *write* with gravity in treating of gravitation. He says:

"The notion that shots rise after leaving the gun is probably older than rifles."

We differ from him. Why not add, for popular instruction, show that this notion probably had its origin in the disposition of the sights of guns? All sights are such that the eye used in firing looks along a line that crosses the axis of the gun prolonged, and reaches the object aimed at more or less below that line. Hence there are two "points blanc;" one where the axis of vision crosses the axis of the barrel of the piece, and the other at the point where the parabola, described by the ball in falling, crosses the axis of sight. Any object struck by the ball between these two points blanc, will apparently, show that the ball has risen, because the point struck will be above the axis of sight.

The impression that a ball rises after leaving the piece, has probably been produced by the common impression, that the line of sight is parallel with the axis of the gun barrel. C. G. Forshey, C. E.

Galveston, Texas.

Inspection of Steam Boilers.

Messrs. Editors:—I was reading in your last paper about the "Inexplicable Power" at Dayton, Ohio. Now in this State (Conn.), there is a law providing for the inspection of steam boilers once a year. Well, the inspector comes around, and as the owner of the boiler don't want to stop work, he inspects the steam gages, looks at the safety valves, asks a few questions, and gives a certificate, which is locked up in the safe. He takes his money, and you see no more of him until next year, when it is gone over in the same way. I am running a set of boilers now, which I will guarantee the inspector knows no more about than you would, should I give you a description of their make. Sometimes they will try water pressure, but I have never seen a boiler thoroughly inspected since the law has been in force. And in consideration of the fact that there is not one in ten engineers (?) that has the least knowledge of the powerful element of which he has charge, is it not a wonder that there are not more wholesale murders than there are now? Nimrod.

Log Roller Wanted.

Messrs. Editors:—Nothing is more needed in our heavily timbered bottom lands than some invention that will enable us to get rid of the timber on our clearings with more ease. By far the heaviest part of clearing is getting rid of the timber which falls, for three or four years after a piece of land is cleared. Thousands of acres would be cleared that now lie unimproved, if there was some good way fixed for one or two men to pile up the logs, so they can be burned.

Ox teams in Texas are cheap, and every farmer can afford a good ox team. It occurs to me that some sort of wagon might be invented, with bowed or crooked axles, without center gearing, that would enable one man, by aid of a screw to each axle, to drive over a log and swing it some four or six feet high from the ground, then, after hauling it to the pile, put under jacks or props, clear the ends by turning back the axles, lay a pair of skids from the log to the log pile, then give the log a turn with a lever to let it roll itself to its place on the log heap. Such an invention would be of vast importance here in Texas, where there is so much unimproved heavily timbered land that must some day be cleared.

Crockett, Texas. I. A. Ansley.

The Unit of Work and the Unit of Force.

Messrs. Editors:—By the criticism on my Foot-pound paper (page 157) I am erroneously made to assume the foot-pound to be a *unit of force* instead of a *unit of work*. I quoted the term "unit of force" from authority, adding marks of quotation, and regret their omission in print. I conformed to, and treated, the quoted term to its results, and then followed by a more practical view, suggesting its agreement with the horse-power of Watt—550 pounds, 1 foot high in a second, or its equivalent, as stated by the critic, of 33,000 pounds in 1 minute. A careful reading of the manuscript would have shown the criticism unnecessary.

Thos. W. Bakewell.

Pittsburgh, Pa.

PROFITS OF ADVERTISING.

The benefits of advertising are appreciated by a great many of our most successful firms, but this mode of creating business is not half enough considered by the majority of persons who are complaining of dull times. Persons having machinery or patents to sell should read the following unsolicited letter:

Messrs. Munn & Co.:—*Gentlemen:*—The first time that I ever advertised in any paper was in your issue of Feb. 12, 1870, for the sale of my patent right for the South and West for my kerosene oil safes. I was hard to be convinced of the advantage to be received, and I am most happy to say that my expectations have been realized. I have reaped from the single insertion nearly $4,000.

Most respectfully yours, G. D. Anderson.

Peekskill, N. Y., March 14, 1870.

RECENT SPECULATIONS ON THE EARTH'S ORIGIN.

[From the Evening Post.]

The *Edinburgh Review* for January has an interesting article upon "Geological Theory in Britain," which sums up the results of recent inquiry and speculation among scientific men in this great field. Nothing shows better the great change which has taken place in the tendencies of scientific study of late years than the new geological theories now discussed. A generation ago, it was the accepted practice of each branch of science to pursue its own course in isolation; to devote its strength to filling up its own outline, rather than to connecting that outline with other branches; and so, by an ever minuter division of labor, to cut itself off more and more from the current of thought among intelligent men in general, and to fall into the hands of trained but often narrow specialists. Now all this is changed, and the natural sciences are linking themselves together more closely every day. Astronomy, geology, natural history, mineralogy, physical optics, chemistry, and electricity approach the solution of the same questions hand in hand; and the most influential theorists in each of these branches are men whose researches extend, more or less, into them all.

The reviewer divides all theories as to the course of geological changes into three classes—those which assume forces formerly at work, entirely distinct in kind, or at least in degree, from any now known; those which assume that the forces of nature are strictly uniform, and that the past changes in the earth have been produced by causes now at work; and those which assume a definite progress towards some goal. Catastrophism is, according to Professor Huxley, the doctrine of a past era in geological inquiry; uniformitarianism, that of the present; while to the third, or evolutionism, he assigns the high honor of being that of the future. The evolutionists of the present day are few in number, but eminent in reputation. Dr. Tyndall, Mr. Herbert Spencer, Professor Huxley, and Sir William Thompson may be quoted as the most prominent leaders in England. The doctrine of the origin of species is indeed merely evolutionism applied to biology, and so far Mr. Charles Darwin may also be considered to belong to this school. Its founder was the great Emanuel Kant, whose work in physical science is only now beginning to be duly recognised.

The notion of sudden "catastrophes" at remote periods, by which mountain chains were upheaved or seas opened, is now generally abandoned. Sir Charles Lyell has succeeded in making the doctrine generally accepted that geological facts are to be explained by forces now at work; that the same power which now raises the coast of Scandinavia at the rate of a few inches in a century, and depresses that of parts of New Jersey about as fast, if it has time enough to work in, will suffice to make continents of all the oceans and to submerge every continent; that the earthquakes and eruptions which have built up some mountains and islands in our own time need nothing but more time to build innumerable others But, according to the most enterprising speculators in this field, the last word on the earth's history is not to be spoken by geology alone; and the changes which are recorded in the rocks under our observation are not the limits of our inquiries.

Indeed, the other sciences sometimes attempt to contradict the conclusions of geology. Mr. Darwin thinks that the washing away of the rocks from the ruins of which the famous "Wealden" strata in the southeastern part of England were formed could not have taken place in less than three hundred million years; and others have thought it more reasonable to assume ten times that period as necessary. But Sir William Thompson insists that this is contrary to known principles of physical science. He says that the sun and moon, acting on the tide wave of the ocean, slowly retard the motion of the earth on its axis; so that it must have been revolving so fast one hundred millions of years ago that no life could exist on its surface, while even the lowest of the Wealden strata are full of fossils. He says the sun is losing its heat by radiation so fast that, at the present rate of emission, it could not have illuminated the earth so long as the geologists claim; while the earth itself must have been one molten mass at anything like the remote period to which they refer these rocks.

But all these arguments are indefinite and unsatisfactory. That which seems most susceptible of one day furnishing a precise argument is the tidal retardation of the earth; but mathematicians are by no means agreed as to its degree, or even its nature; and the reviewer seems to us to attach entirely too much weight to it. It is not certain that it exists to anything like the extent claimed by Sir William Thompson; if it does, it is not certain how long it has existed to this extent; for the form, size, and continuity of the ocean, the distance of the moon and some other elements of the problem may have varied. But, however this may be, Mr. Huxley shows that one hundred millions of years afford probably room enough for all known geological facts. Doubtless a far longer period is probable: and no astronomical or physical presumption has yet been raised against it.

The new geology, then, inherits from the old school the right to assume all the time it needs; it accepts from the "uniformitarians" their rigid adherence to the doctrine of the permanence of law, and claims no force not to be found now at work in nature; but it extends its inductions into new fields of thought and discovery. It finds the system of worlds now existing in space consisting of the following, among other, forms of matter:

First—There is the sun, clearly proved to be a "great fiery globe surrounded by an atmosphere of intensely heated gases and vapors, that are continually rising or falling, like our clouds, according to their change of temperature." Flames

of burning hydrogen flare out seventy or ninety thousand miles beyond the dazzling atmosphere of light. This "photosphere" itself has already been proved, by spectrum analysis, to contain certainly thirteen elements familiar to us on the earth, besides some that are doubtful. In other words, the sun is made of the same materials as the earth, but on fire.

Second—The stars, so far as they can be examined, yield similar results. Nine of our elements have been detected in Aldebaran, including three metals not yet observed in the sun. The nebulæ are made up, some of remote solid stars, but some chiefly of such well-known gases as hydrogen and nitrogen. In short, the starry heavens are made up of matter similar to that of the earth.

Third—The planets generally resemble the earth in form, in solidity, in atmosphere, in their general relation to the sun and his system. Most of them are veiled, some of them very thickly, with clouds; but when their faces can be seen, they show still more striking resemblances to the earth. Mars, for instance, is whitened in every one of his long winters, over all the polar regions, by heavy falls of snow, which melts away again in summer.

Fourth—Meteorites frequently fall to the earth out of space. They are but small planets, turned out of their course by its attraction; and they bring to it nothing new. Twenty-seven of the elements have been found in these wandering bodies; combined just as they often are in our own rocks; and supposed, with the strongest reason, to be specimens of what the earth contains in its hidden depths.

Other facts might be quoted, in addition to those furnished by the reviewer, and bearing on the same conclusion. He might have pointed to the recent researches of Professor Tyndall into cometary matter; to the spectroscopic revelations concerning the identity of the Zodiacal Light with the sun's "corona"; and to recent speculations upon the auroral streamers. But these are enough to justify his inference:

The inevitable conclusion derived from the study of the heavenly bodies—of sun, earth stars, meteorites, and nebulæ—is that the immeasurable space is full of matter of the same kind, but aggregated in different fashions: sometimes being gaseous, at other times solid, sometimes in a state of the most intense heat, at other times cooled sufficiently to admit of the presence of life, as in the Earth and Mars, or lastly, cold, barren, and lifeless, as in the meteorites. Whether the gaseous condition of matter preceded in any particular case the solid we cannot tell. So far as our earth is concerned, the only idea that we can grasp of its origin is that it was a fiery body like the sun, and that it has been gradually cooling from that time down to the present day. This realization of the steady change is a fundamental doctrine of evolutionism.

In short, the earth was once a molten ball, a source of light, like the sun. It has cooled off, and is cooling still. The sun too is cooling; its vast size makes the process slower; but the result is inevitable, and it will one day be what the earth is now. On the other hand, the earth, too, has its destiny: "the time will arrive when, like a meteorite, it will become cold to its very core, and when life will cease to be found upon it, on account of the low temperature." The process may be delayed by collisions with other bodies; for the immense force with which they move is turned into heat by impact, and the stoppage of the motion of the earth itself, by falling into the sun, would furnish as much heat as is radiated from the sun in ninety-five years. "It is absolutely certain that all planetary matter is inevitably gravitating toward the sun, which will be the common bourne of our system. 'As surely,' eloquently writes Sir William Thompson, 'as the weights of a clock run down to their lowest position, from which they can never rise again, unless fresh energy is communicated to them from some source not yet exhausted, so surely must planet after planet creep in, age by age, toward the sun; not one can escape it fiery end. In like manner the satellites of the planets must inevitably fall into their respective planets.'"

The reviewer refuses to look beyond this melancholy conclusion, and will not regard this history "as a never-ending cycle of change, or as a kind of phœnix life." To him, the aggregation and final chilling of the entire system into one blind, black, lifeless mass is simply the end. But, admitting all to be true which he shows to be probable, what becomes of the heat thus lost? Whither is to go the force that now animates and revives the universe around us? Assuredly the task of such speculations is not ended, until that force is traced into new relations, which, since no reason is shown for the contrary, may be pictured as more varied and glorious than any in the present.

After the close of what he terms the evolution of the system, and after its final catastrophe, the boundless space will still contain all of matter and all of force that are in it now; and if these have sufficed for the organization of our present cosmos, they may suffice for another. There is nothing in the argument before us to show that this is an exception to the starry universe at large; that life is limited to one or a few of the heavenly bodies, or even that mind, in some of its conscious forms, is confined to one stage in the great cycle of their evolution. Rather, the strong analogy shown to exist between the earth and all her sister spheres, suggests that the entire creation may be one, not only in its substance and in the laws which control its masses, but also in the constant and universal production of beings capable of enjoying its bounties and delighting in the intelligence it expresses There is nothing to show that the particular astronomical epoch in which we live is an exception to the general history of the universe, or that this earth and those who inhabit it are the highest achievement of the formative skill which built the whole.

It is still open to the dreamer to amuse his leisure, or to the believer to comfort his faith by peopling myriads of worlds with nobler beings than ourselves; and to even imagine that the inevitable wreck of our little earth and narrow sky will be watched by them from without, as one scene of a larger drama in which many such tragedies are included, but whose end is good.

Hardening Saws and Springs.

Saws and springs are generally hardened in various compositions of oil, suet, wax, and other ingredients, which, however, lose their hardening property after a few weeks' constant use: the saws are heated in long furnaces,and then immersed horizontally and edgewise in a long trough containing the composition; two troughs are commonly used, the one until it gets too warm, then the other for a period, and so on alternately. Part of the composition is wiped off the saws with a piece of leather, when they are removed from the trough, and they are heated, one by one, over a clear coke fire, until the grease inflames; this is called "blazing off."

The composition used by an experienced saw maker is two pounds of suet and a quarter of a pound of beeswax to every gallon of whale oil; these are boiled together, and will serve for thin works and most kinds of steel. The addition of black resin, to the extent of about one pound to the gallon, makes it serve for thicker pieces and for those it refused to harden before; but the resin should be added with judgment, or the works will become too hard and brittle. The composition is useless when it has been constantly employed for about a month; the period depends, however, on the extent to which it is used, and the trough should be thoroughly cleansed out before new mixture is placed in it.

The following recipe is recommended:

Twenty gallons of spermaceti oil; Twenty pounds of beef suet, rendered; One gallon of neat'sfoot oil; One pound of pitch; Three pounds of black resin.

These last two articles must be previously melted together, and then added to the other ingredients; when the whole must be heated in a proper iron vessel, with a close cover fitted to it, until the moisture is entirely evaporated, and the composition will take fire on a flaming body being presented to its surface,but which must be instantly extinguished again by putting on the cover of the vessel.

When the saws are wanted to be rather hard, but little of the grease is burned off; when milder, a larger portion; and for a spring temper, the whole is allowed to burn away.

When the work is thick, or irregularly thick and thin, as in some springs, a second and third dose is burned off, to insure equality of temper at all parts alike.

Gun-lock springs are sometimes literally fried in oil for a considerable time over a fire in an iron tray; the thick parts are then sure to be sufficiently reduced, and the thin parts do not become the more softened from the continuance of the blazing heat.

Springs and saws appear to lose their elasticity, after hardening and tempering, from the reduction and friction they undergo in grinding and polishing. Toward the conclusion of the manufacture, the elasticity of the saw is restored, principally by hammering, and partly by heating it over a clear coke fire to a straw color; the tint is removed by very diluted muriatic acid, after which the saws are well washed in plain water and dried.

Watch springs are hammered out of round steel wire, of suitable diameter, until they fill the gage for width, which, at the same time, insures equality of thickness; the holes are punched in their extremities, and they are trimmed on the edge with a smooth file; the springs are then tied up with binding wire, in a loose, open coil, and heated over a charcoal fire upon a perforated revolving plate, they are hardened in oil, and blazed off.

The spring is now distended in a long metal frame, similar to that used for a saw blade, and ground and polished with emery and oil, between lead blocks; by this time its elasticity appears quite lost, and it may be bent in any direction; its elasticity is, however, entirely restored by a subsequent hammering on a very bright anvil, which "puts the nature into the spring."

The coloring is done over a flat plate of iron, or hood, under which a little spirit lamp is kept burning; the spring is continually drawn backward and forward, about two or three inches at a time, until it assumes the orange or deep blue tint throughout, according to the taste of the purchaser; by many, the coloring is considered to be a matter of ornament, and not essential. The last process is to coil the spring into the spiral form, that it may enter the barrel in which it is to be contained; this is done by a tool with a small axis and winch handle, and does not require heat.

The balance springs of marine chronometers, which are in the form of a screw, are wound into the square thread of a screw of the appropriate diameter and coarseness; the two ends of the spring are retained by side screws, and the whole is carefully enveloped in platinum foil, and tightly bound with wire. The mass is next heated in a piece of gun barrel, closed at the one end, and plunged into oil, which hardens the spring almost without discoloring it, owing to the exclusion of the air by the close platinum covering,which is now removed,and the spring is let down to the blue before removal from the screwed block.

The balance or hair springs of common watches are frequently left soft; those of the best watches are hardened in the coil, upon a plain cylinder, and are then curled into the spiral form between the edge of a blunt knife and the thumb, the same as in curling up a narrow ribbon of paper, or the filaments of an ostrich feather.—*Byrne's Practical Metal Workers' Assistant.*

THERE are in the United States forty-eight manufacturers of railway cars. Seventeen of these are in Pennsylvania.

How to Build a Stable.

Generally speaking, we consider bricks the very best material with which to build stables; even preferable to stone, from the fact that the walls inside, having a smoother face, may be kept cleaner, freer from cobwebs and dust deposits than stone walls; and, if built with hollow walls, more free from dampness also; though this is a matter of not so much consequence, as in this climate there will not dampness enough penetrate a solid wall to cause any injury to the horses. It is very desirable, however, to have a stable rat-proof; and it may be made thoroughly so by commencing with a stone foundation—the bottom course of which is broader than the stone-work above it—laid in half cement mortar up to the grade line, and then building the brick wall upon that, filling in all the space inclosed by the walls with concrete up to the line of the top of the water table, and then paving it with large stones firmly bedded, which shall form the floor of the stable. On the outside there should be a stone water-table eight or ten inches high, projecting one or two inches outside of the main walls above, and having the upper surface of the projection beveled off to shed the water; and just above the water-table it would be well to have a course of slate built in the full thickness of the walls, which will prevent any dampness rising up into them from the ground by capillary attraction.

Above the water-table the walls should be built up with a *smooth face*, and with *close, neatly struck joints inside as well as out*, so as to present a clean, even surface, which should always be kept painted or washed with a lime or cement wash. Above the wall-plate the space should be filled in to the under side of the roof-boards.

The ceilings over the main story are usually left with the second story floor beams exposed to view, but we think it very desirable that they should be lathed and plastered; partially, for the sake of the wholesome, cleanly appearance a white ceiling always has, and for the sake of keeping away cobwebs, which, when beams are exposed, always get lodgment—and partially to prevent foul air rising from the room below and tainting the hay in the loft. We would also trim the doors and windows inside with architraves, even if they are only narrow strips of the cheapest stuff.

These two last hints, by the way, are just as valuable for a wood as for a brick stable.

It may be desirable, in some instances, to *fur out* and lath and plaster the walls of a stable, but if this is to be done, it is better to wainscot with wood up to the hight of, say five feet, and to fill in the space between the walls and the wainscot, as high as practicable, with broken glass and mortar, and then to lath and plaster from the wainscot up to the ceiling. A wooden stable, too, may with advantage be treated in the same way, but the space behind the wainscot being wider, may be packed with bricks and mortar, and made solid in that way.

We know it is not customary to put any finish of any kind upon the interior of stables, but we also know that in nine cases out of ten, in ordinary stables, and very frequently in those of a better class, the interiors are perfectly filthy with dust which lodges on every ledge, and overhung with cobwebs which hang thick and heavy from and between the beams overhead, besides being completely *set out* with such objects of "*vertu*" as old sponges, curry-combs, and brushes; bottles of castor oil, dusters, and a dozen other things of the same sort, which are thrown after use upon any projecting beam or ledge that may happen accidentally to be wide enough to hold them.

Now, certainly this sort of thing is not agreeable to the eye, and any person who has fine horses, and takes a proper pride in them, should not overlook it; yet, the groom, if questioned, will say, and truly, too, that he might be brushing all the time and he couldn't keep dust and cobwebs away, so long as there are places for the latter to hang and the former to lodge; in fact, there is only one way, and that is to follow the plan of finishing off that we have suggested, covering up all such places, moreover, making everything so convenient for the most trifling operations of stable economy that there can be no inducement, or excuse even, for carelessness or neglect of any kind.—*Harney's Stables, Outbuildings, and Fences.*

To Brown Gun Barrels.

Take of nitric acid, half an ounce; sweet spirits of niter, half an ounce; blue vitriol, two ounces; tincture of steel, one ounce. Mix all together in eight gills of water. Apply this mixture with a sponge, then heat the barrel a little, and move the oxide with a hard brush. This operation may be repeated a third and fourth time, till you have the brown required.

It is then to be carefully wiped, and sponged with boiling water, in which there has been put a small quantity of potash.* The barrel being taken from the water, must be made perfectly dry, and then rubbed smooth with a burnisher of hard wood; afterward heated to the hight of boiling water and varnished with the following varnish: Take of spirits of wine two parts, dragon's blood, powdered, three drachms; shellac bruised, one ounce; dissolve altogether. This varnish being laid on the barrel, and become perfectly dry, must be rubbed with a burnisher to render it smooth and glossy.—*Brass and Iron Founder's Guide.*

IT is said that preserved fruit and vegetables may be made to retain their green color by digesting them for some time in boiling salt water. After removing the latter, vinegar should be poured over them while boiling hot, removed on the third day, boiled, and poured on again. The repetition of this process a few times produces a dark green color, not dangerous, like the ordinary verdigris.

Improved Mode of Rigging Gaff Topsails.

Whatever tends to increase the safety of vessels and the lives of seamen, and to add to the facility and rapidity of working ships, is of great importance, both in a commercial and humanitarian point of view. Our engraving presents such an improvement. Its importance is such as in our opinion ought to secure universal attention.

We are fully assured that all that is claimed for it has been fully sustained in actual service in all kinds of weather, and that an examination will commend its merits to all intelligent seamen.

The gaff is provided with a shaft lying longitudinally above and parallel to the gaff, rolling in suitable bearings, when actuated by a rolling line which runs over a grooved pulley at the end nearest the main-mast. The sail, instead of being parallel in the usual manner, is wound upon this shaft by men stationed at the rolling line *on deck*.

The sail is hoisted by the gaff-topsail halyard, but the attachment of this halyard to the sail constitutes one of the leading features of the improvement.

To the apex of the topsail is attached a metallic head, as shown in the engraving. This head is formed so that the portion next the mast is cylindrical. The portion extending from this cylinder is wing-shaped, and performs an important function, which will be described hereafter.

The cylindrical portion is hollow, and is provided with a spring latch, which holds a catch formed in a cylindrical piece of metal attached to the end of the gaff-topsail halyard. On the side of the topmast is fixed a guide groove made of iron. This may be described as a pipe with a slot in the aft side of its entire length; and of such a width as to admit the wing of the head affixed to the apex of the sail above described, while the cylindrical portion of the head runs in the interior.

The inner edge of the sail is bound with leather which protects it from wear against the edges of the slot in the guide groove.

When the gaff-topsail halyard is hauled in, the sail is unwound from the shaft; and, as the halyard passes through, the sail-head enters the bottom of the guide-groove, which is made slightly recurved and trumpet-mouthed to facilitate its entrance. The gaff is sustained by a wire rope attached to its point and running back to the peak-halyard blocks. When in tacking it is desired to shift the sail from one side to the other, a messenger provided with a counterpart to the cylindrical portion of the sail-head is attached to the gaff-topsail halyard, by a man who ascends to the jaws of the gaff for that purpose. This messenger runs in a block at the peak of the mainmast, and carries the end of the halyard over from one side to the other, when it can instantly be again attached to the sail, which can then be hoisted as before.

It is claimed that in this form of rigging the following important advantages are secured:

The sail can be set and furled without the necessity of a man leaving the deck. It may be reefed or set over reefed canvas.

It may be set flatter and stand longer by the wind than in the old method; the gaff being securely held to the topmast, and the foot to the shaft along the gaff.

It may be set quicker and taken in quicker, two minutes being the maximum time required to take it in, in any weather. The sail may also be taken in without any danger of losing it.

The sail may be rolled snugly while tacking or jibing the ship, and set quicker when about. It may be handled with greater ease by less help.

It will wear much longer, being free from chafe and shake.

Instead of being tied up in a wad alongside of the mast head exposed to weather, when the lower canvas comes down, it, too, comes down, and is covered with the same sail coats.

It leaves the spars aloft free, and gives a more graceful and light appearance to the rigging.

It lessens the danger attending the smothering of a sail and stowing it in the old way, which sometimes results in loss of life.

The halyards being so arranged that the throat and peak are hoisted on a runner, the lower canvas is easier made than in the old way.

The gaff-topsail when taken aback passes down with the wind under the stays, and is rolled down as readily as when on its own tack. When struck with a squall, letting go the halyards runs the sail down to leeward of the lower canvas where it lies becalmed, and from whence it can be snugly rolled up.

This method of rigging does away with sheets, tack, and clewlines, therefore making a saving of rope.

In setting sail running off the wind, the luff being held abaft the topmast, the sail hoists without furling under the topmast rigging or crosstrees.

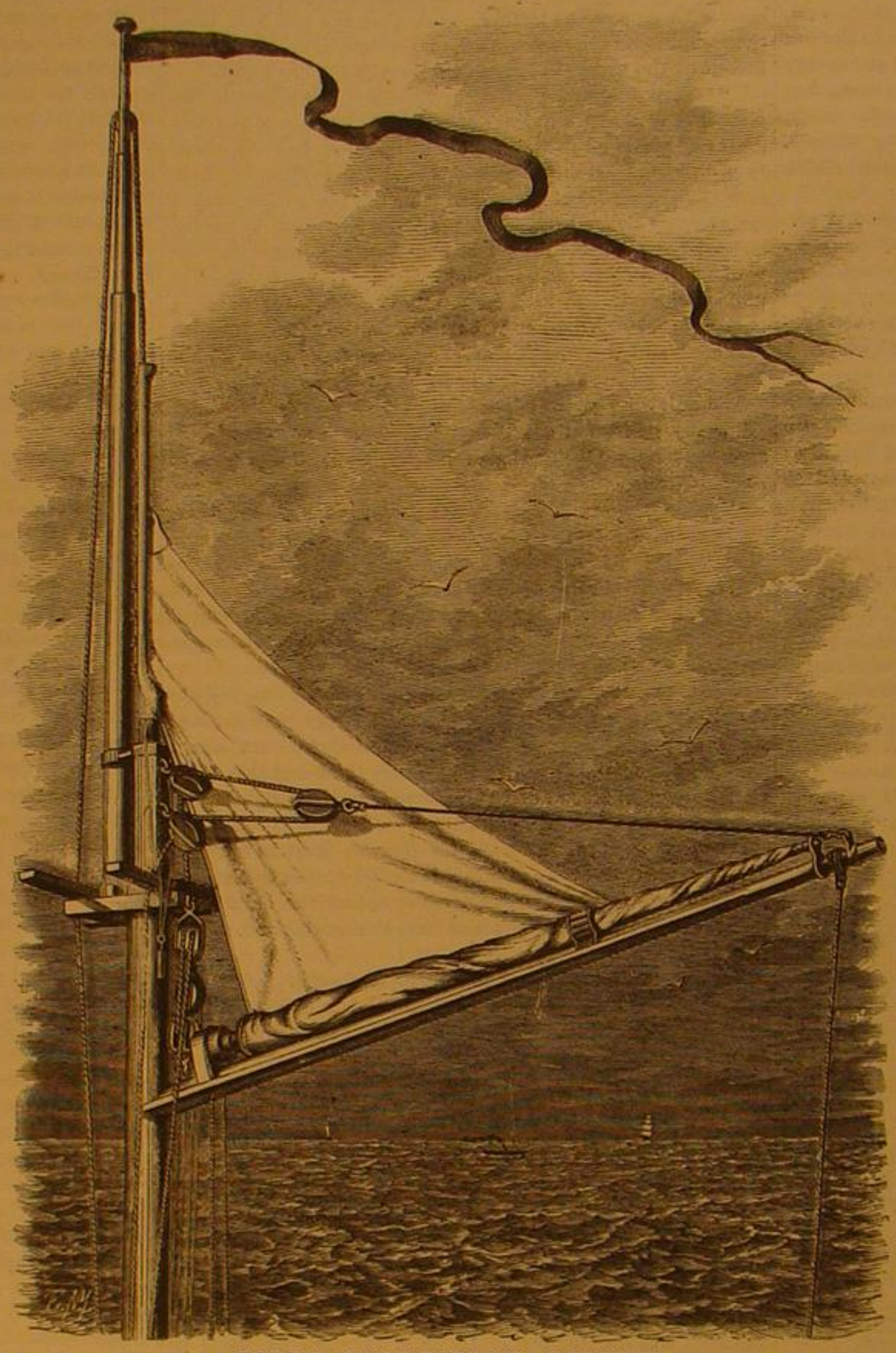
It gives the use of the sail many times when in the old method it would have to be in and stowed.

In short, it is claimed that this invention is time saving labor saving, and material saving; and, as it obviates the danger to which men are sometimes exposed when aloft, that it is life saving also.

As it gives greater facility in handling the vessel, it is claimed that, in cases of emergency, it gives greater safety to vessels.

These claims are as important as they are numerous, and as the invention is that of a practical seaman, long accustomed to the old method and understanding fully its defects, it has been constructed with a view to remove all those defects, and to supply a perfect and practical gaff-topsail rigging.

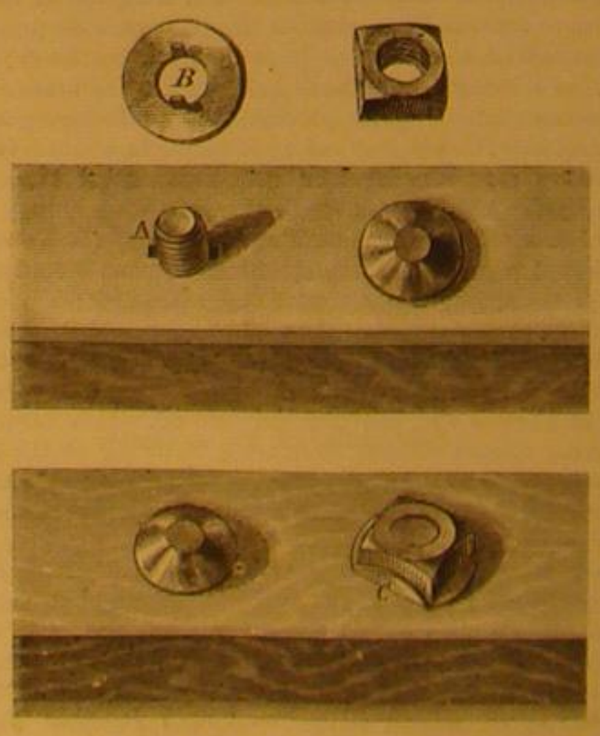
Patented, through the Scientific American Patent Agency, June 29, 1869, by Capt. Geo. A. Ford, Oswego, N. Y. For further information address him as above.



FORD'S GAFF-TOPSAIL RIGGING.

WILLIAMS' IMPROVEMENT IN LOCKING NUTS.

Foremost among the various things to which a useful application of locking nuts is made, it is common to speak of fish joints for railways, but this—though most important—is by no means the only important use to which such nuts can be advantageously put.



A prominent cause of breakage in many kinds of machinery, particularly agricultural machinery of all kinds, from the mower and reaper down to the plow, and in all sorts of vehicles, is the loss of nuts by which some part fails to receive its accustomed support.

A large number of devices have been wrought out by ingenious inventors, designed to lock nuts securely. These devices may be classed as being, first, those which depend upon some modification of the nut; second, those relying upon some modification of the washer; third, those which employ a modification of both nut and washer; and, fourth, those which rely upon some appliance independent of the nut or washer. There are also intermediate grades of devices, employing various combinations of the principles specified.

The device which we herewith illustrate is a very simple and effective method of locking nuts, depending solely for its effect upon a modification of the washer, and the bolt-hole.

The engraving shows the nature of the improvement. The hole, as shown at A, is recessed on opposite sides. This can be done in punching, or if the hole be drilled it may be done with the file. In punching the washer, two projections are made in opposite sides of the hole and turned down as shown at B, so that when placed over the threaded end of the bolt, these projections fit into the recesses of the hole above described. The nut is then screwed on, and when turned down tight, it is locked by simply turning up the edge of the washer, as shown at C.

The recesses in the bolt hole are only employed when it is desired to lock the nuts on a metal surface. On a wood surface the projections are driven down into the wood, which, when the edge of the washer is turned up as above described, effectually locks the nut.

We regard this as a valuable improvement, and one likely to come into extended use. The washers can be made at the same cost as the old style of washers, and it would seem that they could hardly fail of coming into general request.

For further particulars address W. H. Williams, Canton, Ohio.

A New Insect Poison.

M. Cloez, who is engaged at the garden of the Paris Museum, has invented, according to *Scientific Opinion*, what he considers a complete annihilator for plant lice and other small insects. This discovery is given in the *Revue Horticole*, with the indorsement of its distinguished editor, E. M. Carrière. To reduce M. Cloez's preparation to our measures, it will be sufficiently accurate to say, take 3½ oz. of quassia chips, and 5 drachms of stavesacre seeds, powdered. These are to be put in 7 pints of water, and boiled until reduced to 5 pints. When the liquid is cooled, strain it, and use with a watering-pot or syringe, as may be most convenient.

We are assured that this preparation has been most efficacious in France, and it will be worth while for our gardeners to experiment with it. Quassia has long been used as an insect destroyer. The stavesacre seeds are the seeds of a species of lark-spur, or Delphinium, and used to be kept in the old drug stores. Years ago they were much used for an insect that found its home in the human head, but as that has fortunately gone out of fashion, it may be that the seeds are less obtainable than formerly. The stavesacre seeds contain Delphine, which is one of the most active poisons known and we have no doubt that a very small share of it would prove fatal to insects.

The Oldest Piano in America.

The oldest piano in this country, so it is supposed, has recently been presented to the New Haven Historical Society, by Mr. C. M. Loomis, the publisher of *Loomis' Musical Journal*, New Haven, Conn. This instrument was made by an Italian firm in the city of London, in the year 1786. The mechanical action is similar to pianos of the present day. The wires are small and placed together. There is a peculiar sweetness of tone to many of the chords, which would indicate that the instrument was a good one in its day. It seems that an English lady named Mrs. Sarah Palmer imported the piano to this country about 1796. Soon after it came into the possession of a family by the name of Bakewell, where it remained for a period of about sixty years. Finally Mr. Loomis obtained some knowledge of the facts narrated above, and tracked out the instrument, which he purchased for a high price, simply as a curiosity.

White Rubber Shields not the Cause of Sore Mouth.—An item having appeared in our paper regarding the use of rubber shields for nursing bottles, and stating that we were in receipt of a letter from a correspondent, charging that they were a cause of sore mouth in children, and also that such statements had found their way into the English journals, it is perhaps only just that both sides should be heard. We are now in receipt of a letter from the Davidson Rubber Company, stating that there is no foundation for this statement, and sustaining their denial by a certificate of S. Dana Hayes, State Assayer of Massachusetts, to the effect that he has examined the white rubber shields made by the Davidson Rubber Company, and is satisfied that they are perfectly harmless. Mr. Hayes adds that the shields do not contain lead in any form, and it is impossible to extract any injurious substances from them by saliva.

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Contents:

(Illustrated articles are marked with an asterisk.)

*Improvement in Machines for Dressing Millstones.....199
On Tungsten.....200
Circulation of Water in Steam Boilers.....200
Boiler Incrustations.....201
The Home of the Perfumes.....201
How to Cure a Cold.....201
A Milwaukee Steam Engine.....201
*The New Grand Opera House, Paris.....202
The Invention of the Art of Printing.....202
*A Home-Made Differential Thermometer.....203
One-Horse Road Steamer to carry 2 Persons.....203
*Universal Screw and Brad Box.....03
Girding Fruit Trees.....203
The Value of a Practical Journal..203
Ice Formations.....204
Errors in regard to Gravitation...204
Inspection of Steam Boilers.....204
Log Roller Wanted.....204
The Unit of Work and the Unit of Force.....204
Recent Speculations on the Earth's Origin.....204
Profits of Advertising.....204
Hardening Saws and Springs.....205
To Brown Gun Barrels.....205
How to Build a Stable.....205
*Improved Mode of Rigging Gaff Topsails.....205
*William's Improvement in Locking Nuts.....206
A New Insect Poison.....206
The Oldest Piano in America.....206
Our New Paper Currency.....207
Supplementary Report of the Massachusetts Railroad Commissioners on Steel Rails.....207
Proportion of Heat Utilized in Steam Engines.....207
Every Pane of Glass is a Hole to Heat.....208
Engineering Projects.....208
Death of Wm. W. Cornell.....208
Scientific Intelligence.....208
Resharpening Files.....208
Answers to Correspondents.....209
Recent American and Foreign Patents.....209
List of Patents.....210
New Books and Publications.....210

OUR NEW PAPER CURRENCY.

In July, 1866, letters patent were issued, through the Scientific American Patent Agency, to Jas. M. Willcox, bank note-paper manufacturer near Philadelphia, for an improvement in paper, to prevent counterfeiting. As this peculiar paper has been adopted by the Treasury Department for United States securities, and reaches the hand of everybody in the shape of greenbacks, a few words in explanation will be useful to all handlers of money.

Protection in paper, as in engraving, consists in *peculiarity* and in difficulty of imitation; nothing else. Many years ago bank-note paper was made peculiar by the mixing of red, blue, and other colored silk shreds in the pulp before converting it into sheets of paper. This peculiarity was considered a test of genuineness, and was so to a certain extent. Paper made in that way, however, came into the open market, and could be bought by counterfeiters as well as by bank officers and engravers. Mr. Willcox has added a new feature in the introduction of colored shreds, which makes a paper so peculiar that it cannot be made by hand process, or by cylinder machine, but only by the better class or Fourdrinier machine. Even here special machinery is required to *locate* the colored shreds in certain parts of the notes and not in others.

As this machinery exists only in his own mill, and the process is protected by patent, the paper is kept out of the market, and the Government and the public have the advantage of its exclusiveness. The mill is guarded night and day by an armed force in the pay of the Government, to prevent robbery, and there is every reason to believe that this paper will be kept out of unlawful hands.

It will be observed that a line of blue shreds cross the *left-hand* end of all legal tender notes (new issue) of the denominations of one, two, five, and ten dollars; and a similar line crosses the *right-hand* end of all notes above ten dollars. As these lines are in-grain, and cannot be altered, the alteration of a low note to a high one would be at once detected by the position of the localized shreds. As these shreds are interwoven with the fibers of the paper, care should be used to make sure that they are neither entirely *under the surface* nor entirely *on the surface*, but *both*.

In the U. S. currency a double process is carried out. In the first place a red fiber is mixed indiscriminately through the pulp, and consequently through the sheet. This is done in the grinding engine.

A second process (with special machinery) is carried out in the Fourdrinier paper machine by the localizing of a *blue* fiber as the pulp is changed into paper. All is interwoven together, and when the sheets are cut into notes the blue fibers find their position as described.

The new fifty cent note which the Department is preparing to issue, will be upon paper of this description; the localized blue fibers occupying one end only of the notes, while all the remainder will have the indiscriminate red. The double process of manufacture will be shown and the exclusive feature will be prominent.

The thanks of the community are due to the Secretary of the Treasury for his earnest and well-directed efforts to protect them from counterfeits; and their attention is called to a proper understanding of this new feature in protection.

As it has been placed under the guardianship of the Department, it is believed to be effectual, and we are glad to have had an agency in bringing it into use.

ISINGLASS GLUE.—Dissolve isinglass in water and strain through coarse linen, and then add a little spirits of wine. Evaporate it to such a consistency that when cold it will be dry and hard. This will hold stronger than common glue, and is much preferred.

SUPPLEMENTARY REPORT OF THE MASSACHUSETTS RAILROAD COMMISSIONERS ON STEEL RAILS.

A report supplementary to the annual report of the Massachusetts Railroad Commissioners, upon the subject of steel rails, has been presented to the legislature of that State. The information embodied in the report was obtained in answer to questions, printed in circular form, and sent to the officers of the several railroads throughout the country. The circular embraced twenty-one queries relative to the time steel rails were first employed on the respective roads, the extent to which they have been used, their weight per yard, the conditions under which they have been used, their relative cost as compared to iron, and the general results of experience in their use.

Replies to these inquiries were received from 57 roads, twenty of which have made no trial of steel rails; others have tried only a few by way of experiment, and find them, so far, greatly superior in durability to iron rails in similar situations. Twenty-six roads have laid steel rails in amounts varying from 100 tuns to 15,000 tuns and their reports are generally very much in favor of steel rails, particularly, for heavy service.

The names of the roads and the amounts of steel rails they have laid are respectively as follows:

Eastern Railroad, Mass., 410 tuns, about four miles. Weight of rail 56 and 60 lbs. to the yard. Boston and Maine Railroad, Mass., 100 tuns; 60 lbs. to the yard. Boston and Albany, Mass., 1200 tuns, 57 to 62 lbs. to the yard. Boston and Providence, Mass., 1400 tuns, 52 to 62½ lbs. Old Colony and Newport, Mass., 135 tuns, 55 and 60 lbs. to the yard. Vermont Central, 100 tuns, 60 lbs. Connecticut River Railroad, 405 tuns, 56 to 60 lbs. New York and New Haven, 5,500 tuns, 62 lbs. to the yard. Erie Railway, 8,509 tuns, 56 to 62½ lbs. Camden and Amboy, N. J., 1,500 tuns, 56 lbs. North Pennsylvania, 400 tuns, weight of the rails per yard not given. Philadelphia, Germantown, and Norristown, Pa., 350 tuns, 60 lbs. to the yard. Northern Central, of Pa., 300 tuns, 60 lbs. Lehigh and Susquehanna, Pa., 5,100 tuns, 60 lbs. to the yard. Philadelphia and Reading, Pa., 800 tuns, 60 to 64 lbs. Philadelphia, Wilmington, and Baltimore, 3,110 tuns, a small portion 51, but the rest 56 to 58 lbs. Pennsylvania Railroad, 14,794 tuns, 56 to 67 lbs. to the yard. Pittsburgh, Fort Wayne, and Chicago, Ohio, 400 tuns, 60 lbs. Toledo, Wabash, and Western, Ohio, five miles, 60 lbs. to the yard. Cincinnati, Hamilton, and Dayton, Ohio, 400 tuns, 60 lbs. Michigan Central, 298 tuns, 61 lbs. Michigan Southern, two miles, 57 to 62 lbs. to the yard. Chicago and Northwestern, Ill., 1000 tuns, 60 lbs. Chicago, Burlington, and Quincy, Ill., 300 tuns, 60 lbs. Chicago, Rock Island, and Pacific, Ill., 1,600 tuns, 56 and 57 lbs. per yard. Chicago and Alton, 800 tuns, 54 and 60 lbs.

The aggregate of these amounts, added to amounts not communicated by other roads, but ascertained from the report of the State Engineer of New York, and other sources, form the basis of the estimate, that at least 100,000 tuns of steel rails were laid in this country on the first of January, 1870. The conclusions derived from the experience of various railway companies, and given in full in the report may be summed up as follows:

Extremes of temperature do not injuriously affect steel rails. In one case (the Grand Trunk Railway), they have been subjected to a temperature of 30° Fah., without injury. The durability of steel rails far exceeds that of the best iron rails. Two roads, the Erie Railway and the Providence road, report steel rails as having outworn thirteen sets of iron ones; the Chicago and Northwestern, fifteen sets; and the Philadelphia, Wilmington, and Baltimore, *seventeen* sets.

It is also found that heavy grades and sharp curves do not materially affect the wear of the rails. Also, that if the rails be carefully inspected before laying, all flaws and imperfections can usually then be discovered, and that risk to life and property from the breaking of rails may be almost wholly obviated by proper tests, and a small additional expenditure. It seems to be agreed that square notches punched in the base of the rail almost always originate seams or fractures. Some advocate punching the stem of the rail, but the majority favor drilling instead of punching.

The report states that the manufacture of steel-headed rails has made such advances that they are now very serviceable and satisfactory in use, and that their employment is extending, and likely to continue to extend.

It is shown that interest on the investment is a controlling element in the question of the relative economy of iron and steel rails, and the Commissioners seem to incline to Sandberg's estimate, made on the basis of interest at five per cent, which is, that "where ordinary iron rails are worn out in five years or less, solid steel rails are most economical; where they last over ten and up to fifteen years, steel-headed rails would be the cheapest; but if the iron rails will last from fifteen to twenty years, or more, it is cheapest to use them."

The report concludes by stating, that a form of compound rail of two sides ⌋ ⌊ of iron, with a T of steel resting upon them, and all three parts bolted together, has been recommended by several parties, and, in the opinion of the Commission, is likely to prove very satisfactory.

PROPORTION OF HEAT UTILIZED IN STEAM ENGINES.

How the proportion of heat utilized in steam engines from the combustion of coal or other fuel is determined, has been a subject of inquiry from some of our correspondents. We shall in the present article endeavor to make this subject as clear as may be, premising, however, that to those not familiar with the elementary laws of heat the subject presents some difficulties. It will therefore first be necessary to refer to some elementary principles.

It has been found that the rise and fall of the thermometer is not an index of the heat contained in different bodies, and that this instrument can only indicate what is called "temperature," a term very distinct from heat. Temperature is a generic name for certain manifestations of heat, which bear no constant relation in different bodies to the absolute amount of heat present. A better term than temperature is *sensible heat*. It is this heat which is indicated by the thermometer. The heat which exists in substances, and which does not act to expand other colder bodies when near to those substances, and which does not produce the sense of warmth in the animal economy, is called latent heat.

In other words, all substances have definite capacities for heat, and may possess a certain amount without that heat being directly perceivable, and it is by making this latent heat appear as sensible heat by transferring it to other bodies with less capacity for heat, or by reducing the capacity of bodies for heat that its existence is determined.

This may be done by chemical action. Put quicklime and water together, and, although both bodies may possess a very low temperature, their latent heat, being converted into sensible heat by the reaction which takes place, will develop a high temperature in the mass.

When air or any other substance is compressed by mechanical action, so that its bulk is diminished, its capacity for heat is diminished, and more or less of its latent heat is converted into sensible heat. When a gaseous body like steam is mixed with a cold body like water, the steam is condensed to water again, and all its latent heat is imparted to water as sensible heat. Latent heat may therefore be rendered sensible either by mechanical or by chemical action, and it is not necessary to specify further the numerous ways in which this may be performed.

It must be borne in mind here that the terms *latent* and *sensible*, applied to heat, do not indicate any difference in essential quality, and it may be added, incidentally, that modern science tends strongly to substantiate the theory that heat is, to use the words of Helmholz, "simply a shivering motion of the ultimate particles of bodies."

We have seen that the thermometer does not indicate the total heat contained in bodies. Thus a pound of steam at atmospheric pressure and a pound of boiling water affects the thermometer equally, the mercury rising to 212° Fah.; but 5·3144 pounds of water at 32° Fah. may be mixed with this steam, making 6·3144 pounds of water at 212° Here the thermometer has stood at 212° during the entire experiment. It is evident, therefore, that the heat which has raised the temperature of the 5·3144 pounds of water from 32° to 212° was not at any time indicated by the thermometer.

A degree of the thermometer is not therefore a unit of heat.

It has been agreed to consider the amount of heat that will raise a pound of water one degree Fahrenheit, as the unit of heat. Experiment has shown this to be nearly a constant, at least sufficiently so for practical purposes. The heat developed by combustion may then be estimated by multiplying the weight in pounds of a mass of water into the number of degrees the temperature of the mass has been raised by the heat developed.

The experiments of Fabre and Silbermann were perhaps the most accurate ever performed to ascertain the total heat developed by the combustion of various substances.

The apparatus employed was a vessel of brass, gilt, and immersed in a vessel of silvered copper, containing about three and one half pints of water. This copper vessel was surrounded by a case filled with swan's down, to prevent loss by radiation, and this case was in turn surrounded by water in an outer chamber, so that even the small amount of heat that traversed the layer of swan's down should be intercepted. By these means it was found that the amount of heat absorbed by the atmosphere was reduced to a very small and measurable quantity.

The combustibles experimented upon were placed in the interior brass chamber, and were burned in pure oxygen previously dried and conveyed to the chamber through a tube, and the gases of combustion were made to traverse a spiral tube in the water until their temperatures were lowered to that of the water. Small pieces of lighted charcoal were used to ignite solid bodies, and liquids were burned in lamps with wicks of asbestos. Gases were introduced through jets previously lighted.

In this way the heat generated by the combustion of a large number of bodies was determined and tabulated.

The experiments of Joule have shown that the actual amount of heat developed by friction is dependent simply upon the force expended in producing the friction, and conversely it has been determined that the heat actually expended in performing a given amount of work is exactly proportional to the amount of work performed.

Joule has shown that raising the temperature of one pound of water one degree is equal to the mechanical power generated by the fall of a body weighing 772 pounds through one foot of space. This amount of work is called the *mechanical equivalent* of heat.

It will be evident now, that, knowing the amount of heat produced by a given weight of any kind of fuel, and the work performed by a steam engine under the boiler of which the combustion has been performed, that by comparing the actual work performed as measured by the dynamometer, with the total work the heat generated is capable of performing, as determined by the mechanical equivalent of heat, the percentage of heat converted into work by the engine may be also determined. On the average it is probable that this does not exceed ten per cent.

Playfair and De la Bèche found 18,873 units of heat to be the mean total per pound of seventeen different kinds of

English, Welsh, and Scotch coals. A bushel of coals weighing 84 pounds has been made to generate a mechanical effect of 120,000,000 foot-pounds, although probably not more than 100,000,000 are generally developed.

We find this article already too much extended to admit the discussion of the various methods adopted by Joule to to demonstrate the mechanical equivalent of heat. At some future time we will make these experiments the subject of another article.

EVERY PANE OF GLASS IS A HOLE TO HEAT.

The sentence which forms the caption of this article we remember from a popular lecture on heating and warming buildings, delivered by a man who has done much towards educating the American public on matters of domestic economy and hygiene.

Some of our correspondents are asking for information upon the subject of how the solar rays get through panes of glass without heating them. Even in the coldest weather when the glass is below zero in temperature, the heat of the sun passes in, and—we may also add—the radiant heat of a room passes out more or less, without materially altering the temperature of the glass.

The ultimate cause of this phenomenon, which, we may say, is not confined to glass alone, is not yet understood, although it is doubtless dependent upon the molecular structure of the glass. The properties of bodies by which they permit heat rays to pass through their structure freely is called diathermancy. This property glass possesses in a far less degree than many other substances.

The most remarkable diathermanous solid is rock salt. It permits heat from all sources to pass as readily through it as light passes through glass, and hence it has been called the "glass of heat." As a rule the most diathermanous bodies are transparent substances of little density, such as air and the gases. On the contrary, transparent substances of great density interfere with the passage of heat. Among these may be classed glass, rock-crystal, alum, water, heavy oils, etc.

Those bodies which intercept the passage of heat are called athermanous, but the terms diathermanous and athermanous are not very definite in their application, except when applied to bodies which transmit or intercept heat in a marked degree.

One of the most powerful athermanous bodies is alum. This substance is as remarkale in athermanous quality as rock salt is in its opposite character in this respect. Alum, although it be made into a very thin plate, transmits very little heat from any source, although it does not intercept light to any great extent. A piece of smoked quartz permits heat to pass quite freely, although scarcely any light can penetrate it. On the contrary, sulphate of copper, though it permits the passage of blue rays of light freely, almost totally intercepts the passage of heat.

These facts are well established by experiment, and a great many others of a similar character might be mentioned.

The formation of any good theory as to the causes of diathermancy and athermancy is rendered more difficult by the very peculiar modifications in the power of heat transmission consequent upon the source from which the heat is derived.

Thus while glass allows solar heat to pass without difficulty, and while, as above stated, it does not become heated in the rays of the sun, it will in a great measure intercept heat derived from terrestrial sources, and become itself heated. So we see that although "a pane of glass is a hole to heat," it is a hole through which heat enters more freely into than it flows out of an apartment.

It is, moreover, found that heat from various terrestrial sources passes through diathermanous bodies with different degrees of facility. Thus, plate glass will transmit no heat from copper at 212° Fah.; but from copper at 750° Fah. it transmits 6 per cent; of heat from ignited platinum it transmits 24 per cent; and from the naked flame of an argand oil lamp 39 per cent.

It is also found that the diathermancy of solids increases with the degree of polish of their surfaces. But what is most singular of all is that heat which has been transmitted through a diathermanous body is thereby rendered more transmissible through succeeding diathermanous bodies. Thus a larger per cent of the heat which has passed from a lamp flame through a glass chimney, will pass through another diathermanous body than would be transmitted from the naked flame.

These are only a few of the facts connected with this interesting subject. As we have said there is yet too little known of the molecular constitution of bodies to give ground for anything more than speculation as to the cause of the various degrees of facility with which substances transmit heat.

ENGINEERING PROJECTS.

Rapid and comfortable transit through New York seems to be a problem upon which many distinguished engineers are working. In addition to the Pneumatic Tunnel of which we have lately said so much, we now have it announced that the New York City Central Underground Railway is to be proceeded with at once. It is said that a contract for the construction and equipment of the road from the Battery to the Harlem River has been completed.

George B. McClellan, William J. McAlpine, Egbert L. Viele, Julius W. Adams, Sylvester Sweet, I. F. Quinby, and John B. Jarvis having been requested as a Board of Engineers "to consider the question of a subway under Broadway, in the City of New York, with the view of relieving that street rom its present interruptions, and of affording a more convenient and speedy transit for passengers and for merchandise, without injury to the property upon the line of the street, or diversion of the established classes of business thereon," have submitted a report in which they say that a Sub-Arcade Railway will accomplish the objects desired. They think there are no difficulties attending the construction of the work which can not be overcome with engineering skill, and at a comparatively moderate cost; and that it meets a necessity in the most complete and unobjectionable manner. The estimated cost is from $1,600,000 to $2,000,000 per mile.

Marshall O. Roberts, William G. Ogden, Origon Vanderburgh, John I. Blair, Dudley Field, and John D. Sherwood, together with such persons as may become associated with them, have been created a body politic in deed and in law, by the name of the New York Port Submerged Railroad Company. They are empowered to survey, locate, and construct a submarine tunnel tube, or covered way, in or beneath the beds of the Bay of New York and of the Hudson River, from some point in New Jersey opposite the City of New York to some point in the City of New York, with one or more tracks herein to transport by rail or otherwise, freight and passengers, with the privilege of charging and collecting toll. They are not, however, to interrupt the free navigation of the waters. The penalties for obstructing or injuring such marine tunnel are a fine not exceeding $5,000 or imprisonment not less than sixty days, nor more than one year, or both, besides paying the amount of the damage.

SCIENTIFIC INTELLIGENCE.

THE NASCENT STATE.

For a long time chemists have been in the habit of employing the word "nascent" to indicate the birth of a body in certain decompositions. The precise meaning they ascribe to it has never been very clearly understood, but the word has been retained as a convenient one for hiding our ignorapce. Professor Henry St. Claire Deville objects to its use; he thinks we ought to be able to give a precise and exact definition to every expression employed in science, and this is not possible with the word nascent. He states his reasons in an elaborate paper, an abstract of which we shall give to our readers hereafter.

MANUFACTURE OF FERRO-CYANIDE OF POTASSIUM.

Dr. Emil Meyer recently read a paper on this subject before the Chemical Society of Berlin, from which we make a few extracts:

By the heating and melting of animal matter with potash, only cyanide of potassium is produced; the ferro-cyanide is first formed by the action of the carbonate of iron or hydrated oxide of iron in the solution. This transformation is better accomplished in very dilute liquors. The author recommends the use of carbonate of iron prepared from the chloride by lime and warns against the presence of sulphuric acid. Pure carbonate of potash should also be selected. It is better to conduct the fusion at a high temperature with as much exclusion of the oxygen of the air as possible, and to introduce the animal refuse, previously dried, into the fused potash.

This important branch of industry is very little pursued in the United States, although the yellow ferro-cyanide of potassium has extensive applications.

REFINING CAMPHOR.

Crude camphor is adulterated with common salt, sulphur, vegetable matter, tar, and water. Its purification can be best accomplished by sublimation in glass flasks of a capacity of 8 to 10 pounds, at a temperature of 400° Fah. These flasks are made of thin glass with flat bottoms and short necks. They are put into a sand bath, where a uniform and rapid heat can be applied. The crude camphor is broken up, mixed with 3 to 5 per cent freshly-slaked lime and 1 to 2 per cent iron filings, well sifted and introduced through a funnel into the neck of the flasks. The flasks are then put into the sand bath, covered with sand to the neck, and heated gently for half an hour to expel the water. As the temperature increases, the camphor softens, and finally melts. After the whole mass has become fluid the sand is removed from the upper part of the flask and a paper stopper put in to partially close it. The heat is then carefully preserved at a point sufficient to sublime the camphor but not to re-melt it. In this way a very pure article can be obtained.

LIMIT OF THE HUMAN VOICE.

A learned professor, who appears to have had nothing better to do, has been making calculations of the distance to which the human voice would reach if it were as powerful in proportion to the size of the animal, as is the case with the grasshopper. The grasshopper makes himself heard $\frac{1}{16}$th of a mile. An ordinary man weighs as much as 26,000 of these insects, and if his voice were proportionately powerful could be heard for the distance of a thousand miles. Such an arrangement would enable us to dispense with the telegraph and facilitate the abolition of the franking privilege, as the honorable member from Smithtown could address his constituents directly from his seat in Congress; it might have its disadvantages, as, for example, if one were to accidentally sneeze, the roof of the house might be landed in the neighbor's lot, and the walls of the house be generally dislocated. Upon the whole, as "silence is golden," and the telegraph answers every purpose, we are satisfied with the present limit of the voice, and propose to leave the grasshopper in possession of the field.

NEW TESTS FOR PHOSPHORUS AND SULPHUR.

A German chemist, M. Schoen, suggests the following new tests: To detect phosphorus in organic or inorganic matter, mix the solid substance with half its weight of finely-divided magnesium, and heat in a glass tube closed at one end. The mixture becomes phosphorescent, the sides of the tube will be covered with red phosphorus and another portion of phosphorus will combine with the magnesium to form the phosphide of that metal. After cooling a few drops of water will evolve phosphureted hydrogen. As the magnesium will not combine with sulphur the search for this element can be made in the same mixture by sodium or potassium. All compounds of sulphur, whether organic or inorganic, are decomposed by potassium and sodium to form alkaline sulphides. Place the substance to be tested in the bottom of a small glass tube, put in a few pieces of sodium, and add another layer of the substance, and heat gently. After cooling, project the contents of the tube into acidulated water, when a disengagement of sulphureted hydrogen will at once betray the presence of sulphur, or the nitro-prusside of sodium will afford a purple coloration if any sulphur be present. These two tests are probably the most delicate of any hitherto suggested for the detection of phosphorus and sulphur.

SEPARATION OF COBALT.

Keep up the neutrality of the solution containing the chloride or sulphate of cobalt by suspending in it the carbonate of manganese, then pass sulphureted hydrogen gas through the boiling liquor, when all of the cobalt will be precipitated.

COMPOSITION OF THE TAM-TAM AND CYMBAL.

M. Riche, in his researches on alloys finds that the tam-tam and cymbal are made of bronze that can be worked cold the same as iron or aluminum bronze. The best tone is produced by an alloy composed of 78 parts of copper and 22 parts of tin.

EXPLOSIVE COPPER COMPOUND.

Some years ago, when copper pipes were used for the conduction of illuminating gas through dwellings, small crystals were found to collect in the pipes, which proved to be highly explosive, and were shown on analysis to be composed of acetylene and copper. Recently a French chemist has discovered that the same explosive mixture can be produced by passing illuminating gas for some time through a solution of the nitrate of copper. The observation is a recent one, and may lead to the invention of a process for the manufacture of a new explosive compound.

Death of William W. Cornell.

This well known and highly esteemed citizen of New York died at his residence, on Washington Hights, on the 17th inst., of typhoid fever. Mr. Cornell began life depending entirely upon his own energies. He served a regular apprenticeship of seven years at the business in which he subsequently became distinguished. In 1847, in partnership with his brother, J. B. Cornell, he established his iron foundery, employing at first, by reason of the small capital possessed, but one man. The original manufactory was located on Center street. Here the business of the deceased gradually increased until at the end of ten years it had attained to such large proportions that it was necessary to move to another locality. During this year the firm constructed their great foundery on Twenty-sixth street, between Tenth and Eleventh avenues, and which has since remained the principal one owned by the brothers. Mr. Cornell's name is conspicuously associated with the progress of the use of iron as a building material, many of the best known edifices in the country having been constructed by him. Among them we can name the United States Custom House at Savannah, Ga., the Sun Atlantic Mutual Insurance Company, A. T. Stewart's, H. B. Clafflin & Co's, Bank of New York, Bank of Commerce, Union Bank, Ball & Black's, and the New York *Herald* buildings. These are but a few of the many fine structures which will long remain monuments to the skill of the firm of J. B. & W. W. Cornell. Indeed, owning as the deceased did, the most extensive and completely equipped works in the United States for the construction of fireproof building, it is not surprising that he, with his brother, held the foremost position among our iron founders.

In his private life Mr. Cornell was distinguished for many sterling and amiable traits of character, and was very liberal in his gifts, especially to the Methodist Church, of which he was a member.

Re-Sharpening Files.

A very interesting and economical process has been exhibited before the Société d'Encouragement, of Paris, by M. Werdermann. Well-worn files are first carefully cleaned by means of hot water and soda; they are then placed in connection with the positive pole of a battery, in a bath composed of forty parts of sulphuric acid, eighty parts of nitric acid, and a thousand parts of water. The negative pole is formed of a copper spiral surrounding the files, but not touching them; the coil terminates in a wire which rises toward the surface. This arrangement is the result of practical experience. When the files have been ten minutes in the bath they are taken out, washed, and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner; but should the effect not be sufficient, they are replaced for the same period as before. Two operations are sometimes necessary, but rarely more. The files thus acted upon are, to all appearance, like new ones, and are said to be good for sixty hours' work. M. Werdermann employs twelve medium Bunsen elements for his batteries.

At a single blast recently made at Reed's Gap, on the Air Line Railroad, near Wallingford, Conn., 604 cubic yards of solid rock were thrown out. Thirteen holes, fifteen feet deep and three and a half inches in diameter, were drilled. Nitroglycerin was the explosive.

U. S. Patent Office.

How to Obtain Letters Patent
FOR
NEW INVENTIONS.

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For a period of nearly twenty-five years, MUNN & CO. have occupied the position of leading Solicitors of American and European Patents, and during this extended experience of nearly a quarter of a century, they have examined not less than fifty thousand alleged new inventions, and have prosecuted upward of thirty thousand applications for patents, and, in addition to this, they have made, at the Patent Office, over twenty thousand preliminary examinations into the novelty of inventions, with a careful report on the same.

The important advantages of MUNN & CO.'S Agency are, that their practice has been ten-fold greater than that of any other Agency in existence, with the additional advantage of having the assistance of the best professional skill in every department, and a Branch Office at Washington, which watches and supervises, when necessary, cases as they pass through official examination.

CONSULTATIONS AND OPINIONS FREE.

Those who have made inventions and desire a consultation are cordially invited to advise with MUNN & CO. who will be happy to see them in person at the office, or to advise them by letter. In all cases, they may expect an HONEST OPINION. For such consultations, opinion, and advice, NO CHARGE is made. A pen-and-ink sketch and a description of the invention should be sent.

TO APPLY FOR A PATENT,

A model must be furnished, not over a foot in any dimension. Send model to MUNN & CO., 37 Park Row, New York, by express, charges paid, also, a description of the improvement, and remit $16 to cover first Government fee, and revenue and postage stamps.

The model should be neatly made, of any suitable materials, strongly fastened, without glue, and neatly painted. The name of the inventor should be engraved or painted upon it. When the invention consists of an improvement upon some other machine, a full working model of the whole machine will not be necessary. But the model must be sufficiently perfect to show with clearness the nature and operation of the improvement.

PRELIMINARY EXAMINATION

Is made into the patentability of an invention by persona search at the Patent Office, among the models of the patents pertaining to the class to which the improvement relates. For this special search, and a report in writing, a fee of $5 is charged. This search is made by a corps of examiner of long experience.

Inventors who employ us are not required to incur the cost of a preliminary examination. But it is advised in doubtful cases.

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When the model is received, and first Government fee paid, the drawings and specification are carefully prepared and forwarded to the applicant for his signature and oath, at which time the agency fee is called for. This fee is generally not over $25. The cases are exceptionally complex if a higher fee than $25 is called for, and, upon the return of the papers, they are filed at the Patent Office to await Official examination. If the case should be rejected for any cause, or objections made to a claim, the reasons are inquired into and communicated to the applicant, with sketches and explanations of the references; and should it appear that the reasons given are insufficient, the claims are prosecuted immediately, and the rejection set aside, and usually

Without Extra Charge to the Applicant.

MUNN & CO. are determined to place within the reach of those who confide to them their business, the best facilities and the highest professional skill and experience.

The only cases of this character, in which MUNN & CO. expect an extra fee, are those wherein appeals are taken from the decision of the Examiner after a second rejection; and MUNN & CO. wish to state very distinctly, that they have but few cases which can not be settled without the necessity of an appeal; and before an appeal is taken, in any case, the applicant is fully advised of all facts and charges, and no proceedings are had without his sanction; so that all inventors who employ MUNN & CO. know in advance what their applications and patents are to cost.

MUNN & CO. make no charge for prosecuting the rejected claims of their own clients before the Examiners and when their patents are granted, the invention is noticed editorially in the SCIENTIFIC AMERICAN.

REJECTED CASES.

MUNN & CO. give very special attention to the examination and prosecution of rejected cases filed by inventors and other attorneys. In such cases a fee of $5 is required for special examination and report, and in case of probable success by further prosecution, and the papers are found tolerably well prepared, MUNN & CO. will take up the case and endeavor to get it through for a reasonable fee, to be agreed upon in advance of prosecution

CAVEATS

Are desirable if an inventor is not fully prepared to apply for a Patent. Caveat affords protection, for one year, against the issue of a patent to another for the same invention. Caveat papers should be carefully prepared.

The Government fee on filing a Caveat is $10, and MUNN & CO.'s charges for preparing the necessary papers are usually from $10 to $12.

REISSUES.

A patent when discovered to be defective, may be reissued by the surrender of the original patent, and the filing of amended papers. This proceeding should be taken with great care.

DESIGNS, TRADE MARKS, AND COMPOSITIONS

Can be patented for a term of years, also, new medicines or medical compounds, and useful mixtures of all kinds. When the invention consists of a medicine or compound, or a new article of manufacture, or a new composition, samples of the article must be furnished, neatly put up. Also, send a full statement of the ingredients, proportions, mode of preparation, uses, and merits.

PATENTS CAN BE EXTENDED.

All patents issued prior to 1861, and now in force, may be extended for a period of seven years upon the presentation of proper testimony. The extended term of a patent is frequently of much greater value than the first term; but an application for an extension, to be successful, must be carefully prepared. MUNN & Co. have had a large experience in obtaining extensions, and are prepared to give reliable advice.

INTERFERENCES

Between pending applications before the Commissioners are managed and testimony taken; also, Assignments, Agreements, and Licenses prepared. In fact, there is no branch of the Patent Business which MUNN & Co. are not fully prepared to undertake and manage with fidelity and dispatch.

FOREIGN PATENTS.

American inventors should bear in mind that five Patents—American, English, French, Belgian, and Prussian—will secure an inventor exclusive monopoly to his discovery among ONE HUNDRED AND THIRTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such, that patents can be obtained abroad by our citizens almost as easily as at home. MUNN & Co. have prepared and taken a larger number of European Patents than any other American Agency. They have Agents of great experience in London, Paris, Berlin, and other Capitals.

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The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line.

Important advance on the draft and easement of carriage. See Jackson's Patent Oscillating Wagon, with tests of draft, models, etc., No. 149 High st., Newark, Essex Co., N.J. See Scientific American, Sept. 25, 1869.

Parallel Vise.—The most durable, labor-saving, and strongest. with the firmest hold. A. P. & M. Stephens & Co., 91 Liberty st., New York.

The "Anti-Friction" Horse Power is the best for driving every kind of farm or factory machinery. Send stamp for circular to R. H. Allen & Co., Postoffice Box 376, New York.

Our Catalogue of Agricultural and Horticultural Implements, machines, and tools (300 pages, 600 illustrations) is sent, postpaid, for $1. This is refunded on receipt of first order. R. H. Allen & Co., Postoffice Box 376, New York.

Photographs.—Rockwood & Co., 839 Broadway, for five dollars, make 8x10 photographs of machinery or views within the city.

Machinery Wanted.—Good Calender Mills, suitable for working India-rubber. Address (stating description and prices), Postoffice Box 3213, Boston, Mass.

A "Wood & Light" Patent Shafting Lathe, 28-in. swing, 25ft. bed, used 3 mos., at a sacrifice. E. P. Hampson, 38 Courtlandt st., N. Y.

An experienced master mechanic and draftsman desires an engagement. References unquestionable. Address Postoffice drawer 370 Watertown, N. Y.

Manufacturers of Oroid Watches will find a good wholesale customer by addressing J. N. Boylan, Detroit, Mich.

Adams & Lovell, 1105 State st., Erie, Pa., manufacturers of all kinds of wooden articles.

A practical machinist and draftsman wants a situation as draftsman. Best recommendation can be given. Address Eugon Walther, 1302 Coates st., Philadelphia.

A reliable man as machine shop superintendent can be heard from by addressing J. Q. Preble, 77 White st., New York.

Situation wanted.—A Pattern maker, who is a draftsman, desires a situation. Address C. F. L., box 576, Youngstown, Ohio.

Manufacturers and dealers in articles for family use from $1 to $5 will please send circulars with price to G.B. Bull, 333 Main st, Buffalo, N.Y.

A good business for a machine shop.—The right to manufacture, on royalty or otherwise, a first-class article already introduced; demand unlimited. Address Wm. Johnson, Lambertville, N. J.

Wanted—Machines to make chocolate. Send price list to Chas. Mueller, 185 Croghan st., Detroit, Mich.

Respirator.—Royalty for the manufacture of the same for sale by T. A. Hoffmann, Beardstown, Ill., Patentee. Send for circular.

I want to correspond with manufacturers of wood planing and molding machines. Please describe cutter head. T. N. Müller, Engineer, 698 3d avenue, New York.

Manufacturers and Dealers in the best machines for cutting or sawing veneering, address with circular, H. Burgett, Lewistown, Ill.

Machine wanted for digging wells. Address John W. Nale, Millville, N. J.

15,000 feet 7-16 round sticks, made direct from the board, with Hatch's Aggregate Molding machine, in one hour. W. D. Hatch, Antrim, N.H

Dickinson's Patent Shaped Carbon Points and adjustable holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24th, and Nov. 20, 1869. 61 Nassau st., New York.

All parties able to furnish second-hand or new hydraulic or other powerful presses, are requested to send details of price, power in tuns, measurement, and distance between plattens when open and when shut. Address Powers, 5 West 4th st., New York city.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

1250 lbs. portable platform scales, $25; hay scales, 4-tun, $75. Send for free price list, No. 373. Edward F. Jones, Binghamton, N. Y.

American Boiler Powder.—A safe, sure, and cheap remedy for scale. Send for circular to Am. B. P. Co., P. O. Box 315, Pittsburgh, Pa.

Physicians of every school wanted to engage in an easy and lucrative office practice. For particulars, address W. C. Coburn, M.D., 568 Main st., Buffalo, N. Y.

Those desiring excellent copies of old daguerreotypes, tintypes, or card pictures, can have them made to their satisfaction by sending to John A. Whipple, 297 Washington st., cor. Temple Place, Boston, Mass.

Right For Sale.—Action and Reversion Water Wheel (self-governing). Will vent large or small volumes of water. Will retain its power under back water. Address William E. Hill, Erie, Pa.

Kidder's Pastilles.—A sure relief for Asthma. Price 40 cents by mail. Stowell & Co., Charlestown, Mass.

Needles for all sewing machines at Bartlett's, 569 Broadway, N Y.

For tool making, buy 15-in. engine lathes with taper attachment, made by the Pratt & Whitney Company, Hartford, Conn.

Pat. paper for buildings, inside & out, C. J. Fay, Camden, N. J.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For first-quality new 14, 17, and 20-in. screw lathes, milling machines, and one-spindle drills, at small advance from cost, apply to Geo. S. Lincoln & Co., Hartford, Conn.

Hackle, Gill Pins, etc., at Bartlett's, 569 Broadway, New York.

Perforated Zinc and Sheet Iron for separators, smut machines grain dryers, tubular wells, malt kilns, etc. R. Aitchison & Co., Chicago

T. F. Randolph, Steam Model Works, Cincinnati, Ohio.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

Portable Pumping or Hoisting Machinery to Hire for Coffer Dams, Wells, Sewers, etc. Wm. D. Andrews & Bro., 414 Water st., N. Y.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

Keuffel & Esser, 71 Nassau st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Two 60-Horse Locomotive Boilers, used 5 mos., $1,300 each. The machinery of two 500-tun iron propellers, in good order, for sale by Wm. D. Andrews & Bro., 414 Water st., New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

C. D. S., of N. Y.—The theory of the spheroidal shape of the earth has other foundation than the fact that a pendulum of given length oscillates more rapidly as we approach the poles. But suppose this were the only reason for the statement that the earth is a spheroid, it is sufficient. It is quite evident that you do not comprehend the fact that the resultant of the action of gravity on all the particles of masses is motion or pressure in right lines joining their centers, and that their attraction is directly as their masses and inversely as the square of the distances between their centers.

T. S., of N. Y.—There are devices used to determine the position of veins of gold, silver, etc., but they bear no analogy to the magnet. They are generally forked switches of witch hazel, etc., and we have no faith whatever in their efficacy. Such switches are called "divining rods."

R. O. S., of Del.—The term "air," used in works on painting, signifies the medium through which objects are viewed. The effect produced upon outline and color by air, in this meaning of the word, is an important element of art knowledge.

R. T. V., of N. J.—An expeditious and good method of reproducing from an engraving, a plate from which clear and distinct impressions can be taken, is much needed. None of the methods now used gives perfectly satisfactory results.

D. G. B., of Miss.—The disease called rust in wheat and other graniferous plants, is caused by the presence of minute fungi, a natural order of plants of a very low type, many of them parasitic, and a great number of them poisonous.

M. J. A., of N. Y.—The melting point of pure nickel is slightly less than that of iron. You should have had no difficulty in melting it in a brass-founder's furnace; perhaps you had instead of nickel some difficultly fusible alloy.

F. B. M., of N. Y., and others.—You will find a rule for computing proportions of safety valve and lever on page 16, current volume of the SCIENTIFIC AMERICAN.

D. N., of N. Y.—The oil referred to in the recipe for cement for leather, is raw linseed oil; the pitch, the common pitch used for caulking, etc.

R. S. T., of Minn.—The "gentles" spoken of by Izaak Walton are the larvæ of the common flesh fly, or, as they are commonly called, maggots.

J. S. & Co., N. Y.—We know of no paint that will dry so hard that it will not rub and mar. Asphaltum is what is generally used for edge tools.

A. C., of Ohio.—Your question is not clear. What do you mean by the end of the shaft of an overshot water wheel opposite the bucket end?

G. Y., of Mass.—The best way to convert the rapid rotation of a shaft into a slow rectilinear motion, is, for your purpose, the screw and rack.

F. C.—To make whitewash stick add to it a small proportion of glue, previously dissolved in hot water. Fish glue, or isinglass, is the best.

F. B. M., of N. Y.—We cannot give you the desired information in regard to Cazal's Electro-Magnetic Automator.

P. G., of Tenn.—The base of the substances called amides, is composed of one atom of hydrogen and two of nitrogen.

R. S., of La.—A saturated solution of common alum contains nearly ninety-one per cent of water by weight.

D. R. P., of Va.—Hematin is the red coloring principle of log wood.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

MORTISING MACHINE.—James Skipp, Newark, N.J.—This invention relates to a new and useful improvement in machines for mortising wood, and consists in the method of reversing the chisel, and in the mechanism connected therewith.

CAN FILLER.—N. L. Brundage and B. Downing, Pittston, Pa.—This invention relates to a new and useful improvement in an article for filling cans in the process of preserving fruits, meats, vegetables, and all similar articles.

LUMBER ELEVATOR AND WASHER.—S. E. Worrell, Quincy, Ill.—This invention reates to a new and useful improvement in machines for elevating or "drawing," and washing lumber, whereby the labor ordinarily required for that operation is greatly diminished, while the lumber is cleaned and suitably prepared for the planing machine.

CENTRIFUGAL GOVERNORS.—Thomas Moore, Brooklyn, N. Y.—This invention relates to a new and useful improvement in governors for regulating the speed of steam engines, and for all purposes to which it is applicable, whereby the governor is rendered more sensitive than governors of ordinary construction.

POCKET LOCK.—F. L. Roell, Northampton, Mass.—The object of this invention is to provide a safeguard against pickpockets, and it consists in arranging at the mouth or opening of the pocket, metallic rods, which are allowed to open and close, and are operated and adjusted by means of a sliding ring or rings.

HOTEL AND BURGLAR ALARM.—C. S. Noe, Bergen Point, N. J.—The object of this invention is to construct an electric hotel and burglar alarm, which from a single battery will charge a suitable number of wires, of which each will serve to operate the alarm when closed by a suitable switch, besides indicating on a dial or other plate the particular switch which was moved to produce the current.

SOFA BED.—John Needham, Morrisiana, N. Y.—This invention relates to a new and useful improvement in a combined sofa and bed, convertable from one to the other with the greatest facility.

SCREEN COAL HOD.—M. S. Nichols and Reuben Weaver, Central Village, Conn.—The object of this invention is to provide a coal hod which shall enable the user to sift or screen the coal from the ash, as the latter is taken from the stove or grate, and it consists in making the hod in two parts, one being a receptacle for coal and the other for the ashes.

MECHANICAL MOVEMENT.—William Garrison, Clarkstown, N. Y.—This invention relates to a new mechanism for converting oscillating into rotary motion and is chiefly applicable to machines for elevating or conveying heavy loads, by means of ropes or chains wound upon or unwound from rotating drums. The invention consists in such a combination of a pivoted lever with double pawls and two rotating geared drums, that at every oscillation of the lever the drums are both rotated in opposite directions.

DAMPER ACTION FOR PIANOFORTES.—A. H. Hastings, New York city.—This invention relates to a new manner of operating the dampers of upright pianofortes, directly by means of the keys, with an object of avoiding friction, and for producing more reliable action, than could heretofore be obtained by the devices now in use.

LIFE STOOL.—H. T. Pratt, New York city.—This invention consists in providing stools for use on steamers and other vessels, adapted for use also as life preservers, the said stools being composed of a short, hollow cylindrical or other shaped part, made of paper, and two ends or heads of wood, one of which ends forms the seat, and the other the base; also, when required, one or more handles, and a strap or cord for attachment to the body. The paper is used for the construction of the cylinder, because of its high capacity to resist the action of heat, cold and moisture; also, because of its great strength and lightness.

COMPOUND FOR MAKING CONCRETE PAVEMENT.—Hiram M. Conklin, Carlstadt, N. J.—This invention relates to a new and useful compound for cementing gravel, sand, and other substances to form concrete pavements, roadways, and the like.

MACHINERY FOR REFITTING CONICAL VALVES.—Chas. F. Hall, Brooklyn, N. Y.—This invention relates to improvements in machinery for refitting the valves and valve seats of globe valves, and has for its object to provide machinery having greater efficiency than any now in use for the purpose. The invention consists in an arrangement of the stock of the conical mill or other formed cutting instrument for dressing the valves, whereby the same may be fed up to the valves by a positive feed device, and secured at any required position for the better finishing of the face of the valves, which when finished by the present implements are liable to have ridges or grooves, or be chattered in the said faces. It also consists in an arrangement of the tail stock for feeding and securinging in a similar way; also, for rotating to turn the valves; and also for adapting it for application to the guide used for attachment to the shell of the valve for supporting the reamer used for dressing the valve seat, whereby a similar positive feed may be imparted to the reamer, and be arrested for smoothening and finishing off the surface of the valve seat; also, whereby the whole apparatus may be comprised in a fewer number of parts.

SKIVING MACHINE.—John Kavanagh and M. S. Moulton, Boston, Mass.—This invention relates to improvements in machines for skiving leather, and consists in the combination on a suitable stand of revolving wheels and adjustable cutters, under an arrangement whereby the leather to be skived, whether in straight or curved strips, may be attached to the faces of the said wheels, and drawn by turning them under the cutters supported near the said faces of the wheels, and pitched at any required angle, and operating to skive or bevel the edges.

BURGLAR-PROOF SAFE.—William McFarland, Williamsburgh, N. Y.—This invention has for its object to improve the construction of burglar-proof safes, in such a way that it will be impossible to blow powder through the joint between the door and body of the safe to blow the door open.

FIRE ESCAPE.—Michel Lewes and John C. Swenson, Williamsburgh, N. Y.—This invention has for its object to furnish a simple, convenient, effective, and reliable fire escape for permanent attachment to buildings, which shall be so constructed and arranged as not to interfere with the opening and closing of the blinds or shutters.

PIPE JOINT.—Robert B. Coar, Jersey City, N. J.—This invention has for its object to furnish an improved pipe joint, which shall be so constructed and arranged as to form a flexible joint, and one which, at the same time, will be close, and will not allow the pipe to be pulled apart.

INCLINE PLANE ELEVATOR.—Thomas B. Simonton, Williamsburgh, N.Y.—This invention has for its object to improve the construction of my improved elevator, patented November 24, 1868, and numbered 84,385, so as to adapt it for use upon the inclines of railways for carrying cars up and down said inclines.

FAUCET.—James Bulger, Port Sherman, Mich.—This invention has for its object to furnish a simple and convenient faucet, which shall be so constructed and arranged that the valve or cut-off may be within the cask so that no liquid can be left in the faucet to heat, sour, corrode, or freeze and so that it cannot be left open by inexperienced or careless persons.

COMBINATION WATER WHEEL—John Fuller and Herbert Fuller, Lockington, Ohio.—This invention has for its object to furnish an improved combination water wheel, which shall be so constructed and arranged as to utilize the power that has heretofore been lost by the friction of the water upon the scroll or guide shoot, and at the same time enabling small wheels to be used so as to obtain the desired rapidity of motion without extra gearing.

CULTIVATOR.—Martin Bruner, Jr., Fremont, Ohio.—This invention has for its object to furnish an improved cultivator, which shall be so constructed as to bring the soil close up about the plants, and which will allow the plows to be easily, quickly, and conveniently raised and lowered as desired.

ADJUSTABLE WINDLASS.—John S. Brown, Schenectady, N. Y.—This invention relates to new and useful improvements in windlasses, for use on canal boats and on shipboard, and for all the purposes for which windlasses are employed.

GRAVEL PAN.—Henry Franke, Brooklyn N. Y.—The object of this invention is to provide an apparatus on which gravel or sand used for paving purposes, can be heated and dried in a continuous process. The invention consists in the construction of a system of heating flues, together with an open pan, in which the sand is contained, all parts being so arranged that the sand or gravel can be put into the pan at the top and taken out at the open sides ready for use.

SPOOLING GAGE.—R. H. Norris, Paterson, N. J.—This invention relates to a new instrument for recording the length of silk or other thread, wound upon spools, and for sounding an alarm when the required length has been wound; and also at certain desired intervals during the winding process.

FLOATING MILL POWER.—A. G. Heitmann, Brooklyn, N. Y.—This invention relates to a new apparatus for operating mills or other suitable machinery by the power of flowing or ebbing water, and consists chiefly in pivoting the superstructure on which the working machinery is set up, to a lower gate or float, and in suspending the paddle wheels by which the machinery is moved, between the said gate and the superstructure, so that by adjusting the distance between the two parts aforesaid, the amount of water acting on the paddle wheel may be regulated at will, and conformed to the amount of power required.

COOLING APPARATUS.—Theodore Gründmann, Cleveland, Ohio.—This invention relates to a new apparatus for cooling mash, beer, and other liquids, and consists in a novel arrangement of pipes, passages, and vessels for obtaining the desired result, namely; the rapid and thorough cooling of the liquid, and the absolute discharge of the warmer cooling liquid.

GAS GENERATOR AND HEATER.—Henry Schminke, Baltimore, Md.—This invention relates to an apparatus intended for burning the vapor generated by heat from any hydro-carbon liquid, such as gasoline, and has for its object to utilize the heat of the burning jet in generating the vapor required to feed the same, and to prevent the impurities of the hydro-carbon from obstructing the flow of vapor.

CENTERING ATTACHMENT TO LATHES.—Daniel Kelly, Philadelphia, Pa.—This invention has for its object to provide an attachment to lathes, whereby the two processes of centering and drilling may be combined in one that is to say, simultaneously performed.

COURSE INDICATOR FOR VESSELS.—H. P. Tuttle, Brooklyn, N. Y.—This invention relates to a new instrument by which the true course of a vessel with regard to the variations of the needle, can be readily ascertained. The invention consis in the combination of two pointers or hands with a dial, the pointers turning on the same pin. They are so ground and held together that they will both move simultaneously, so that when one is set the other will also move unless held fast.

LOCK FOR SHIPS' PUMPS.—A. G. Ziesing, Weehawken, N. J.—This invention has for its object to provide a device by means of which the pumps in ships can be locked, to prevent their being used while so locked.

PAPER BOXES.—John Root, New Haven, Conn.—This invention relates to improvements in the manufacture of small, stiff, paper boxes, such as are used for matches and the like, and it consists in securing the turned up and lapped ends and sides by rivets driven through and clinched, in substitution for the present mode of pasting them together, which is very objectionable, on account of the time required to dry, and also because, owing to the nature of the work, it must be done by hand, whereas the riveting may be done by machinery.

LOOM.—Jas. Nuttall, Walmersley, England.—This invention relates to improvements in looms, and consists in an improved construction of pattern or tappet chain for actuating the harness levers or treadles.

GRINDING MILLS.—E. H. Vining, Covington, Ga.—The first part of this invention relates to an improved mode of feeding the grain from the hopper to the stones, and consists in the combination with a cup, arranged on the top of the balance iron, of a tube permanently connected to the bottom of the hopper, in the same vertical axis, and another tube having a telescopic connection with the first, and certain adjusting devices, whereby the feeding of the grain and the varying of the feed are effected with great uniformity. The second part of this invention relates to an improved alarm apparatus, for warning the miller when the grain is nearly out of the hopper, and consists in the combination with a strap of leather, or other flexible substance, traversing the bottom of the hopper, to be pressed down by the weight of the grain when the hopper is full, of a slide, bell-clapper, and bell, held out of action when the strap is covered with grain by the said strap, but let fall when the grain passes off the strap, so that the bell clapper will come in contact with the stone, and be agitated by it so as to strike the bell and give the alarm.

ATTACHING SOLES TO BOOTS AND SHOES.—C. S. Chaffee and Alex. Wahlig, Birmingham, Conn.—This invention relates to improvements in attaching soles to boots and shoes, and consists in attaching them by screws passed through eyelets formed in or connected to an endless wire, laid in a channel cut in the sole to sink the wire below the surface, the said eyelets being made to coincide with the holes formed for the screws, and the said holes being large enough to permit the screws to force them well down into them, so as to produce such tension on the wire as to cause it to hold the leather snugly to the insole between the holes.

CARBURETING APPARATUS.—Charles Lawrence, Cincinnati, Ohio.—This invention relates to improvements in the construction and arrangement of carbureting apparatus calculated to provide a more efficient and useful apparatus than any now in use. It consists in such an arrangement that the vapor is passed through a series of carbureting and condensing cells, or chambers, whereby the impregnation of the air with the vapor is more thoroughly accomplished, as also the condensation and separation of the moisture from the gas. The apparatus employed consists in a vessel of sheet metal of any preferred kind, divided perpendicularly into two general divisions, subdivided horizontally into compartments by perforated plates, through which the vapor and the air are forced together, and caused thereby to form the most perfect combination. One of the general divisions is a chamber to which the gasoline is admitted by a pipe. Near the bottom of the said chamber is provided a perforated plate, by which the air which is admitted through the bottom is spread and disseminated thoroughly throughout the gasoline. To further effect the said dissemination, a depression is formed in the bottom of the vessel around the mouth of the air pipe, and a perforated plate is placed over the same. Above this chamber is another chamber, separated therefrom by a perforated plate. This chamber is filled with sponge or any other prepared absorbent material, and through it the vapor of gasoline taken up by the air is passed, and the impregnating process thereby continued. From the latter chamber the vapor collects in the space above, passing through another perforated plate, from whence it is conveyed by a pipe to the bottom of the next general division of the apparatus, where it passes through a similar course, and passing therefrom into a third division, which is denominated the condensing division, passing this time downward through the perforated plates and absorbent material, into the space from which it is taken by a pipe, to the gasometer or to the gas mains. Patented March 8, 1870.

EXTENSION TABLE.—C. P. Lenz, Poughkeepsie, N. Y.—This invention consists in combining a bureau or case, containing drawers or shelves, with an extension table, the said bureau or case forming the support of the middle set of rails, and being thereby out of the way, and almost entirely out of sight.

SEED AND GUANO DRILL.—Alfred Iverson, Jr., Macon, Ga.—This invention relates to a combination of devices, including a hollow cylinder for holding seed or guano, or both, with a circumferential slot, through which the contents of the cylinder are dropped, as it is drawn along, subject to the regulation of an adjustable exterior shield, a fixed stirring finger within the cylinder, and an elastic coverer in the rear.

ADJUSTABLE CASTER.—John M. Veasey, Denver, Col.—This invention consists in adapting to the legs of tables, and especially sewing machine tables, casters, so combined with levers and inclosed in recesses, that when the table is to remain stationary, and a firm footing is desirable, in order that it may not shake, the casters may be withdrawn so far within the recesses as not to touch the floor at all, and when the table is to be moved from place to place, the casters may be lowered so as to raise the table legs off the floor and leave the table supported entirely on the casters.

LAWN MOWER.—Joseph C. Field, Chicago, Ill.—This invention consists in so constructing a lawn mower, that the propelling power is applied to the shaft of the cutting cylinder, and so that the cutting cylinder may be revolved with a speed varying from that due to the forward motion of the machine, and by an application of power independent of the propelling power.

MACHINE FOR MANUFACTURING BITS.—James Swan, of Seymour, Conn.—This invention relates to a new and useful improvement in machinery for grinding the edges of auger bits and giving the outside "clear" to the lips, and consists, firstly, in a telescopic shaft and mandrel for holding, adjusting, and revolving the bit. Secondly, in a mechanism for varying the position of the bit with regard to the grinder or buzz, so as to give the proper out side "clear" to the tips of the bit, and, thirdly, in combination therewith an adjustable grindr of buzz, and the necessary mechanism for producing, the various motions.

GAGE FOR TOBACCO CUTTER.—W. N. C. Willson, Summit Point, W. Va.—This invention has for its object to gage, with accuracy, the quantity of tobacco, of different qualities, which the same amount of money will buy, and to secure uniformity in quantity, at different times, when the quality is the same.

MACHINE FOR SHAPING AND SEAMING SHEET METAL FOR ROOFING PURPOSES.—John M. Veasey, Denver, Col.—This invention has for its object to form sections of tin roofing, in trough shape, and with reflexed edges, in order to adapt them to convenient use.

RAILROAD GATE.—S. M. Snyder, Brady, Pa.—This invention has for its object to enable a railroad train to open, automatically, in advance of its passage, a gate placed across the track for preventing cattle from straying thereon to places whither they should not wander

MANURE SPREADER.—Daniel Hill, New Vienna, Ohio.—This invention relates to a new machine for spreading manure and fertilizing materials upon fields, in suitable desired quantities, but evenly and without manual labor.

PROCESS OF WORKING CAST IRON INTO WROUGHT IRON.—Philemon Merryman and Robert McCombs, West Fairview, Pa.—This invention has for its object to separate cinder from iron, in puddling furnaces, and consists in drawing off the cinder at any time before the iron comes to a boil or ferment, and at any point below the foreplate.

Official List of Patents.

Issued by the United States Patent Office

FOR THE WEEK ENDING March 15, 1870

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

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100,708.—COMBINED LOCK AND LATCH.—G. B. Allen, Norwalk, Conn.
100,709.—SHIP'S BLOCKS.—C. F. Annan, Boston, Mass.
100,710.—HAY-LOADER.—John Bachelder, Norwich, Conn.
100,711.—CHURN.—Timothy Baker, St. Johns, Mich.
100,712.—SLATE FRAME.—W. N. Bartholomew, Newton Center, Mass.
100,713.—CULTIVATOR TEETH.—Sanford Beckwith, Oskosh, Wis.
100,714.—COMBINATION LOCK.—Spencer Bentley and Charles Mee, Detroit, Mich.
100,715.—FARE REGISTER.—Frederick Blackburn and George W. Woodside, Philadelphia, Pa. Antedated February 28, 1870.
100,716.—STRAW-STACKING MACHINE.—William Boggs, Covington, Ohio.
100,717.—DETACHABLE HANDLE FOR KNIVES AND FORKS.—Leroy Boynton and W. F. Sweet, Jackson township, Pa.
100,718.—RAG-WHIPPER AND DUSTER FOR TREATING PAPER STOCK, ETC.—Leverett Brainard, Hartford, Conn.
100,719.—FAN AND PARASOL COMBINED.—Joshua Brooks, Boston, Mass. Antedated February 26, 1870.
100,720.—CULTIVATOR.—Martin Bruner, Jr., Freemont, Ohio
100,721.—FAUCET.—James Bulger, Port Sherman, Mich.
100,722.—MACHINE FOR SAWING LATH.—J. H. Butler, Hampden, Me. Antedated March 1, 1870.
100,723.—METHOD OF SECURING SOLES TO BOOTS AND SHOES.—C. S. Chaffee and Alexander Wahlig (assignors to themselves and J. M. Goulding), Birmingham, Conn.
100,724.—BOOT AND SHOE SHAVE.—A. B. Clark, North Oxford, Mass.
100,725.—ENAMEL AND CLAY GAS RETORTS, BURNERS, TILES, ETC.—D. W. Clark, Chicago, Ill.
100,726.—PIPE JOINT.—R. B. Coar, Jersey City, N. J.
100,727.—CONCRETE AND WOODEN PAVEMENT.—W. B. Coates (assignor for one half his right to Joseph Leeds), Philadelphia, Pa.
100,728.—SAFETY ATTACHMENT FOR POCKETS.—H. R. S. Colton, Houghton, Mich.
100,729.—FERTILIZER.—John Commins, Charleston, S. C.
100,730.—COMPOUND FOR MAKING CONCRETE PAVEMENTS.—Hiram M. Conklin, Carlstadt, N. J.
100,731.—MACHINE FOR DRILLING AND TAPPING GAS FITTINGS.—R. T. Crane, Chicago, Ill.
100,732.—TURBINE WATER WHEEL.—E. F. Crocker, Niles, Mich. Antedated March 2, 1870.
100,733.—FOLDING-CHAIR.—J. C. Crummy and A. A. Parsons, Pittsburg, Pa. Antedated February 25, 1870.
100,734.—COMBINED LATCH AND LOCK.—C. L. Dean, Newark, N. J.
100,735.—AUTOMATIC CRADLE.—S. G. Delano, Argentine, Mich.
100,736.—APPARATUS FOR THE PRODUCTION OF OZONE.—C. F. Dunderdale, New York city.
100,737.—APPARATUS FOR FORCING AIR INTO CARBURETERS ON RAILROAD CARS.—C. F. Dunderdale, New York city.
100,738.—RAILWAY RAIL JOINT.—E. P. Dwight, Philadelphia, Pa.
100,739.—GATE.—Thomas Ellison, Abingdon, Ill.
100,740.—CORN HUSKER.—N. Evinger, Sandford, Ind.
100,741.—BURGLAR-PROOF SAFE.—J. M. Ewing, Hastings, Mich.
100,742.—LAWN MOWER.—J. C. Field, Chicago, Ill.
100,743.—PLOW.—Miranda Fort, Talbatton, Ga.
100,744.—CIGAR PIERCER.—H. N. Foster, East Greenwich, R. I.
100,745.—GRAVEL PAN.—Henry Franke, Brooklyn, N. Y.
100,746.—COMBINATION WATER WHEEL.—John Fuller and Herbert Fuller, Lockington, Ohio.
100,747.—MECHANICAL MOVEMENT.—Wm. Garrison, Clarkstown, N. Y.
100,748.—CORN PLANTER.—William Gilman, Ottawa, Ill.
100,749.—MACHINE FOR STAMPING LACE PAPER.—Ambrose Giraudat, New York city.
100,750.—STEERING APPARATUS.—E. G. Green, East Gloucester, Mass.
100,751.—COPING FOR WALLS.—John Grindrod, Albany, N. Y.
100,752.—APPARATUS FOR COOLING BEER AND OTHER LIQUIDS.—Theodore Gründmann, Cleveland, Ohio. Antedated March 5, 1870.
100,753.—DEVICE FOR OPERATING CHURNS.—Edgar R. Hall and Wm. H. Town (said Hall assigns his right to said Town), Syracuse, N. Y.
100,754.—METHOD OF STRENGTHENING BOBBINS OR SPOOLS.—Albert Hallowell (assignor to himself, A. T. Atherton, and H. T. Durgin), Lowell, Mass.
100,755.—PAPER-MAKING MACHINERY.—Wm. W. Harding, Philadelphia, Pa.
100,756.—ROCK-DRILLING MACHINE.—Jacob Hart, Savannah, Mo.
100,757.—SCREW-DRIVER.—Lewis Hart, Unionville, Conn.
100,758.—FARE BOX FOR RAILROAD CARS.—Geo. C. Hathorn, New York city.
100,759.—GATE.—James Hays, Fostoria, Ohio.
100,760.—MEDICAL COMPOUND FROM CHLORAL.—T. H. Hazard, Richmond, Va.
100,761.—FLOATING-MILL POWER.—A. G. Heitmann (assignor to himself and James Kelly), Brooklyn, N. Y.
100,762.—MANURE SPREADER.—Daniel Hill, New Vienna, Ohio, assignor to himself and Isaac I. Evans, Richmond, Ind.
100,763.—WINDOW CORNICE.—Robert N. Hoffman, Chicago, Ill.
100,764.—FEEDING MECHANISM FOR SEWING MACHINES.—J. A. House, Bridgeport, Conn.
100,765.—KNITTING MACHINE.—J. M. Howe, Rochester, N. Y.
100,766.—CONDENSER AND LIME-EXTRACTING HEATER.—John Huntington, Cleaveland, Ohio.
100,767.—HORSE HAY FORK.—T. D. Ingersoll, Monroe, Mich.
100,768.—HORSESHOE.—Hiram Ingraham, Armada, Mich.
100,769.—HOISTING MACHINE.—Joseph Jewsbury, Brook Fields, England, assignor to H. A. Clarke, Boston, Mass.
100,770.—STUMP EXTRACTOR.—W. O. Johnson, Alma, Mich.
100,771.—SKIVING MACHINE.—John Kavanagh, Providence, R. I., and Moses S. Moulton, Boston, Mass.
100,772.—CENTERING ATTACHMENT FOR LATHE.—Daniel Kelly (assignor to himself and Walter K. Ludwig), Philadelphia, Pa.

100,773.—APPARATUS FOR LIGHTING GAS BY ELECTRICITY.—W. H. Kelly, New York city.
100,774.—VAPOR BURNER.—Isaac Kling, Seymour, Ind.
100,775.—MACHINE FOR MAKING FRUIT CANS.—Isaac Kling, Seymour, Ind.
100,776.—EXTENSION TABLE.—Chas. P. Lenz, Poughkeepsie, N. Y.
100,777.—FIRE ESCAPE.—M. Lewis and J. C. Swenson, Williamsburgh, N. Y.
100,778.—MACHINE FOR CLEANING STABLES.—T. F. Longaker, Philadelphia, Pa.
100,779.—ANIMAL TRAP.—M. W. Lyman, Chicago, Ill.
100,780.—PLOW.—T. T. Mattox, Griffin, Ga.
100,781.—BURGLAR-PROOF SAFE.—Wm. McFarland, Williamsburgh, N. Y.
100,782.—BASIN WITH WASTE-PIPE ATTACHMENTS.—G. C. Miller, Goshen, and J. H. Coates, New York city.
100,783.—DIE FOR FORMING PERCH PLATES.—R. R. Miller, Plantsville, Conn.
100,784.—CIRCULAR SAW MILL.—Jonathan Mills and A. G. Waldo, Milwaukee, Wis. Antedated Feb. 28, 1870.
100,785.—GOVERNOR FOR STEAM ENGINES.—Thomas Moore, Brooklyn, N. Y.
100,786.—SIPHON.—S. S. Moyer, Allentown, Pa.
100,787.—FARM GATE.—Joseph H. Murphy and Patrick J. Murphy, Abingdon, Ill.
100,788.—MODE OF PREVENTING THE STEALING OF BONDS, ETC.—J. Myers, Jr., Brooklyn, E. D., N. Y.
100,789.—SOFA BED.—John Needham, Morrisania, N. Y.
100,790.—BUCKWHEAT HULLING MACHING.—Thomas Nelson, (assignor to Newton Reynolds and H. G. Nelson), Troy, N. Y. Antedated March 3, 1870.
100,791.—SCREEN COAL HOD.—M. S. Nichols and Reuben Weaver, Central Village, Conn.
100,792.—HOTEL AND BURGLAR ALARM.—C. S. Noe, Bergen Point, N. J.
101,793.—SPOOLING GAGE.—R. H. Norris, Paterson, N. J.
100,794.—TAPPET CHAIN FOR LOOM.—James Nuttall, Walmersley, England, assignor to T. Isherwood and C. Maxon, Westerly, R.I. Antedated March 4, 1870.
100,795.—COAL CAR AND TRUCK WHEELS.—John Patterson, Pittsburgh, Pa.
100,796.—PRESSER-FOOT FOR SEWING MACHINES.—Wm. W. Pettee, Foxborough, Mass.
100,797.—VENTILATOR.—W. E. Phelps, Elwood, Ill.
100,798.—KNITTING MACHINE.—Frank Philip, Stockport, N. Y., assignor to Hamilton E. Towle and George Ed. Harding, New York city.
100,799.—WRITING SLATE.—George Edwin Poor, Charlestown, Mass.
100,800.—RIDING ATTACHMENT FOR PLOWS.—A. E. Porter and A. L. Porter, Lamoille, Ill.
100,801.—LIFE PRESERVING STOOL.—H. T. Pratt, New York city.
100,802.—THILL COUPLING.—G. W. Price, Adrian, Mich.
100,803.—CLOTHESLINE HOLDER.—John C. Rankin, Mount Vernon, N. Y.
100,804.—HAY RAKE AND LOADER.—G. H. Reister, Washington, Iowa. Antedated Feb. 26, 1870.
100,805.—SAFETY ATTACHMENT FOR POCKETS.—F. L. Roell, Northampton, Mass.
100,806.—PAPER BOX.—John Root (assignor to himself and Andrew Martin), New Haven, Conn.
100,807.—VAPOR BURNER FOR COOKING OR HEATING.—H. S. Saroni, Baltimore, Md.
100,808.—WASHING MACHINE.—E. B. Scattergood, St. John's, Mich. Antedated March 11, 1870.
100,809.—GRATER.—Leonard Schmidt, Lancaster, Pa.
100,810.—KNITTING MACHINE.—Henry Batchford Scudder, Needham, Mass.
100,811.—INCLINE PLANE ELEVATOR.—T. B. Simonton, Williamsburgh, N. Y.
100,812.—CULTIVATOR.—J. B. Skinner, Rockford, Ill.
100,813.—MORTISING MACHINE.—James Skipp, Newark, N. J.
100,814.—STEAM ENGINE SLIDE VALVE.—A. J. Stevens, San Francisco, Cal. Antedated March 5, 1870.
100,815.—COMBINED CORN MARKER, PLANTER, AND CULTIVATOR.—Wm. Stirk, Fort Wayne, Ind.
100,816.—MACHINE FOR BENDING THE LIPS OF AUGER BITS.—Jas. Swan, Seymour, Conn.
100,817.—HARVESTER.—P. A. Tobey (assignor for one half his right to S. Tobey), Caton, N. Y.
100,818.—HORSE-POWER.—P. A. Tobey (assignor for one half his right to S. Tobey), Caton, N. Y.
100,819.—CHECK PIECE AND SHROUD YOKE FOR SHIPS' RIGGING.—Henry Townsend, Philadelphia, Pa.
100,820.—PADDLE WHEEL.—Benjamin W. Tooker, Brooklyn, N. Y.
100,821.—HAND INDICATOR FOR SHOWING THE COURSE OF VESSELS.—H. P. Tuttle, Brooklyn, N. Y.
100,822.—VEGETABLE SCOOP.—John F. Unglish, Webster, N. Y.
100,823.—DIE FOR MAKING CLINCH RINGS.—Samuel Vanstone, Providence, R. I.
100,824.—GRINDING MILL.—E. H. Vining, Covington, Ga.
100,825.—DIE OR FORMER FOR MAKING DOUBLE-SHINNED MOLDBOARD BLANKS FOR PLOWS.—W. M. Watson, Tonica, Ill.
100,826.—LADLE FOR PORING METALS.—A. S. Wells, New Britain, Conn.
100,827.—HORSE POKE.—Geo. Whitbeck, Phelps, N. Y.
100,828.—LIFTING JACK.—F. C. White, Euclid, Ohio.
100,829.—SLUICE BOX FOR GOLD MINING.—J. H. Whitney, Helena, Montana Territory. Antedated March 5, 1870.
100,830.—REVERSIBLE KNOB LATCH.—Joseph Whittingham, Pittsburgh, Pa.
100,831.—APPARATUS FOR WASHING AND ELEVATING LUMBER.—Stanley E. Worrell, Quincy, Ill.
100,832.—ELEVATOR.—M. L. Wyman, Melrose, assignor to O. Tufts, Boston, Mass.
100,833.—LOCK FOR SHIPS' PUMPS.—A. G. Ziesing, Wehawken, N. J.
100,834.—TRACK-LAYING MACHINE.—J. R. Adams, San Francisco, Cal.
100,835.—APPARATUS FOR DRYING AND EVAPORATING.—C. Alden, Newburg, N. Y.
100,836.—SPOKE LATHE.—G. F. Almy, Toledo, Ohio.
100,837.—RAILWAY CAR COUPLING.—S. J. Anderson, Cazenovia, N. Y.
100,838.—CENTRIFUGAL PUMP.—William Draper Andrews, New York city.
100,839.—FRICTION WHEELS FOR GEARING.—W. D. Andrews, New York city.
100,840.—LAWN MOWER.—Joseph Arbeiter, East Hartford, assignor to Samuel Colt, Hartford, Conn.
100,841.—STEAM ENGINE.—John S. Barden, Providence, R. I.
100,842.—BELT-SHIPPING MECHANISM FOR SPINNING JACKS.—Joseph Baron, Millbury, Mass.
100,843.—HEDGE FENCE.—A. Belt, Newtown, Iowa.
100,844.—DETERGENT COMPOUND.—William Berry, Boston, Mass., assignor to himself, George W. Belcher, and William G. McLeod.
100,845.—LANTERN.—W. J. Berry, Brooklyn, N. Y.
100,846.—LIFTING JACK.—L. J. Blades, Harrington, and J. Mahoney, Wilmington, Del.
100,847.—STEAM ENGINE GOVERNOR.—Horace Boardman, Port Richmond, N. Y.
100,848.—CARVING WOOD.—Myron T. Boult, Battle Creek, Mich.
100,849.—APPARATUS FOR MAKING EXTRACTS AND DECOCTIONS FROM COFFEE, TEA, AND OTHER SUBSTANCES.—Louis Brauer, Washington, D. C.
100,850.—CIGAR SHIELD.—George E. Brinkerhoff, New York city.
100,851.—FUNNEL CAN FILLER.—N. L. Brundage and B. Downing, Pittston, Pa.
100,852.—PORTABLE BEER COOLER.—E. C. Bundy, Oneonta, N. Y.
100,853.—CULINARY BOILER.—F. M. Carnes (assignor to Giles Carter and Smith Carpenter), Rochester, N. Y.
100,854.—POTATO DIGGER.—H. C. Carr, Bordentown, N. J.
100,855.—WOOD-TURNING LATHE.—James Chase, Rochester, N. Y.
100,856.—HAY TEDDER.—T. J. Clark and G. M. Clark, Higganum, Conn.
100,857.—EGG CARRIER.—W. J. Clark, Lena, Ill.
100,858.—STAIR ROD.—W. M. Clayton, New York city.
100,859.—CAPSTAN.—D. N. B. Coffin, Jr., Newtown Center, Mass.
100,860.—RAILWAY CAR AXLE.—Charles Cole, Troy, N. Y., assignor to himself and Harvey Cole, Hartford, Conn.
100,861.—HAY AND COTTON PRESS.—R. H. Cole and G. F. Cole, Greenport, N. Y.
100,862.—ORANGE KNIFE.—Edward L. Cooke, Hartford, Conn.
100,863.—CULINARY VESSEL.—C. E. Corbett, Binghampton, N. Y.
100,864.—BODY LOOP FOR CARRIAGES.—Fredrick A. Cowles, Plantsville, assignor to himself and J. B. Savage, Southington, Conn.
100,865.—PAPER BOX.—C. O. Crosby, New Haven, Conn.
100,866.—PHOTOGRAPHIC PLATE DIPPER.—D. H. Cross, Bennington, Vt.
100,867.—DEPURATOR.—Wm. Curran, St. Louis, Mo.
100,868.—VISE.—R. J. Cushing, Bowdoinham, Me.
100,869.—PLOW.—M. K. Dahl, Waupun, Ill.
100,870.—RAILROAD CAR VENTILATOR.—Samuel Darling, Providence, R. I.
100,871.—MANUFACTURE OF FERTILIZERS.—J. Y. Diaz, Havana, Island of Cuba.
100,872.—LATCH.—S. W. Drowne, Norwich, Conn.
100,873.—CARRIAGE WHEEL HUB.—Jacob Dump, Kingston, Conn.
100,874.—STILL FOR DISTILLING HYDROCARBONS.—J. B. Edwards, North Greenbush, N. Y.
100,875.—MODE OF LUBRICATING THE WHEELS IN TREAD POWERS.—S. D. Ely, Millstone, N. J.
100,876.—PROCESS OF TREATING ACID RESIDUUM FROM OIL REFINERIES.—Alonzo Farrar, Brookline, Mass.
100,877.—COMPOSITION, TO BE USED FOR PRINTING OR PAINTING ON SURFACES.—Alonzo Farrar, Brookline, Mass.
100,878.—Division A. — MACHINE FOR MANUFACTURING HARVESTER GUARD FINGERS.—Jerome Fassler, Springfield, Ohio.
100,879.—NEEDLE CASE.—W. B. Field, Rockville, and Burroughs Beach, Meriden, Conn.
100,880.—COFFEE POT.—J. F. Fitch, B. G. Devoe, and R. W. B. McLellan, Vandalia, Ill., said McLellan assigns his right to said Fitch and Devoe. Antedated March 11, 1870.
100,881. PROCESS OF MAKING GLASS SIGNS, SHOW CARDS ETC.—Christian Flammer, Chicago, Ill.
100,882.—COMBINED CARRIAGE, CRADLE, SWING, AND BABY WALKER.—W. H. Flanigan, Philadelphia, Pa.
100,883.—AUTOMATIC BOILER FEEDER.—Elisha H. Goldman, Clayton, Ind.
100,884.—TORPEDO AND CARTRIDGE.—Edwin Gomez, New York city.
100,885.—PUMP.—D. J. Gorton (assignor to himself and W. E. Gorton) West Eau Claire, Wis.
100,886.—SUSPENDER.—B. J. Greely (assignor to T. O. Potter and J. W. Smith), Boston, Mass.
100,887.—APPARATUS FOR ELEVATING AND BAGGING GRAIN.—J. S. Hasbrouck, Tyre, N. Y.
100,888.—DAMPER FOR PIANOFORTE.—A. H. Hastings, New York city. Antedated March 5, 1870.
100,889.—PACKING APPARATUS.—Cornelius E. Haynes, Boston, Mass.
100,890.—LEATHER SCARFING MACHINE.—Charles H. Helms, Poughkeepsie, N. Y.
100,891.—LATHE FOR SETTING JEWELS IN TIME PIECES.—H. H. Haskett, McLean county, Ill.
100,892.—MANUFACTURE OF BRICKS.—G. S. Hewitt, Boston, Mass.
100,893.—ELEVATED RAILWAY.—B. L. Hood, H. O. Hood, and E. W. Clark, Jr., Washington, D. C.
100,894.—SADDLE.—George Horter (assignor to himself T. K. Peterson, and E. C. Fenner), New Orleans, La.
100,895.—JOINT FOR FISHING RODS.—W. J. Hubbard, Ansonia, Conn.
100,896.—PIPE COUPLING FOR HEATING AND VENTILATING RAILROAD CARS.—F. R. Hunt, Leavenworth, Kansas.
100,897.—PACKAGE BAND AND FASTENER.—F. R. Hunt, Leavenworth, Kansas.
100,898.—SEED AND GUANO DRILL.—Alfred Iverson, Jr., Macon, Ga.
100,899.—HASP AND STAPLE FASTENING.—E. P. Jones, Shell Mound, Miss.
100,900.—RAILWAY CAR BRAKE.—E. P. Jones, Shell Mound, Miss.
100,901.—WAGON BRAKE.—Edward P. Jones, Shell Mound, Miss.
100,902.—MANUFACTURE OF STAVE BASKET.—H. C. Jones, Dowagiac, Mich.
100,903.—MACHINE FOR BENDING FIFTH WHEELS.—Wm. J. Jordan, New Lisbon, Ohio.
100,904.—BINDING ATTACHMENT FOR SEWING MACHINES.—A. C. Kasson, Milwaukee, Wis.
100,905.—REVOLVING, ROCKING, AND RECLINING CHAIR.—George Knell, Moorestown, N. J.
100,906.—LIFE PRESERVER.—Camille Krejci, Scranton, Pa.
100,907.—APPARATUS FOR WORKING HIDES.—Henry Lampert, Rochester, N. Y.
100,908.—FANNING AND SMUT MILL.—Horace Littlefield, Lewis, Iowa.
100,909.—NEEDLE-ADJUSTING BLOCK FOR SEWING MACHINES.—T. A. Macaulay, Northampton, Mass.
100,910.—DRAWBRIDGE.—Neil Macneale, Cincinnati, Ohio.
100,911.—FEATHER WASHER AND DRYER.—John Mallory, Penn Yann, N. Y.
100,912.—MACHINE FOR SPINNING SHEET METAL.—John J. Marcy (assignor to himself and E. Miller & Co.), Meriden, Conn.
100,913.—SMUT MILL.—D. W. Marmon (assignor to Nordyke, Marmon, & Co.), Richmond, Ind.
100,914.—FRUIT DRYER.—J. B. May, Magnolia, Ohio.
100,915.—PRODUCTION OF LIGHT FROM HEAVY HYDROCARBONS.—R. S. Merrill, Cambridge, assignor to W. B. Merrill and Joshua Merrill, Boston, Mass.
100,916.—PUDDLING PROCESS FOR MAKING WROUGHT IRON.—Philemon Merryman and Robert McCombs, West Fairview, Pa.
100,917.—RAILWAY RAIL.—James Millholland, Reading, Pa.
100,918.—ICE-CREAM FREEZER.—Thos. Mills and G. M. Mills, Philadelphia, Pa.
100,919.—FENCE.—David Mitchell, New Berlin, Pa.
100,920.—WATER-WHEEL.—A. F. Murray and Henry Green, Moline, Ill.
100,921.—HANDLE FOR TABLE CUTLERY.—J. H. Nichols and Wm. Bower, Beaver, Pa.
100,922.—HARVESTER RAKE.—Aaron Palmer and C. W. Palmer, Brockport, N. Y.
100,923.—WASHING MACHINE.—G. W. Putnam, South Glens Falls, N. Y.
100,924.—MODE OF PRODUCING PHOTO-LITHOGRAPHIC TRANSFERS.—Isaac Rehn, Washington, D. C., assignor to himself and Norris Peters.
100,925.—FOLDING CRIB AND CRADLE.—D. M. Reynolds, Chicago, Ill.
100,926.—SPIRAL SPRING FOR RAILWAY CARS.—F. W. Rhinelander, New York city.
100,927.—MACHINE FOR PREPARING WOOD FOR INLAYING.—C. F. Ritchel, Newark, N. J.
100,928.—MACHINE FOR HEADING BOLTS.—John Root (assignor to himself and McLagon & Stevens), New Haven, Conn.
100,929.—MACHINE FOR CORRUGATING SHEET METAL.—Franklin Roys, East Berlin, Conn.
100,930.—VAPOR BURNER.—Henry Schminke, Baltimore, Md.
100,931.—CATARRH REMEDY OR SNUFF.—Thos. C. Scruton, Farmington, N. H.
100,932.—SCRUBBING BRUSH.—John See, Philadelphia, Pa.
100,933.—BURGLAR ALARM.—Reuben Shaler, Madison, Conn.
100,934.—MECHANISM FOR OPERATING SEWING MACHINES.—Elisha Shiver, Washington, D. C.
100,935.—MECHANISM FOR DRIVING SEWING MACHINES.—Elisha Shivar (assignor to J. H. McBlair), Washington, D. C.
100,936.—EXTRACTING TURPENTINE FROM PINE TREES.—J. C. Shuler, Cane Hoy, S. C.
100,937.—METALLIC ALLOY TO IMITATE THE PRECIOUS METALS.—Lorenzo Sibert, Staunton, Va.
100,938.—SPOON HOLDER.—Samuel Simpson, Wallingford, Ct.
100,939.—MAN-HOLE PLATE FOR TANNERY STUFFING WHEEL.—Henry Smith, Jr., Milwaukee, Wis.
100,940.—RAILROAD CONDUCTORS' TICKET CASE.—Joseph T. Smith, Louisville, Ky.
100,941.—CORN HUSKER.—T. S. Smith, Cincinnati, assignor to himself and O. H. P. Anderson, Salem, Ohio.
100,942.—WATER-WHEEL REGULATOR.—H. D. Snow, Bennington, Vt. Antedated March 11, 1870.
100,943.—RAILWAY GATE.—S. M. Snyder, Brady, Pa.
100,944.—MANUFACTURE OF CEMENT FOR ARTIFICIAL STONE.—Stanislas Sorel, Paris, France, assignor to J. F. Wood, Boston, Mass.
100,945.—MANUFACTURE OF ARTIFICIAL STONE.—Stanislas Sorel, Paris, France, assignor to J. F. Wood, Boston, Mass.
100,946.—COMBINED CURRENT-WHEEL AND CONDENSING ENGINE.—Hatherly Spear, Cape Elizabeth, Me.
100,947.—HEATING ATTACHMENT FOR STEAM BOILERS.—Elihu Spencer, Elizabeth, N. J.
100,948.—IRON FRAME FOR UPRIGHT PIANOS.—Geo. Steck, New York city.
100,949.—WRAPPING SCYTHES FOR TRANSPORTATION.—Lovett Stimson (assignor to the Greenwoods Scythe Company), New Hartford, Conn.
100,950.—HORSE RAKE.—J. C. Stoddard, Worcester, Mass.
100,951.—THILL COUPLING.—Chauncey Thomas, Boston, Mass. Antedated March 3, 1870.
100,952.—ASH SHOVEL.—R. J. S. Thompson, Washington, Pa.
100,953.—MANUFACTURE OF ROSIN OIL.—Joseph Treat, New York city.
100,954.—COMPOSITION FOR CONCRETE PAVEMENTS, WALKS, ETC.—A. Van Camp, Washington, D. C., and M. M. Hodgman, St. Louis, Mo.
100,955.—COMBINED HEDGE TRIMMER AND MOWER.—Geo. Waddington, Le Roy, Ill.
100,956.—LANDAU CARRIAGE DOOR.—Edward Wells, New Haven, Conn.
100,957.—PLOW.—R. J. Wheatley, Duquoin, Ill.
100,958.—AUTOMATIC CAR BRAKE.—Marmaduke Wilkin and John Clark, London, England.
100,959.—GAGE FOR TOBACCO CUTTER.—W. N. C. Willson, Summit Point, West Va.
100,960.—CAR BRAKE AND STARTER.—E. P. Jones, Shell Mound, Miss.

REISSUES.

3,878.—SAW MILL.—A. P. Barlow, C. H. Eastman, W. W. King, Z. B. Small, and J. H. Johnson, Claremont, N. H., assignees of A. P. Barlow.—Letters Patent No. 72,155, dated December 17, 1867.
3,879.—AUGER.—I. T. Payne, Chester, Conn.—Letters Patent No. 75,454, dated March 10, 1868; antedated February 28, 1868.
3,880.—PADLOCK.—F. W. Smith, Jr., Bridgeport, Conn., Geo. W. Bassett, New York city, and S. R. Wilmot, Bridgeport, Conn., assignees of Frederick Egge.—Letters Patent No. 86,377, dated Feb. 2, 1869.

DESIGNS.

3,895.—ARTIFICIAL FLOWER.—C. S. Baldwin, New York city.
3,896 and 3,897.—FLOOR CLOTH PATTERN.—Hugh Christie, Morrisania, assignor to W. M. Brasher & Co., Brooklyn, N. Y. Two patents.
3,898.—PATTERN OR CHART FOR APPLYING MEASUREMENTS AND LAYING OUT DRESS WAISTS.—Willett Cornwell and Elmira Cornwell, Rochester, Minn.
3,899.—CHILDREN'S CARRIAGE.—Geo. H. Mellen, New York city.
3,900.—CLOCK FRONT.—Nicholas Muller, New York city.
3,901 to 3,905.—TYPE.—W. H. Page, Norwich, Conn., assignor to W. H. Page & Co. Five patents.
3,906.—TRADE MARK.—Wm. Pearson and Peter Hogoboom, Ripon, Wis.
3,907.—STAIR ROD.—August Pohl, Brooklyn, N. Y.
3,908.—HANDLE CAP FOR SATCHELS.—J. M. Riley, Newark, N. J.
3,909.—THERMOMETER.—C. R. Sherman and Wendell Macy, New Bedford, Mass.
3,910.—BAGGAGE RACK.—R. M. Snodgrass, Pittsburgh, Pa.
3,911.—COOKING STOVE.—David Stuart and Lewis Bridge (assignors to David Stuart and Richard Peterson), Philadelphia, Pa. Antedated March 1, 1870.
3,912.—SHUTTER BAR.—John Tiebout, New York city.

EXTENSIONS.

HARVESTER RAKE.—Owen Dorsey, of Newark, Ohio.—Letters Patent No. 14,350, dated March 4, 1856; reissue No. 1,067, dated Oct. 23, 1860; reissue No. 2,982, dated June 9, 1868.

WOOD-BENDING MACHINE.—J. C. Morris, Cincinnati, Ohio.—Letters Patent No. 14,405, dated March 11, 1856; reissue No. 1,312, dated May 27, 1862.

NEW BOOKS AND PUBLICATIONS.

THE PRINCIPLES OF MECHANISM AND MACHINERY OF TRANSMISSION. Comprising the Principles of Mechanism, Wheels, and Pulleys, Strength, and Proportions of Shafts, Couplings for Shafts, and Engaging and Disengaging Gear. By William Fairbairn, Esq., C. E., LL.D., F.R.S., F.G.S., Corresponding Member of the National Institute of France, and of the Royal Academy of Turin, Chevalier of the Legion of Honor, etc., etc. Philadelphia: Henry Carey Baird, Industrial Publisher, No. 406 Walnut street. Price, by mail, free of postage, $2·50.

Few names are more widely and favorably known to the mechanical and scientific world than that of Mr. Fairbairn. Whatever publication bears his name, bears a guarantee that its subject has been thoroughly thought out, and that its conclusions are presented with that clearness which characterizes all of Mr. Fairbairn's works. The volume before us contains the results of the experience and study of one of the most accomplished millwrights and engineers of the present century. It first discusses the principles of mechanism, and, passing over the elementary forms of construction, in which various mechanical movements are discussed, it takes up the general subject of the transmission of power by machinery, in which the devices in general use for this purpose are discussed at length. This is followed by a chapter on the strength of shafts, with rules for computing strength, tables of resistance to flexure, torsion, etc.; and the work is completed by an extended discussion of various forms of couplings, engaging and disengaging gear, hangers, plumber blocks, main shafts, etc., etc. It is a book which every mechanic ought to possess.

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The former edition of this work has, we are informed by the publisher in his preface, been exhausted for several months; but the demand for it

has remained unabated. That edition achieved a wide and well-merited popularity, and is so well known that it needs no word of praise from us. The present edition has, we see, received some very important and valuable additions. Besides careful revision of the old text, entire new chapters have been appended. Among the subjects treated in the added chapters, we find "Metallurgic Chemistry," and "Metallurgic Operations," by John Scoffern, M. B., "Recently Patented Refining Processes," "Wrought Iron in large Masses," by William Clay, and "Application of Iron to Shipbuilding," by William Fairbairn. Several chapters on various branches of Electro-Metallurgy have also been added. The chapter on "Recently Patented Refining Processes," contains a full account of the Bessemer process. This is the best American work of its class yet published.

ANNUAL OF SCIENTIFIC DISCOVERY; or, Year Book of Facts in Science and Art, for 1870, exhibiting the most Important Discoveries and Improvements in Mechanics, Useful Arts, Natural Philosophy, Chemistry, Astronomy, Geology, Biology, Botany, Mineralogy, Geography, Antiquities, etc. Together with Notes on the Progress of Science during the Year 1869. A List of Recent Scientific Publications, Obituaries of Eminent Scientific Men, etc. Edited by John Trowbridge, S. B., Assistant Professor of Physics in the Massachusetts Institute of Technology, aided by Samuel Kneeland, M. D., Professor of Zoology and Physiology in the Institute, and W. R. Nichols, Graduate of the Institute. Boston: Gould & Lincoln, 59 Washington street. New York: Sheldon & Co. London: Trubner & Co.

This annual is as usual a tolerably complete record of scientific progress for the past year. We, however, observe some omission of events which are certainly of greater importance than some which find a place in the book. On the whole, we do not think this number has been edited with the usual care. We observe also that some extracts from our journal have not been properly credited.

THE RECORDS OF LIVING OFFICERS OF THE U. S. NAVY AND MARINE CORPS. With a History of Naval Operations during the Rebellion of 1861–5, and a List of the Ships and Officers Participating in the Great Battles. Compiled from Official Sources, by Lewis R. Hammersly (late Lieutenant U. S. Marine Corps). Philadelphia: J. B. Lippincott & Co.

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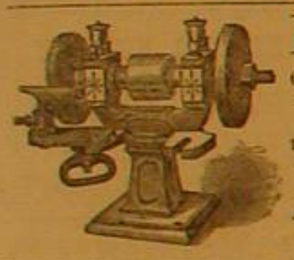

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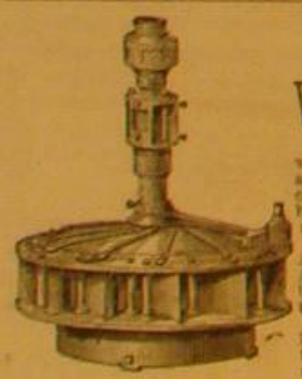

SMALL

Water Wheels.

We are not acquainted with S. D. Parker, M.D., and have never had any correspondence with him, but his very fine and interesting account of a SMALL TURBINE in No. 5, Vol. 23, SCIENTIFIC AMERICAN, requires at least our sincerest thanks.
Below is Mr. Williams' letter to us in regard to us in regard to the same wheel.

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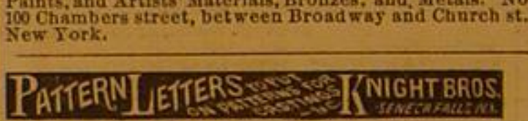

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SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXII.—No. 14. [NEW SERIES.] NEW YORK, APRIL 2, 1870. $3 per Annum, [IN ADVANCE.]

Improved Bolt Cutter.

Most bolt-cutting machines have but two dies in the cutter head. The work performed by these dies is, without doubt, underrated by most mechanics, increasing in severity with the size of the bolts. The machine herewith illustrated has these dies in the cutter head, between which the work is equally distributed, and also possesses such other points of merit as to secure the award of the first prize, the large medal, at the recent Mechanics' Fair at Buffalo.

The principal points of superiority claimed for this bolt cutter is the clean and perfect manner in which the thread is cut by one passage over the iron, with rapidity and ease of action, uniformity of work, simplicity, and durability.

The arrangement of the dies is such, that as soon as they begin to cut, they will close as far as the stop will allow them, and the bolts will be cut the same size, any length.

As soon as the bolt is cut its required length, the dies are opened by the lever and the bolt taken out *without the necessity of running back off the thread.*

The action of the dies is the same as a lathe tool, taking a clean chip, which leaves the thread firm and strong.

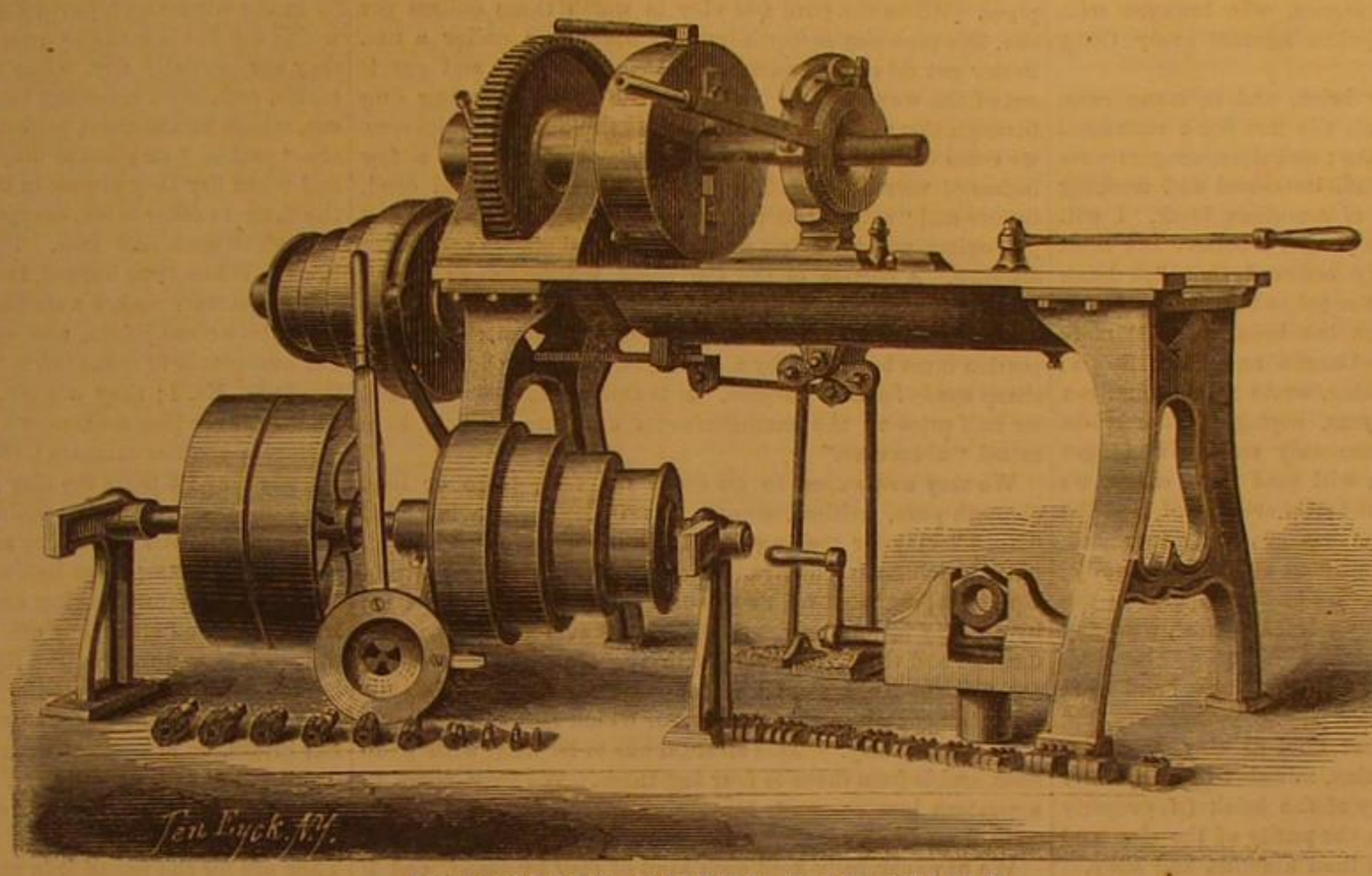
The dies can be sharpened by grinding. When too much worn, they can be taken out of the head, refitted, and re-tempered in a very few minutes. In cutting short bolts, a plug socket is placed in the jaws, which will admit the head of the bolt. In using the socket, it is not necessary to stop the machine to take out or replace the bolt. One socket will answer for all bolts, if it will admit the head and not allow it to turn.

Besides the ordinary V-shaped thread, from $\frac{3}{8}$ to $1\frac{1}{2}$ inches inclusive, by once passing over the bolt, the machine will cut coach screws, and square threads, double and single, such as piano stool, letter press, and cider-mill screws, from $\frac{3}{8}$ to $1\frac{1}{4}$ inches, of not less than four threads to the inch. For sizes, from $\frac{3}{8}$ to $1\frac{1}{4}$ inches, inclusive, square thread, once passing over the bolt with a No. 2 machine, with double center, is sufficient to cut a perfect thread. No. $2\frac{1}{2}$ will cut from $\frac{3}{8}$ to 2 inches, inclusive, V-thread, and to $1\frac{1}{2}$ in. square thread. No. 3 machine will cut from $\frac{3}{4}$ to 3 in., V-shaped, and to $2\frac{1}{2}$ square thread. The machine will also tap nuts of corresponding sizes to bolts cut. With each complete No. 2 machine is furnished a nut holder, and with complete machines, Nos. $2\frac{1}{2}$ and 3, are furnished parallel vises for holding nuts, as shown in the engraving, thereby making it a perfect bolt cutter and nut tapper.

Each complete No. 2 single center machine is furnished with six sets of dies, six burrs (master taps), cone, pulleys, counter shaft with hangers, and nut holder. The double-center machines have the same, with eight sets dies and eight master taps. No. $2\frac{1}{2}$, same, with eleven sets dies and eleven master taps. No. 3, single center, same, with eight sets dies and eight master taps. No. 3, double center, same, with twelve set dies and twelve master taps. With cutter heads, dies only are furnished.

The center head may also be employed to advantage on other bolt-cutting machines, or attached to engine lathes, of which those swinging from sixteen to twenty inches are the most convenient for this purpose.

We are informed that many of these tools are now in use, and that they even perform work hitherto reserved for the screw-cutting lathe, such as vise screws, lead screws for lathes, etc. It is stated, and attested by reliable parties, that this machine will cut two 1-inch screws per minute, and nuts with equal rapidity. For further particulars, address R. L. Howard, manufacturer, Chicago street and Erie Canal street, Buffalo, N. Y.



SCHLENKER'S PATENT BOLT CUTTER.

Improved Self-Connecting Car Coupling.

Our reader are well aware that very many attempts have been made to devise a safe and efficient self-connecting car coupling, by which cars will, when run together, couple themselves without the aid of an attendant, whose life is often endangered in coupling cars by the old method.

The one herewith illustrated works well on the model, and we see no reason why it should not also work well in actual practice.

Fig. 1

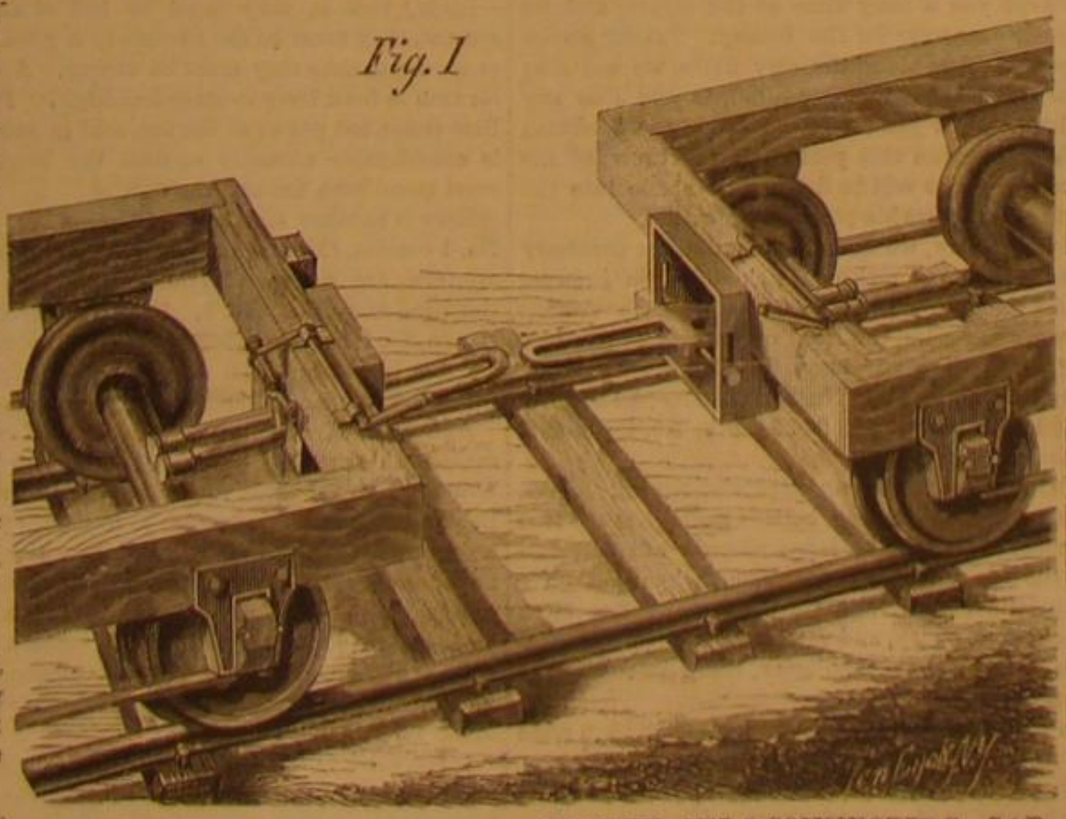
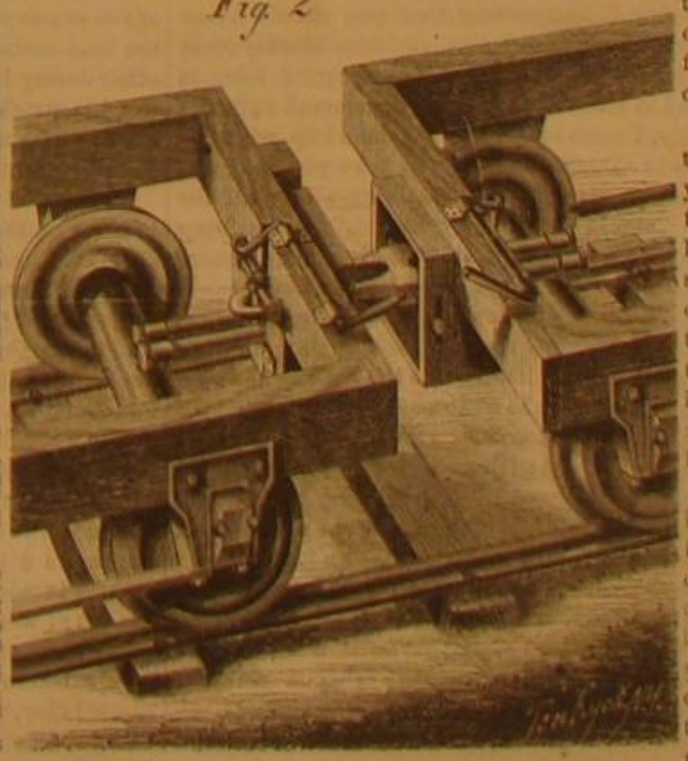


Fig. 2



LANDIS' SELF-CONNECTING CAR COUPLING.

Fig. 1 shows two cars with this coupling attached, but uncoupled. Fig. 2 shows the same cars coupled. The uncoupling is very quickly and easily performed without entering between the platforms of the cars, as will be seen upon inspection of the engravings.

The coupling links are pivoted in such a manner as to give both vertical and lateral play, and balanced so that they maintain an approximately horizontal position. The coupling pin has vertical play through the eye of a horizontal bar, which bar has a horizontal rotary motion in suitable bearing. Thus the coupling-pin may swing inward, but can swing outward only to the vertical position where it meets a latch, which holds it from swinging any further until the coupling is raised, as hereinafter described.

To an eye in the upper end of the coupling pin is attached a short link, which connects the coupling pin with a crank lever, by which, when it is desired to uncouple the car, the coupling pin is raised enough to clear the latch, when it swings outward and the coupling link is released.

It makes no difference which coupling link slides on the top of the other. In whatever position they come together they will couple the cars. The device is simple, and, it would seem, might be advantageously applied, to both freight and passenger cars. As it is cheap and certain in its operation we consider it worthy the attention of railroad men.

Patented, Nov. 3, 1868, and assigned to Hiram F. Landis, whom address at Hummelstown, Pa.

Painting in Milk.

In consequence of the injury which has often resulted to sick and weakly persons from the smell of common paint, the following method of painting with milk has been adopted by some workmen, which, for the interior of buildings, besides being as free as distemper from any offensive odor, is said to be nearly equal to oil painting in body and durability. Take half a gallon of skimmed milk, six ounces of lime, newly slaked, four ounces of poppy, linseed, or nut oil, and three pounds of Spanish white. Put the lime into an earthen vessel or clean bucket, and having poured on it a sufficient quantity of milk to make it about the thickness of cream, add the oil in small quantities at a time, stirring the mixture with a wooden spatula. Then put in the rest of the milk, and afterwards the Spanish white.

It is, in general, indifferent which of the oils above-mentioned you use; but, for a pure white, oil of poppy is the best.

The oil in this composition, being dissolved by the lime, wholly disappears; and, uniting with the whole of the other ingredients, forms a kind of calcareous soap.

In putting in the Spanish white, you must be careful that it is finely powdered and strewed gently over the surface of the mixture. It then, by degrees, imbibes the liquid and sinks to the bottom.

Milk skimmed in summer is often found to be curdled; but this is of no consequence in the present preparation, as its combining with the lime soon restores it to its fluid state. But it must, on no account, be sour; because, in that case, it would, by uniting with the lime, form an earthy salt, which could not resist any degree of dampness in the air.

Milk paint may likewise be used for out-door objects by adding to the ingredients before-mentioned two ounces each more of oil and slaked lime, and two ounces of Burgundy pitch. The pitch should be put into oil that is to be added to the milk and lime, and dissolved by a gentle heat. In cold weather, the milk and lime must be warmed, to prevent the

pitch from cooling too suddenly, and to enable it to unite more readily with the milk and lime.

Time only can prove how far this mode of painting is to be compared, for durability, with that in oil; for the shrinking to which coatings of paint are subject depends in great measure upon the nature and seasoning of the wood.

The milk paint used for in-door work dries in about an hour; and the oil which is employed in preparing it entirely loses its smell in the soapy state to which it is reduced by its union with the lime. One coating will be sufficient for places that are already covered with any color, unless the latter penetrate through it and produce spots. One coat will likewise suffice, in general, for ceilings and staircases; two will be necessary for new wood.

Milk painting may be colored, like every other, in distemper, by means of the different coloring substances employed in common painting. The quantity I have given in the recipe will be sufficient for one coat to a surface of about twenty-five square yards.—*Painter, Gilder and Varnisher.*

THE MANUFACTURE OF FIRE BRICKS.

Twenty years ago, the manufacture of fire brick in the United States was in its infancy—in an experimental condition. Consumers of fire brick had, for the most part, foreigners, chiefly English, for managers, who brought with them to this country their prejudice against every thing American.

We had to beg them to try our brick, and in many cases pay them for doing so. Nearly all the fire brick consumed at that time, were of English make; and the managers were often agents for English houses, all interested and working together against the production of American brick. I will do them the justice however to say, that I believe the most of them were sincere, and really believed that fire brick could not be produced in America equal to English fire brick. But latterly, American fire brick has been exported more or less to the British dominions—Canada and Nova Scotia; and a British house of high standing, wrote to an American manufacturer within the last year, saying, "Your bricks always give good satisfaction; the only trouble is to get them in small quantities. If you will send us a cargo, we will sell them for you." Thus the tables are turned, and the production of American fire brick has gradually increased, until at this time more than fifty millions are made annually; and I believe the best American fire brick competes in the quality of successfully withstanding intense heat, with any brick produced in the world.

What are they made of? and how are they made? and what is the secret of their production?

Fire brick is made of a peculiar kind of clay, the principal ingredient of which is alumina, mixed with a smaller portion of silex; and the quality of the brick (if properly manufactured) is in exact ratio to the purity of the clay and its freedom from all matters other than alumina and silex.

Fire clay is found in England and west of the Alleghany Mountains in the United States, in the vicinity of coal fields, in a semi-rocky state, resembling soap stone; and in many instances it forms the bed or hearth on which rests the bituminous coal. Like the coal, it contains more or less sulphuret of iron, the worst enemy fire brick makers have to contend with, except it be potash, ½ of 1 per cent of which would ruin any fire clay. The manufacture of fire brick from this kind of clay is the same in all countries, except the difference in machinery to work it, and the process is simple.

But I shall confine myself in this article, mostly to the subject of manufacturing fire brick from the noted fire clay of New Jersey, which is found in the town and vicinity of Woodbridge; and which, so far as I know, is unlike any other fire clay. As you wish to know all about making fire brick out of this clay, it is necessary that you should know all about the stock, or the different varieties of clay that make up the stock; for the secret of making good brick is partly to be found in the stock; and to understand fully its nature and quality, I must invite you to take a trip with me to the clay mines in Woodbridge. I will take you to one of the largest and best worked mines, containing nearly all the varieties of clay found in the fire clay district. On arriving at the mines, we look down into a valley, thirty feet or more below the surface on which we are standing, and behold forty or fifty men, mostly with spades and shovels, a part working into the bank above the clay, and a part digging and throwing clay out from pits, whence the bearing has been removed, on to platforms made of loose boards, from which teams are almost constantly seen loading and carting it away.

The first impression is that it can never pay, the whole bearing and clay to be removed being from forty to fifty feet in depth, and all to be handled with the spade and shovel. Indeed it does seem very much like a mouse endeavoring to eat up a large hay stack. Now we will go down into this valley; if it is a wet time, it will be somewhat difficult to get around on account of the mud that will cling to our boots with great tenacity; but knowledge is often obtained under difficulties. We now find ourselves on a level of the first stratum of clay. Before us rises the bank of earth, thirty, sometimes forty feet high, from the clay to the surface. This is called "the bearing." On the other side of the valley is the "dump ground," rising some twenty-five or thirty feet high, with sewers underneath, which are extended as we proceed, to carry off the water. The bearing is moved across the valley on to the dump ground; and as the bearing recedes, the "dump" moves forward, care being taken to keep room between bearing and dump, to mine and cart away the clay. The best way to move the bearing to the dump, is by means of a portable engine and portable railway. But I shall weary your patience if I go into details too much, and our business is to examine the different varieties of clay that make up the stock for making fire brick.

The workmen have a pit cleared off and all "skived off;" that is, all the rubbish cleaned off down to the clean clay, and to a sufficient distance from the bearing to be out of danger of being filled by a slide from the bearing when half dug out; for the lower part of this bearing is very treacherous. You need have no fear of the bank pitching over upon you; it never pitches over; but the lower part being composed of a black clay mixed up with lignite, quicksand, and sulphuret of iron, and filled with water, sometimes runs out like hot lead, and down comes the bearing with a slide, the top nearly maintaining its level as it descends. Thus you will see that we are always in some danger of having our pit filled with very dirty, impure stuff, against which the superintendant has constantly to guard. Now let us dig the clay. The men clean their boots before they go on or into the pit. The spade is driven in and the "spits" or lumps thrown out. If the clay has a clean, light-colored, bright, silvery look, it is good, "top clay," fit for use in making brick. If there are any impurities, such as colored streaks or small specks of sulphuret of iron, invisible to the naked eye, but known by the gritty feeling on the spades, it must be condemned without mercy and thrown out by itself. Such clay is called "pipe clay," because it is used for making vitrified pipes. While the pure top clay is worth three dollars per tun, this pipe clay is worth but fifty cents or a dollar a tun. Better get rid of it at once for what it will bring and get it out of the way, for we want all the room. Having dug through this strata of top clay, about three feet in thickness, we come to the pure "alum clay," overlaid with a few inches of very dirty stuff, composed of black clay and sand, lignite and "sulphur balls," interesting only to chemists and geologists, which having carefully cleaned off, we commence digging. A portion of the top spits, will be impure, being more or less impregnated with the sulphuret of iron which rested upon it, and when thrown on the platform, the impure portion must be cut off by a careful man placed there with a sharp spade for that purpose. It is thrown one side and sold for half price to the manufacturers of alum, and is here called "alum clay."

We may now expect to go down ten feet, more or less, through pure, gritless, smooth alum clay, which is called "No. 1" clay for making fire brick; but we must continually watch for impurities. The miner may suddenly strike a vein impregnated with sulphuret of iron, which he detects by a gritty feeling on the spade. This must always be condemned and thrown one side with the alum clay. Getting through the No. 1 clay, we come to a much harder clay—pure, but containing more silex, for which reason it is called "No 1 sandy clay." This stratum has to be dug with grub hoes, and is from three to four feet thick. We then come to a stratum less compact, containing more silex, and called "No. 2 sandy clay."

We have carefully kept each kind of clay by itself, and if we have struck a stratum in the fine clay, a portion of which has a red look (which is sometimes the case), we have put that by itself and called it "spotted clay." In some portion of the clay fields, nothing but this "spotted clay" is found; in other portions nothing but "pipe clay," and again in other portions, very little but "top clay."

You will see from the above, that perpetual vigilance is necessary in purchasing stock for the manufacture of fire brick; and this vigilance must be secured *at the mines as the clay is mined.* If the impure is mixed with the pure at the mines, it cannot be separated afterwards; and if we wish to make fire brick that will always give good satisfaction, we must mine our own clay.

But I have kept you a long time at the mines, and we will now take our departure for the factory. Taking a view of the country as we pass along the clay fields, we see that the land under which the clay is deposited, is just like any other Jersey land. It is good farming land; the Irishman has his patch of potatoes this year near the brow of the bank, where next year he will be driving his spade into the clay forty feet below where his potatoes grew.

Arriving at the factory, we find all the buildings necessary to carry on the business of making brick either in summer or winter, and a separate place or shed to store each variety of clay. Here we have, 1st, the No. 1 clay worth $6 per tun, at the mines; 2d, No 1 sandy clay, $5; 3d, spotted clay. $2·50; 4th, top clay, $2·50; 5th, No. 2 sandy clay, $2·50; 6th, kaolin clay, $2; 7th, fire sand, $1·50; 8th, No. 1, cement; 9th, No. 2 cement.

The kaolin clay is not found deposited with the other clays, but in locations not far distant. I believe geologists say it is decomposed rock. It contains a large amount of mica, and will not like the other clays, fly into atoms when put on a hot fire in a plastic state. It is used by many fire brick makers in place of top clay, and very generally by the consumers of fire brick for laying the brick, being mixed into a creamy state for that purpose.

Now before we commence making brick we must burn some spotted clay, and some No. 1 clay, keeping them separate, and giving them a sufficient heat to melt cast iron, so as to take the shrinkage well out of them. They are then crushed in any suitable machine to the size from that of a pin head to that of kernels of corn, and this is misnamed "cement." [A machine for this purpose, the invention of Mr. Hall, was illustrated and described on page 158, current volume.—*Eds.*]

Having thus prepared what we call No. 1 and No. 2 cement, we are ready to compound a mixture for brick; and just here, we must take into consideration the purpose for which we will make brick. What is our line of business? Many large works make brick almost exclusively for gas works. This includes brick, slabs and retorts. Other large works make almost exclusively for iron makers and iron workers, including a great variety of shapes and sizes. Brick may answer for gas works that would not do for iron works, on account of the lighter degree of heat to which they are subjected in the manufacture of gas.

We will take the following mixture: 10 parts spotted clay; 6 parts top clay; 4 parts No. 2 sandy clay; 5 parts No. 2 cement; 2 parts fire sand. The clay being run through the clay crusher, each kind as it is crushed is placed round by the pit, the cement and sand being placed evenly upon it; it is then shoveled into the pit, care being taken to spread it evenly over the whole pit, so that all the kinds shall become thoroughly mixed. The proper quantity of water is then let in, then another section of the same proportions is prepared in the same way, and repeated, till the pit (which is about five feet deep and holds enough for from eight to nine thousand bricks) is filled, water enough being added as we proceed to make the right consistency. If left to soak over night, it may then be shoveled into the "tub mill," which is connected with the pit, and being thoroughly mixed as it passes through, is molded into brick by a molding machine, which receives the "mud" from the bottom of the mill. The molds containing the brick are carried off and the brick dumped from them on a smooth, clean, drying floor, (if in the winter on a paved floor in the "flue house," under which the fire is made to pass through flues), and left till they are partially dry, when they are pressed in metallic molds, each brick receiving twenty-five or thirty tuns pressure, which makes them perfect in shape and uniform. They are "packed" or piled as they are pressed, and left to dry, and when dry they are set in the kiln, heated, and burned in the same as other brick, except that they require more fire—enough to melt cast iron. This heat would melt common brick. When thus burned, they are ready for market.

This mixture makes a smooth, plump, strong, good-looking brick, lays close joints, and stands the poker well; and if our business is to make brick for gas works, we may stamp the brick No. 1; they *are* No. 1 for gas works; but if our customers are iron makers, we must stamp them No. 2.

Here is another mixture: 10 parts No. 1 clay; 4 parts No. 1 sandy clay; 3 parts top clay; 6 parts No. 1 cement; 2 parts fire sand. Crush, mix, mold, press, and burn as before. This mixture will not make as smooth, good-looking bricks as the other, being more liable to warp and requiring much care both in manufacturing and handling, being more tender both before and after they are burned, for the reason that the stock is so pure that the fire will not take hold of and harden them so readily as the others.

Without experience, the purchaser would select the inferior bricks, on account of their being more dense and better looking, but experienced iron masters know better. With them, quality is the great consideration. Every one of these bricks must be stamped No. 1 as they come from the press. They are for the use of iron makers and iron workers, and on no account should we allow an inferior brick however good looking it may be, to bear this stamp. We are obliged to charge ten dollars per thousand more for these bricks than the others, and sometimes lose customers because we will not sell No. 1 brick as cheap as others; but if we value our reputation, we shall resolutely resist all temptation to stamp an inferior brick, No. 1, for the sake of selling them as cheap as others do. In time, it may be three or four years, we will get a letter from a consumer written thus: "Since we had brick of you four years ago, we have been purchasing brick of various parties, and find no brick to stand as well as yours. If you can furnish us the same kind, please send," etc.

The best quality of fire bricks must have *breathing qualities—lungs;* that is, they must be full of air cells. In this respect, they must be the reverse of a good building brick; at the same time they must be strong. A smelting furnace for iron is from forty to sixty feet high. The ore, coal, and lime stone, are put in at the top, and in passing down, there is considerable abrasion against the brick, and the brick must stand both fire and the friction.

Here is another mixture: 10 parts No. 1 clay; 10 parts No. 1 cement. Mix, press, and burn as before. Bricks of this mixture are stamped extra. They cost five dollars per thousand more than No. 1. For some purposes they are superior to No. 1, and for other purposes they are not. They resist flux better, but will not resist abrasion quite as well. Some customers continually order them.

And now, Messrs. Editors, as far as I can do it without making this article too long, I have shown you theoretically, how to make fire brick; perhaps you will understand better how to make the best fire brick, if I show you how to make a poor one out of the best stock. Take the same mixture we have for extra brick (10 parts No. 1 clay and 10 parts No. 1 cement), grind the cement to powder, mix thoroughly and press solid. This will make a very smooth, handsome, solid brick; but when subjected to an intense heat, its density will conduct the heat into and then contract the end of the brick for some distance.

If the brick is in the arch or crown of a heating furnace or forge, and the same is suddenly cooled, the end of the brick for some two inches will fall off, and the brick will be condemned as very poor. Thus I have shown you what fire bricks are made of, how they are made, and what the secrets are.

If you wish to embark in the business, and have one hundred thousand dollars to invest, and have credit for fifty thousand dollars more, and can resist the temptation, with Roman firmness, to mix impure clay with the pure, and the temptation to stamp No. 2 brick with the No. 1 stamp, and if you have the patience to exercise perpetual vigilance fourteen years, by that time you will acquire a reputation for

making good fire brick. No slovenly or careless man will ever acquire that reputation.

[For the Scientific American.]

SOMETHING ABOUT SILVER.

BY PROFESSOR CHARLES A. JOY.

Pure silver can be distilled the same as zinc, but requires a very high heat and a special furnace. By using lime as a crucible and applying the heat of the oxyhydrogen flame, it may be distilled in the form of a pure white, very soft metal, having the specific gravity 10·575. Thus prepared, it can be easily hammered into thin foil, which is transparent, with bluish green color; thicker leaves show yellow light. It is an interesting fact that silver will let what are called the actinic or chemical rays of light pass through it so that it is possible to take a photographic print under a very thin silver plate. Silver amalgam has been made artificially at the French mint in Bordeaux in a quantity of mercury which had been used to extract silver from refuse. On filtering through chamois leather some well-defined crystals remained which, on analysis, were found to contain, in 100 parts: Silver, 27·4; quicksilver, 72·6. This would show a relation of one atom of silver to three atoms of mercury, whereas, in the native amalgam, the relation is one to two.

Pure silver if highly heated in oxygen will absorb 6·15 to 7·47 volumes of that gas, and under the same circumstances will take up 0·907 to 0·938 volumes of hydrogen, 0·486 to 0·545 carbonic acid, and 0·15 carbonic oxide—in this property it differs considerably from palladium.

When it is attempted to prepare the pure metal by electrolysis, it is a curious fact that silver, in the form of peroxide, goes to the positive pole, and as a metal to the negative pole, if a plate of silver is used at the positive pole. The explanation of this is made on the ground that the ozone of the decomposition of the water attacks and oxidizes the silver.

Sulphurous acid throws down small crystals of silver from solutions, and this method is employed to recover the metal from photographic wastes; it is also used when a chemically pure metal is sought, for the accurate determination of specific gravity or atomic weight. The question of the atomic weight of silver has been subjected to a rigid examination by several chemists, and on the modern theory of oxygen, equal to sixteen, it has been decided to be 107·93 as the mean of a large number of determinations.

The temperature of fusion of silver is also a question that has occupied the time and attention of chemists for a long period and scarcely any two agree; Becquerel puts it at 916° Cent. (1680° Fah.)

The specific gravity of silver ranges between 10·424 and 10·511, and the mean of 13 determinations was found to be 10·468—generally it is stated at 10·5. It is softer than copper and harder than gold; its absolute resistance per cubic centimeter is, for cast silver, 5760 lbs., for wire, 6310 to 8270 lbs., and for heated wire 3600 to 3900 lbs. The tenacity of silver has been studied by Matthiessen, and can be stated for comparison, as follows: alloy of tin and copper, 1; gold, 3·6 to 4·3; copper, 4·3; silver, 7·2; platinum, 7·2; iron, 13; steel, 30. It is so ductile that a grain of it can be drawn out 400 feet, and it can be hammered into leaves so thin that it would require 100,000 of them to make a pile an inch in hight. Its conductivity for heat is to copper in the ratio of 100 to 73·6; and for electricity as 1000 to 954. Cast silver expands, according to Calvert, between 0° and 100° Cent., 0·001991; and its specific heat is 0·05701. Although silver is a remarkably good conductor of heat, its power of radiation is very small, so that a silver vessel retains the heat of a liquid contained in it longer than any other metal.

According to Elsner, a mass of silver at the heat of a porcelain furnace, was entirely volatilized.

Nearly all of the oxidizable metals precipitate silver from its solution. Green vitriol or sulphate of iron precipitates it readily, and if the liquid be boiled, some of the silver is dissolved, but again falls down when the liquid cools.

Tin and lead act rapidly in a solution of nitrate of silver to precipitate the metal; more slowly act osmium, zinc, copper, bismuth, antimony, and quicksilver. Phosphorus also reduces salts of silver the same as it does solutions of copper. Cadmium is a good metal to substitute for zinc in the reduction of silver.

Peroxide of hydrogen at once attacks silver and converts it into a suboxide. Cane sugar precipitates silver from the nitrate upon the addition of ammonia and boiling, but grape sugar is preferable for this purpose. Silver can be made to take the place of potash in ordinary alum, and the double sulphate of alumina and silver be produced. And this reminds us to state that modern chemists call silver a *monad* and place it in the same family with potassium and sodium. Some years ago Dr. Torrey, of New York, discovered a compound of carbon and hydrogen with copper, which was produced by the passing of ordinary illuminating gas for a long time through copper tubes, and was shown to be highly explosive; it has recently been found that a similar compound with silver can be formed by passing illuminating gas through an ammoniacal solution of nitrate of silver; a brown black flocculent precipitate settles, which, on an anvil, or heated, explodes with great violence, leaving finely-divided carbon and metallic silver as a residue.

The analogous compound of copper can be prepared in the same way by passing the gas through nitrate of copper. It is now known that the explosive powder is a compound of acetylene. It is possible that by passing the gas issuing from oil wells through the nitrates of silver or copper, this interesting substance could be formed.

Some years ago there was a report that all of the copper-bottomed ships brought home silver from the salt water of the ocean, and mathematicians at once went to work to compute the enormous quantity of the precious metal that must be contained in the oceans of the world; but since the original discovery nothing further has been said on the subject. In 1849 silver was also found in the blood of several animals, especially of the ox, but in all of these cases the occurrence is generally considered to be accidental.

The production of silver was stated by Wagner, in 1868, to be in values:

North America	$20,000,000
Mexico and South America	35,000,000
British America	500,000
Australia and New Zealand	1,000,000
Siberia	1,500,000
All other countries	2,000,000
Total	60,000,000

The uses of silver are numerous, and are continually on the increase. It is too soft to be employed pure for coinage, but when alloyed with copper is much harder and better suited to the wear of a circulating medium. The value of silver to gold is as 1 to 15½, and the specific gravity as 15 to 18, so that for the same sized coin the value of the pure gold has 29⅔ the relative worth of the silver of the same size and weight. Silver wire and silver foil have long been extensively employed, and various methods have been prepared for cleaning the articles made for it. Among the liquids that have been employed for this purpose may be mentioned a solution of permanganate of potash, also cyanide of potassium, hot hydrochloric acid, borax, and potash. The so-called silver beads and pearls for embroidery are made of tombac metal which is rubbed with silver amalgam and freed from mercury by heat. Brass can also be plated with imitation silver by rubbing it with a preparation composed of equal parts of mercury, tin, and bismuth, and one and a half parts prepared chalk—a trifling amount of silver makes the colors and appearance of silver more enduring.

Further uses of silver in photography, in numerous alloys, in the manufacture of mirrors, and for ornamental purposes have been given in the SCIENTIFIC AMERICAN in previous years. The present article presents certain properties of the metal more fully than they are given in our modern works on chemistry, and will serve for reference to all persons interested in the subject.

[For the Scientific American.]

THE GUAVA.

BY JOHN B. GORDON.

The guava is a tree which grows in tropical countries, and it is found principally in the West Indies. It is of the genus termed by botanists, Psidium, and is of two sorts, the P. pomiferum and P. peryferum. The plant does not attain any considerable size, being generally about fifteen feet high; and it is of very delicate formation. The bark is quite thin, and of a light brown color. It peels off in small portions when exposed to the sun; to prevent this, the trees are usually planted beneath others of a larger growth and hardier nature. The leaves are of an elliptic, lanceolate form. They are very distinctly marked by the fibers of which they are composed. They are of a dark green color, and measure about 2½ inches. The flowers resemble those of the orange, and emit a strong perfume. The fruit is about the size of a small lemon. It is almost of the same shape and color. The interior consists of a red, pulpy substance, containing an innumerable quantity of small seeds somewhat larger than those of the fig. The rind of the fruit is of the consistency of that of an apple. Of this fruit the West Indians make several kinds of preserves, the guava jelly, stewed guava, quake pear, and marmalade. The most lucrative is the guava jelly. The fruit is often eaten in its raw condition. The negroes are so fond of it that they are very wary and diligent in guarding the trees from robbery when they are bearing fruit.

The guava jelly is obtained by boiling the guavas with sugar and spices; and, after expressing the juice through a cloth, it is left to cool. Of course it undergoes minor processes, which I omit, they being inappropriate to the object of this paper.

The jelly is frequently bottled, but oftener it is put into small cylindrical boxes made of laminated pine board. A great quantity of this comfit is manufactured in Cuba, where it is termed "Jalea de guayaba," which is exported to the United States and Europe. Notwithstanding that a good deal is made in the smaller islands, they import quite a quantity of the Cuban jelly.

After the juice has been expressed from the guava, there remain the skins and the pulp containing the seeds; the latter is stewed and bottled, and it constitutes the stewed guava. This is generally partaken of with milk.

The skins are converted into the delicacy termed "quake pear," by a process varying slightly from the foregoing.

The guava marmalade is not frequently made. It consists of the guava grated and prepared in a peculiar manner.

Of the forementioned preserves, the marmalade is preferred by most connoisseurs. The small seeds in the stewed guava are very objectionable, the more so if one is subject to toothache, as they get into the cavities of decayed teeth, causing a great deal of suffering.

The natives of the West Indies are great herbalists; they convert almost any plant into medicine of some kind or other, and they have discovered several medicinal properties in the guava tree and its complimentary portions; what they are, I cannot pretend to say.

There is no distinction made between the name of the tree and that of the fruit in English, both being guava; the French term the tree, *goyavier*, and the fruit, *goyave*. Their respective terms in the Creole patois are, *gyan-baum*, and *gyan*.

CHEMICAL NEWS.

EASY PREPARATION OF CHLORATE OF BARYTA.

It is sometimes important to be able to prepare chloric acid for use in the arts, and the most convenient salt for the purpose is chlorate of baryta, as that can be easily decomposed by sulphuric acid and the chloric acid liberated. Moritz Brandau proposes the following simple method of procedure: 49 parts by weight of sulphuric acid, 333 parts of sulphate of alumina, 122½ parts chlorate of potash are mixed to a thin paste in water and gently warmed. The product is a solution of chloric acid with alum, and excess of sulphuric acid and sulphate of alumina. When it is entirely cool it is mixed with about an equal volume of alcohol and then filtered. The alcoholic filtrate is then neutralized with caustic baryta which gives us chlorate of baryta in solution, while sulphate of baryta is precipitated. The chlorate is decanted from the precipitate and evaporated to expel the excess of alcohol, and is then ready for use. It could be employed in the preparation of oxygen gas, but for this purpose would be more expensive than chlorate of potash. The uses of chloric acid are not well understood, and a cheap method like the above for its production may lead to a more general application of this highly interesting compound.

THYMOL AS A DISINFECTANT.

Paquet recommends thymol as a substitute for carbolic acid. It is prepared from the etherial oil (oil of thyme) of *Ptychotis tjowan*, an umbelliferous, officinal plant from the East Indies. In a concentrated form it serves as a cautery for the removal of warts, and also in cases of hollow teeth is very efficacious, without leaving the disagreeable odor of carbolic acid or creosote. In aqueous solution (1000 aq.) it has a cooling effect upon bad sores, and stops decay.

By the injection of a mixture of four grains thymol, two grains aniline, and one hundred grains glycerin into a dead body, all decomposition and decay were arrested for months.

CHEMICAL ANALYSIS OF AIR.

In order to form some idea of the impurities carried into the air near large manufacturing towns. Dr. Smith, of England, took advantage of the property of rain to bring down a certain proportion of them, and resorted to an analysis of rain water. He found in the vicinity of chemical works five grains of sulphuric acid per gallon; near Liverpool two and a half grains, in Newcastle three grains, in Manchester three and a half grains. The acid was probably in a free state, as the rain water turned blue litmus red. Muriatic acid was also present, but in larger amounts near the seashore than inland. A tun of the rain water was found to contain 100 grains of ammonia. In a million cubic feet of air near Manchester was found 4,008 grains sulphuric acid and 59 grains muriatic acid.

TESTS FOR SULPHUR, PHOSPHORUS, AND NITROGEN.

In order to detect small quantities of phosphorus in any compound, mix a small quantity in a glass tube closed at one end with an equal weight of magnesium powder or foil, and gently heat. If any phosphorus be present a red film will form on the cool part of the tube, the mixture will become phosphorescent, and with water it will yield phosphureted hydrogen. As magnesium does not combine with sulphur, the same substance can be taken to test for that element. Heat the contents of the tube with metallic sodium and project it afterwards into acidulated water; if any sulphur be present, an evolution of sulphureted hydrogen gas will at once betray it. If nitrogen be suspected in any compound, heat it in a similar way with metallic sodium, and the formation of cyanide of sodium, indicating nitrogen, can be shown by an iron salt.

These three tests for sulphur, phosphorus, and nitrogen, are probably the best that can be employed for small quantities, and have the additional merit of easy execution.

SEPARATION OF COBALT.

It is sometimes necessary to separate cobalt from iron, manganese and other metals; this is said to be effected if the solution be kept neutral by carbonate of manganese and sulphureted hydrogen gas be passed through it; all of the cobalt will be precipitated.

A REMARKABLE GAS WELL.

At a recent meeting of the Lyceum of Natural History, Professor Wurtz gave an account of an extraordinary gas well at West Bloomfield, Ontario Co., N. Y. Borings five hundred feet in depth were made in search of petroleum, and at this depth the rush of gas was so great as to render further operations impossible. According to rough calculations made on the spot, the flow of gas is at the rate of 18,000 cubic feet per hour, and it comes out with a roar. Its illuminating power is low as there is very little heavy carbureted hydrogen in it, and was found to be equal to six candles. An analysis gave Professor Wurtz the following results:

Marsh gas	82·41 per cent
Carbonic acid	10·11 "
Nitrogen	4·31 "
Oxygen	0·23 "
Illuminating hydrocarbon	2·94 "
	100·00

It is proposed to use the gas for illuminating and heating purposes.

A NEW OXIDE OF AMMONIUM.

M. Maumene has published a method for the preparation of oxide of ammonium by the action of metallic nitrates. He employs 200 grammes nitrate of ammonia, 2,170 grammes hydrochloric acid (density 1·12), and 552 grammes tin are gradually mixed to prevent elevation of temperature. The product is crystalline, soluble in alcohol, and does not give a precipitate with a platinum salt, and is decomposed. The crystals are not octahedron but short prisms. The composition of the new compound, expressed by the formula $H_2NO_2.HCl$.

Improved Hominy Mill.

The inventor of this mill was one of those killed by the terrible boiler explosion at the State Fair held at Indianapolis, last October, the account of which excited universal sympathy throughout the entire country. Mr. Jackson was at the fair for the purpose of exhibiting this mill, from which his widow is now desirous to realize something to support and educate her children.

She writes us that some parties are endeavoring to take advantage of her comparatively helpless position, to deprive her of her rights, and we sincerely hope that the invention, which we are informed has proved its value in actual service, may find a purchaser, or some manufacturer who will undertake to make the mills, and protect the widow of Mr. Jackson in her rights.

The mill is intended to crack or break corn for hominy, and differs from mills constructed for that purpose heretofore. Hominy mills, with a continuous feeder, have been found inefficient, for the reason that in many cases a large portion of the corn will pass through without being broken, thus causing extra labor to separate it afterward.

In this mill the corn is put in the hopper, A, in charges, and subjected to the action of the crackers or breakers, which consists of screws, B, and knives, C, arranged on a shaft in rows. In the process of breaking the corn, the fine flour or any refuse matter is, to a great extent, separated by the action of fans or blowers, E, and expelled through the slats, F, Fig. 2, into a receptacle placed to receive it. After the corn has been reduced thoroughly, it is dropped into the conveyer, G, which is a quick-pitched screw. This conveyer being set in motion by the gears, H, moves the grain into the screen, I, below, where it is properly bolted and rendered fit for market.

This mill has been thoroughly tested, and pronounced by competent judges to be a perfect success. It may be constructed of any size, from a mammoth mill that will turn out a hundred bushels of hominy a day down to a small hand-power mill for family use. The latter is just what is wanted by every farmer, especially in the West and South.

Patented, June 15th, 1869, by A. P. Jackson. State rights will be sold, and liberal terms given to parties wishing to manufacture and sell on royalty. Address E. J. Jackson, Memphis, Ind.

Fig. 1.

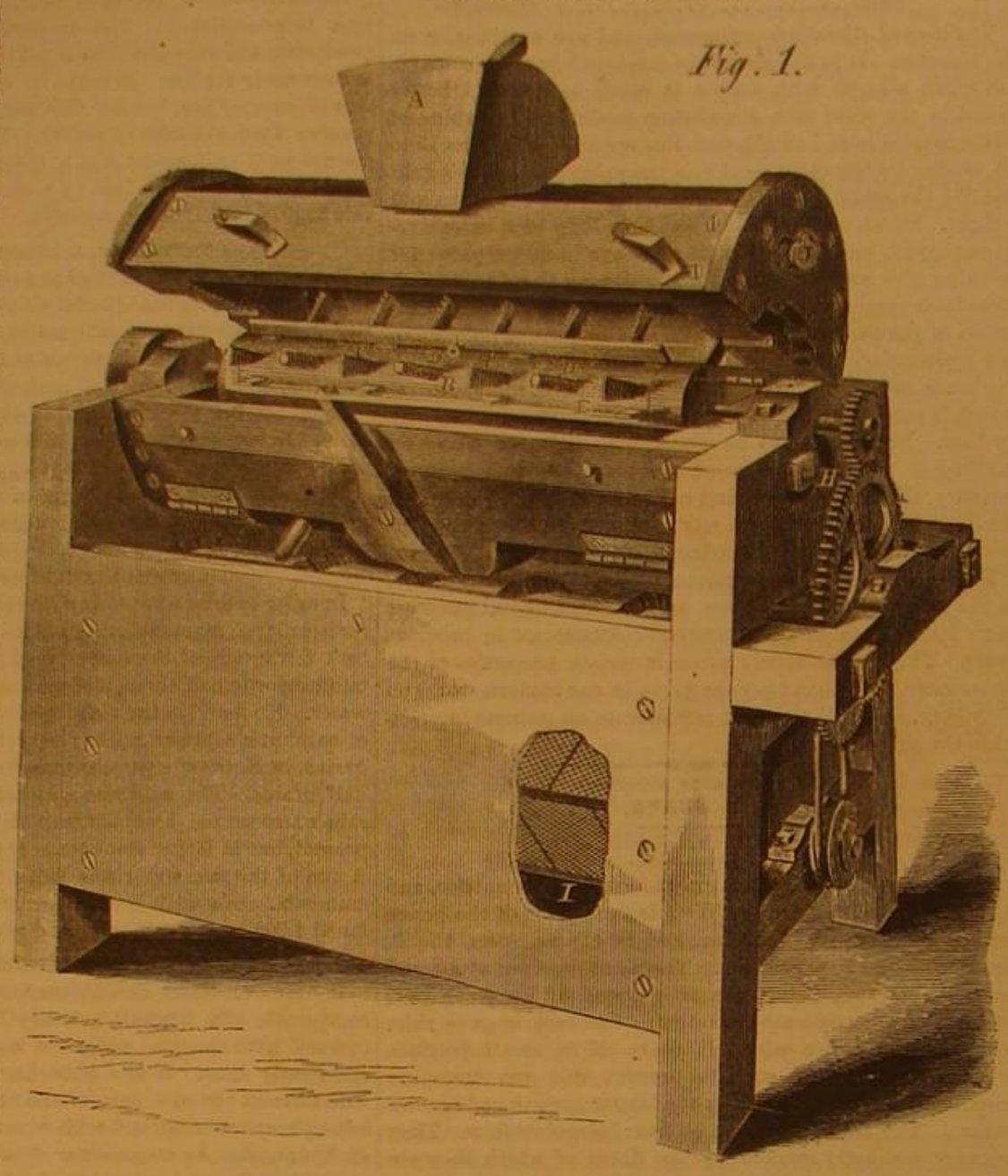
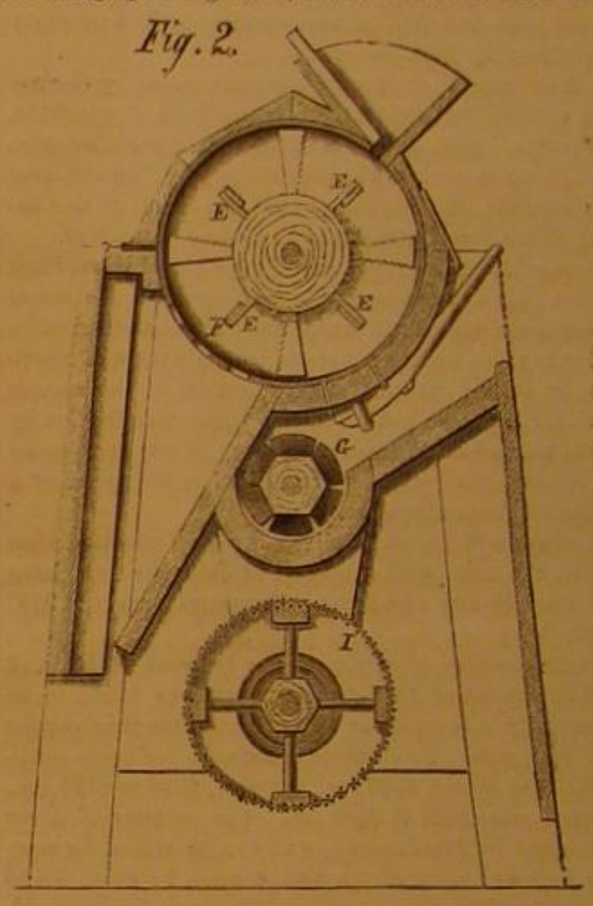


Fig. 2.



JACKSON'S IMPROVED HOMINY MILL.

Improvement in Railroad Car Springs.

Our engravings illustrate a newly-devised car spring, which the inventor claims possesses great strength and elasticity with adjustability, so that the amount of movement can be regulated.

A perspective view of this car spring is shown in Fig. 1, and a vertical and longitudinal section in Fig. 2. The shell or case which incloses the plates is made in two pieces, A and B; A being the upper and B the lower part. The lower part, B, telescopes into the upper part, and is held in place by bolts, C.

The cases inclose an arrangement of elastic plates or bars, D, Fig. 2, the ends of which abut on shoulders formed on the two portions of the case, as shown. These plates are separated by cross-bars, E, shown in section Fig. 2, which cross bars are kept in place by vertical guides.

The cross bars, E, transmit the strain from the upper plates or leaves of the spring, to the lower plates, and each plate or leaf acts independently of every other one in the spring. The cross bars are placed at a point about one third the length of the spring from the end. It is claimed that this arrangement distributes the strain equally on all points of the plates, which gives all the power the steel plates afford, and diminishes the liability of breakage.

Of course the strength of the spring and the amount of movement may be regulated and adjusted by the thickness of the plates, their number, and the positions of the cross bars. These springs are equally applicable to any form of passenger or freight car now in use.

The spring has been tested under cars for some time with, we are informed, highly satisfactory results, and we are told the inventor is already in receipt of a large number of orders.

Patented, through the Scientific American Patent Agency, Feb. 15, 1870, by C. M. Banks, Roxborough, Philadelphia, Pa. For further information, address patentee, care J. Jeffries & Sons, rear Girard House, Philadelphia, Pa.

Fig. 1

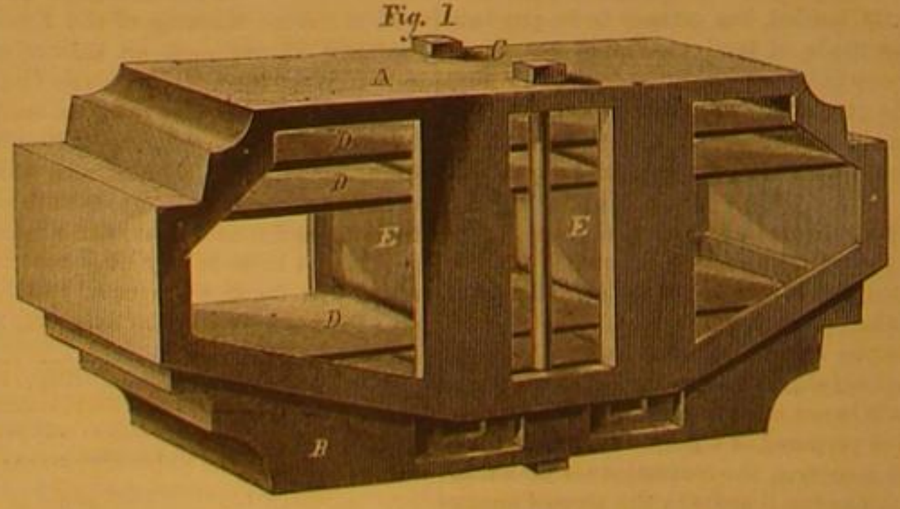
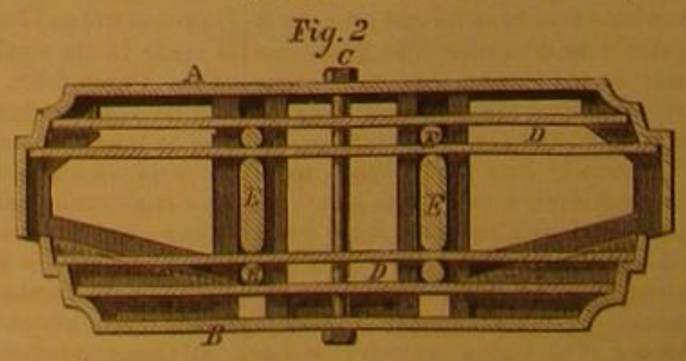


Fig. 2



BANKS' INCLOSED PLATE CAR SPRING.

Black-Bronzing Iron and Steel.

This method of coloring iron and steel serves both as an ornamentation and preservative from rust. The following mixtures can be employed: Liquid No. 1.—A mixture of bichloride of mercury and sal ammoniac. Liquid No. 2.—A mixture of perchloride of iron, sulphate of copper, nitric acid, alcohol, and water. Liquid No. 3.—Perchloride and protochloride of mercury, mixed with nitric acid, alcohol, and water. Liquid No. 4.—A weak solution of sulphide of potassium.

A sponge is slightly moistened with liquid No. 1, and rubbed upon the metal, previously well cleaned; and when quite dry, a second application of the liquid is made. The crust of oxide formed upon the application of the liquid is removed by a wire brush, and the metal rubbed with a clean piece of rag, and this operation is repeated after every fresh application of the several liquids. Several coats of No. 2 are then applied, and also of No. 3, with a full sponge; and after drying for ten minutes, the pieces of metal are thrown into water heated nearly to the boiling point, where they are allowed to remain five or ten minutes, according to their size.

After being cleaned, they are again covered with several coatings of liquid No. 3, afterward with a strong coating of No. 4, and again immersed in the bath of hot water. When removed from the bath, the pieces are dried and wiped several times with carded cotton, dipped in liquid No. 3, diluted each time with an increased quantity of water; then they are rubbed with a little olive oil and wiped; they are again immersed in water heated to 140° Fah., and upon being removed from it, they are rubbed briskly with a woolen rag and, lastly, with oil. The pieces thus treated are of a beautiful glossy black, especially if they have been polished.

Iron and cemented steel are well adapted to receive this black polish; cast steel is still better adapted for it, as it assumes a more uniform brilliancy. Cast iron presents more difficulties, because it does not assume the same tint all over equally.

The Architecture of the Human Body.

Professor Humphry, M.D., F.R.S., in a recent lecture upon the architecture of the human body, said that as the tail diminishes in animals, the hinder limbs seem to grow out. Thus the serpent is nearly all tail and no limbs; the whale, with its shortened trunk, has a broad flat tail; also, as the tail of the tadpole disappears, the hind legs of the frog take its place. Man has the bones of a small, incipient tail, with three flat sides; this tail turns inwards, so that the human being is really the only animal in creation who can occupy an arm-chair in comfort. The head of the thigh-joint rests in a socket so very shallow that it is only held in its place by atmospheric pressure and the ligaments surrounding the joint, and the leg swings to and fro below this shallow socket very much like a pendulum. The thigh-bone is by far the longest bone in the human body. Madder, when taken into the living body, is found to have the curious property of coloring growing bone, but it does not color the bone in places where growth is not going on. Thus much about the growth of bone has been learnt by feeding pigs with madder, whereby it has been found that bones grow chiefly at the ends of the shafts, and not at the center of the bone, or at the joints. After the age of twenty-five has been passed, the bones will give on examination little or no clue to the age at death of the individual who owned them, so in the recent case of the murder of a woman at Norwich, the medical men were not so much to blame as the newspapers supposed, when they were unable to give a clue as to the age of the deceased, from an examination of the bones.

WHAT ARE CONDIMENTS?

Professor Fonssagrives, in his new treatise upon dietetics, gives us some curious information upon the use of condiments in France and in England, and includes under that term a somewhat surprising list of things; as, for example, magnesia, Vichy waters, bicarbonate of soda, and Gregory's powder. He assures his readers that this last mixture is habitually used in England as a condiment, and universally enjoys a high reputation. A writer in the *Medical Times*, commenting upon the difficulty of accurately defining a condiment, observes: "We recollect hearing a hospital nurse remark, when a patient complained that he did not like his beef-tea out of the same unwashed cup which had just held his medicine, that it was impossible for the authorities to provide him with a separate receptacle for each of his condiments." The professor's list does not comprise what, according to the medieval adage, is the truest condiment—hunger; but for the comfort of readers who have no appetite, he conclusively proves the benefit which would arise in their case from the habitual use of pepsine.

PLASTER of paris, mixed with resin soap forms a good cement for fastening kerosene lamp burners.

NATURAL HISTORY---THE GREAT AUK.

BY PROFESSOR JAMES ORTON, IN THE AMERICAN NATURALIST.

The recent addition of a specimen of this rare bird to the Smithsonian Museum, is an event worthy of record. There are now three specimens in the United States; the one just mentioned, another in the Academy of Natural Sciences, Philadelphia, and a third in the Giraud cabinet in Vassar College. The last is the most perfect specimen, and certainly possesses the greatest historical value, as it is the one from which Audubon made his drawing and description. It was caught on the banks of Newfoundland.

The Great Auk or Gare-fowl, fortunately for itself did not live long enough to receive more than one scientific name—*Alca impennis*. It was about the size of a goose, with a large head, a curved, grooved, and laterally flattened bill; wings rudimental, adapted to swimming only, approaching in this respect the penguins of the southern hemisphere. The toes are fully webbed, the hind one wanting; the plumage is black, excepting the under parts, the tips of the wings, and an oval spot in front of each eye, which are white. It was an arctic bird, dwelling chiefly in the Faroe Islands, Iceland, Greenland, and Newfoundland. "Degraded as it were from the feathered rank (said Nuttall), and almost numbered with the amphibious monsters of the deep, the auk seems condemned to dwell alone in those desolate and forsaken regions of the earth." But it was an unrivaled diver, and swam with great velocity. One chased by Mr. Bullock among the Northern Isles, left a six-oared boat far behind. It was undoubtedly a match for the Oxfords. It was finally shot, however, and is now in the British Museum. "It is observed by seamen," wrote Buffon a hundred years ago, "that it is never seen out of soundings, so that its appearance serves as an infallible direction to the land." It fed on fishes and marine plants, and laid either in the clefts of the rocks or in deep burrows a solitary egg, five inches long, with curious markings, resembling Chinese characters. The only noise it was known to utter was a gurgling sound. Once very abundant on both shores of the North Atlantic, it is now believed to be entirely extinct, none having been seen or heard of alive since 1844, when two were taken near Iceland.

The death of a species is a more remarkable event than the end of an imperial dynasty. In the words of Darwin, "no fact in the long history of the world is so startling as the wide and repeated extermination of its inhabitants." What an epoch will that moment be when the last man shall give up the ghost! The upheaval or subsidence of strata, the encroachments of other animals, and climatal revolutions—by which of these great causes of extinction now slowly but incessantly at work in the organic world, the Great Auk departed this life, we cannot say. We know of no changes on our northern coast sufficient to affect the conditions necessary to the existence of this oceanic bird. It has not been hunted down like the Dodo and Dinornis. The numerous bones on the shores of Greenland, Newfoundland, Iceland and Norway, attest its former abundance; but within the last century it has gradually become more and more scarce, and finally extinct. There is no better physical reason why some species perish than why man does not live forever. We can only say with Buffon, "It died out because time fought against it." From the *Lingula prima* to the Auk, genera have been constantly losing species, and species varieties; types and links are disappearing.

Unhealthfulness of Iron Stoves.

Considerable discussion having arisen as to the permeability of cast iron to gases, and to their morbific effect in ill-ventilated rooms, the conclusions of Gen. Morin, as given in a report to the French Academy, will be read with interest.

The experiments extended over a year, and were performed at the "Conservatoire des Arts et Metiers," in Paris, being terminated in February, 1869.

His conclusions are as follows:

1. In addition to the immediate and grave inconveniences arising from the facility with which stoves of the ordinary metals attain a red heat, cast-iron stoves, at a dull, red heat, cause the development of a determinate but very variable amount of carbonic oxide, a very poisonous gas.

2d. A similar development takes place, but in a less degree, in sheet-iron stoves raised to a red heat.

3. In rooms thus heated, the carbonic acid naturally contained in the air, and that derived from respiration, may be decomposed, and produce carbonic oxide.

4. The carbonic oxide may arise from several different, and, sometimes, concurrent causes, as, the permeability of the iron to this gas, which passes from within outward; the direct action of the oxygen of the air upon the carbon of the iron heated to redness; the decomposition of the carbonic acid in the air by its contact with the heated metal, and the influence of organic dust naturally contained in the air.

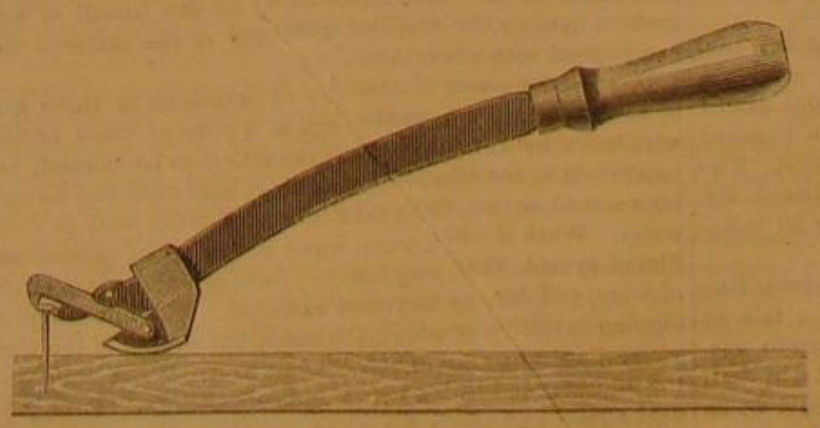
5. The effects observed in a room lighted by four windows, and two doors, one of which is frequently opened, would be made manifest and grave in ordinary rooms, without ventilation, in consequence of the presence and decomposition of various kinds of organic dust therein present.

6. Consequently, stoves and heating apparatus in cast or sheet iron, without interior linings of fire-bricks, or other refractory substances, which will prevent their becoming red-hot, are dangerous to the health.

MM. St. Claire Deville and Troost have shown that the air in contact with the external surface of a cast-iron stove may become charged with a proportion of carbonic oxide equal to ·0007 to ·0018 of its volume. Experiments on rabbits show that carbonic oxide has the property of expelling a part of the oxygen contained in the blood; and that the small amount of ·0004 will cause the expulsion of ·45 of the oxygen of the blood. Though sheet-iron stoves are less dangerous, on this account, they are not so harmless as Dr. Carret supposes, as they are open to the grave objections of the sudden elevation of temperature of their external surface, and of then decomposing the carbonic acid of the air. It has long been admitted as a fact in science, that iron, at a red heat, decomposes carbonic acid, takes a portion of its oxygen, and transforms it into carbonic oxide. The experiments showed that the amount of carbonic oxide formed was notably less in a moist than in a dry air; this justifies the common use of vessels filled with water on stoves and furnaces.—*Annual of Scientific Discovery.*

IMPROVED IMPLEMENT FOR DRAWING NAILS.

We copy from the *English Mechanic* a description of an invention whereby nails, spikes, or brads driven into packing cases, flooring, or other timber or woodwork may be drawn or extracted therefrom in such a manner that they will not be broken, bent, or twisted, and unfitted for further use, and so that the wood will not be split or otherwise injured by their extraction.



The implement (a side view of which, showing the position of the parts with regard to the nail being extracted, is given) consists mainly of two hooks or claws so arranged together, and in combination with a lever and adjustable curved shoe, which forms the fulcrum of the said lever, that in drawing a nail, they can be first forced into the wood below the head of nail, they can be first forced into the wood below the head of the nail, and then by a proper movement of the lever made to grip the nail and draw it from the wood, the curved shoe sliding towards the nail as the same leaves the wood, so that the nail is drawn out in a direction parallel or nearly so with its axis, and is thereby extracted without being broken, bent, or twisted.

The Production of Sulphur in California.

According to the *Alta California*, the production of sulphur and manufacture of its compounds in California are rising in importance. The chief supply of the world is obtained from the sides of Mount Etna, in Sicily, and that State used the Sicilian brimstone until lately. Now the sulphur works on the shore of Clear Lake produce four tuns a day, as much as the coast can consume. The freight from the Mediterranean, the increased charge on account of the combustible nature of the material, and the necessity of keeping large stocks on hand, so as to prevent any disturbance of trade in case a cargo should be delayed or lost, give decided advantages to the home manufacture.

The Sicilian brimstone cannot be had in California for less than four cents per pound, and the domestic article is sold for three and a half cents. Clear Lake occupies the crater of an extinct volcano, and the evidences of volcanic action are abundant in the vicinity. The triangle formed by the lake, the Geysers, and St. Helena—each about twenty-five miles from the other two—abounds with volcanic scoria, trap, lava, obsidian, tufa, warm springs, and other remains of eruptions, and signs of subterranean heat at no great distance from the surface.

The sulphur bed of Clear Lake is about eight miles from the southern end, on the eastern shore, only a few hundred yards from the water. There is a bank resembling ashes, in which there are numerous alkaline and sulphur springs, and, also, vent holes from which sulphurous fumes escape. These holes are surrounded by beautiful crystals of pure sulphur deposited from the fumes rising from below. The earth, containing about fifty per cent of sulphur, is placed in an iron retort, which is heated to a high temperature, so that the sulphur is driven off in fumes into a receiver, where it settles in a liquid form, and runs out into pine boxes, two feet long and a foot square. It is as pure as the Sicilian brimstone, but the latter comes in sticks, which are more convenient for handling, when small pieces are wanted.

The lump sulphur is used chiefly for making powder and sulphuric acid, which last is employed in making blue-stone, giant powder, nitric acid, and muriatic acid, and in refining gold and silver. The consumption of sulphuric, nitric, and muriatic acid on the coast, amounts to 2,000,000 lbs., and the entire demand is supplied by home manufacture.

Lately the production of flowers of sulphur has been commenced at Clear Lake. The fumes passing off from the retort instead of being carried into a small hot receiver as for brimstone, are led into a large cool chamber, in which they condense into a flaky, snowlike condition. This form of sulphur will be needed in large quantities next spring and summer, as a cure for the mildew which attacks the vines and did great damage in many of the vineyards last year.

The Lower Lake *Bulletin* says: There are no less than eight new mines of quicksilver and sulphur now being opened up in this vicinity (southern part of Lake County); the three mines of these minerals now in daily operation employ over 300 men. With eight more in practical operation, nearly 900 men and several millions of dollars in property valuation will be added to this part of the country. And these are not possibilities, they are probabilities. The mineral is there; men are employed there now in running tunnels and holding the ground, and time will develop them.

A Strong Cement for Iron.

To four or five parts of clay, thoroughly dried and pulverized, add two parts of iron filings free from oxide, one part of peroxide of manganese, one half of sea salt, and one half of borax. Mingle thoroughly, and render as fine as possible; then reduce to a thick paste with the necessary quantity of water, mixing thoroughly well. It must be used immediately. After application, it should be exposed to warmth, gradually increasing almost to white heat. This cement is very hard, and presents complete resistance alike to a red heat and boiling water.

Another cement is to mix equal parts of sifted peroxide of manganese and well-pulverized zinc white, add a sufficient quantity of commercial soluble glass to form a thin paste. This mixture, when used immediately, forms a cement quite equal in hardness and resistance to that obtained by the first method.

TEST FOR ARSENIC.—A new and very delicate test for arsenic has been discovered by Bettchdorff. Its sensibility is so great that it is said to be capable of detecting one part of arsenic in a million parts of solution; and the presence of antimony does not affect it. In order to apply this test, the arsenious, or arsenic liquid is mixed with aqueous hydric-chloride (hydrochloric acid), until fumes are apparent; thereupon stannous chloride is added, which produces a basic precipitate, containing the greater part of the arsenic as metal, mixed with stannic oxide.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

The Yosemite Valley.

MESSRS. EDITORS:—Will you kindly grant to me, as an act of simple justice, the use of your columns to say a few words in answer to your editorial of the 19th ult. Your authority for some of the so-called facts stated, has sadly misinformed you, and misrepresented them; and by so doing has left—or endeavored to leave—upon the public mind the impression that Mr. Lamon was the only *bona fide* settler in Yosemite prior to its cession to the State of California. That, I am sorry to say, is as unfair as it is untrue. The same misrepresentation was attempted before the Legislature of California, but after its full examination by committees of both Senate and Assembly, a unanimous report was made by each committee in favor of *both* settlers.

Not satisfied with this, the same parties, influenced by unfair motives, again made a similar statement in the San Francisco *Evening Bulletin* in December last. I met that by the following statement and challenge through the columns of that paper, but which they failed to accept:

"I arrived in Yosemite with my family, to settle there, May 20th, 1864; and the act of cession was not passed until June 30th, 1864—appearing for the first time on this (the Pacific) coast, I believe, in the *Bulletin* of August 3d, 1864. As these facts can be abundantly established, my settlement there can be proven to be *before* the passage of the act of cession to the State.

"As the above statements of some of the commissioners have been made before, both here and elsewhere, in order to set that matter at rest, I now challenge them, or any one of them, to meet me before a notary public, where I will swear that my statement is true and theirs is not. Will they do the same for mine? We shall thus have the opportunity afforded of seeing which of the two will be guilty of perjury, and willing to suffer the consequences.

"Respectfully, J. M. HUTCHINGS."

As the same ubiquitous statement, like a certain well-known ghost, has again made its appearance, I again renew the challenge, and we shal see if that will possess the power of laying it or not. I hold that it is dishonorable to discuss any subject unfairly, and as dishonest as it would be to steal to misstate a fact. Let the question be discussed solely and fairly upon its own merit, and I will meet any one, at any time, for that purpose.

Besides, I am prepared to prove that not only was I the first visitor to Yosemite, and the first to make its glories known, by description and illustration, from 1855 down to the present moment; but that as early as 1861, when health began to fail me, I had goods packed ready for transportation for the express purpose of making Yosemite our future home. Then, however, "Dame Rumor" half filled the valley with snow, by its drifting into it, as into a railroad cut; and our departure was postponed in order to prove the truth or falsity of such a rumor. For that purpose Mr. Clark, one of the commissioners alluded to in your editorial, and Mr. Lamon, the other person there spoken of, set out with myself to test the question.

When snow had increased to nearly two feet in depth both of those gentlemen declined to go any farther; and as I could not think of risking my family in such a place, until I had unmistakably demonstrated the safety of such a proceeding, I reluctantly started on without them.

With my provisions, blankets, overcoat, ax, sketching materials, etc., at my back, I wandered on through the cloud-draped, snow-covered, and trailless forest, *alone*. Each night I slept where any friendly rock or tree offered me shelter. Some days the deep snow, at times only up to my middle, at others up to, or above my chin, and frequently dropping me down among bushes, allowed of my traveling half a mile only from daylight till dark. On other days I accomplished from two to three miles. In this way I spent eleven days without seeing a human face or hearing the music of a human voice, and was thus enabled to reach the wonderful valley, and obtain satisfactory proof that the rumors—like the statements of your authorities—were without foundation.

Twice on this perilous trip I came near losing my life. Once when crossing some snow-covered logs that bridges a stream, the bottom dropped out, and, catching by one arm, I saved myself from being swept over a waterfall a hundred yards distant, and over eight hundred feet in hight. The other, on descending a slippery rock, I fell backward, my head striking on my ax, fortunately only inflicting an insignificant wound.

This is but one or two of many instances I could name. Had those men who sit in judgment upon me, and who talk as loosely and glibly about "squatters"—even stooping to misrepresent and defame me—performed and endured but half what I have done for my Yosemite home, they would be as unwilling as I am to surrender it—to be driven from it as though by living upon unclaimed, unappropriated, and entirely unreserved public lands, as a *bona fide settler*, I had committed some crime, and the driving me from it was but a fitting punishment therefor.

It is said that Sheridan, the English statesman, once went out from Cockneydom gunning. At noon he arrived at a farm house, and, seeing a large flock of tame ducks upon a pond, and a countryman standing near, eating his dinner, after looking first at the ducks, and then at the man, he offered him half a sovereign for a shot at the flock. This being promptly accepted, and the money paid over, Sheridan blazed away at the ducks, and killed a large number. Turning to the countryman with a somewhat sarcastic and triumphant smile, he said inquiringly: "You didn't make much by that, my man—did you?" "Oh, I didn't lose anything,' was the stolid reply, "they 're not my ducks!"

Now, I opine that if those men who have misrepresented both me and the facts, had a loved home in Yosemite (consecrated by winter solitude, by many difficulties and privations and dangers, by ennobling and enlarging family ties, by many years of domestic happiness and peace); if they had endured for it, struggled for it, as I have done—in other words, if these were "their ducks" instead of mine, would they show quite as much *sang froid* in having them killed?

J. M. HUTCHINGS.

Washington, D. C., March 24, 1870.

Easy Method of Restoring Jewelry to its Original Luster.

MESSRS. EDITORS:—Years ago when electro-plating was first introduced into this country, I perceived while experimenting on the new process, that cyanide of potassium was a valuable article for restoring the luster of tarnished jewelry, but supposing that the fact must already have been revealed to the trade by the electro-platers, who could not be ignorant of it, I paid no further attention to the subject, beyond using the article in my own business.

About fifteen months ago, however, a gentlemanly-looking individual came into my store and offered to sell for five dollars a receipt for cleaning my goods, assuring me that it had been carefully prepared, under his direction, by a celebrated chemist.

Upon my declining to purchase he became anxious for me to witness the effect of his mixture. The result, although not as decided as it should have been, was satisfactory, and the conviction flashed across my mind that I had my old acquaintance, the cyanide, before me. A smell at the mixture verified the fact.

"That is cyanide of potassium," I remarked.

"Cyanide is one of the ingredients," he replied, "the principal one; but there are four or five others. There is ammonia in it."

I doubted his assertion, but experience has taught me not to reject without a fair investigation even doubtful information because it is opposed to my preconceived opinions, so, although I refused to purchase his receipt, I willingly gave him an article to which he had taken a fancy for two of his vials. From a commercial point of view I was a loser by the transaction, but scientifically considered, a gainer, as it had led me to a series of experiments which confirmed my impression that a solution of cyanide of potassium in water—pure and simple—was equal if not superior to any compound that could be used, its action on the articles submitted to it being thorough and instantaneous. A piece of jewelry, so tarnished and dirty as to be unsalable, immersed in it for a few seconds, then rinsed in clean water and dried, was as clean and bright as when it came from the manufactory. At first I hesitated about submitting costly pearls and coral to its action, but soon found that the luster of the pearls instead of being injured was improved by the thorough cleaning of the settings around them; the same being the case with the coral, the liquid cleaning all those parts of the work which neither brush, buff, nor thread could reach. Fine filigree and Tuscan work; French, or fire gilt work; plated and galvanized goods were equally benefited; the only articles which could not safely be dipped being those which washing would injure, namely work with imitation pearls and paste gummed in, or with transparent stone mounted in close settings with foil behind. Lockets, and box and glass pins can be done by removing the glasses.

When I kept a manufactory I derived considerable profit from my wholesale and retail customers by cleaning their goods which had become tarnished and dirty by exposure. The work which then occupied a whole day can now be done by the new process in a couple of hours, the rouge and lathe being unnecessary.

Among the thousands of retail dealers scattered over the country, there are many to whom the process is still unknown. To them the knowledge of it will be valuable, as it will enable them to clean their own goods, at a saving of both time and money. I therefore send it for the benefit of your readers, naming the smallest quantity of the material that can be used with advantage.

Dissolve one ounce of cyanide of potassium in three gills of soft water. Turn up the end of a piece of brass or iron wire into a hook. Attach to it the article to be cleaned, and immerse it in the solution, shaking it backwark and forward for a second or two, then take it out and rinse well in clean water. Wash it with warm water and soap to remove any film of cyanide that may remain; rinse again, dip into spirits of wine, and dry in boxwood sawdust. The advantage of dipping in spirits of wine is the immediate drying of the work without any sticking of the sawdust to it. When done with the solution, put it in a bottle and cork tightly. It may be used again and again for some months. Do not forget to label the bottle—*Poison*.

One caution is necessary; do not bend over the solution so as to inhale its odor, nor dip the fingers in it; if one of the articles drops from the hook, better empty the solution into another vessel. The cyanide is a violent poison, and although there is no danger in cautiously using it, carelessly inhaling it is injurious, and its absorption through the pores of the skin even more so.

ALEXANDER ALLAN.

Improved Stove Legs Wanted.

MESSRS. EDITORS:—In reading lately in the SCIENTIFIC AMERICAN, I noticed an article headed "Dangerous Stoves," which accorded so nearly with my experience about one year ago that I feel prompted to write you, partly to relate my experience in the matter, and partly to offer a remedy for what is certainly a most unmitigated nuisance, to say nothing of the danger to which both life and property are often exposed.

I purchased a stove with extension top and water heater; the latter a covered boiler set loosely upon the top of the stove, and holding about four pails of water.

One morning one of the legs of my stove was discovered to have fallen out; my little girl, then about ten years old, being the first to discover it, attempted to replace it, when the stove, standing upon two legs as it was, tipped over, throwing the boiler off and scattering its boiling contents all over the room. My child barely escaped a severe if not fatal scalding.

Now I fully agree with your correspondent that the matter is a serious one, and calls loudly for a reform. I suggest, as a remedy, that the legs upon the bottom of the stove, instead of being "dovetailed," be made square or beveled outward, and that the tapering part of the leg be made *solid* instead of *forked* (as they frequently are, for the purpose, I suppose, of saving a pound or two of cast iron), and then at least a three eighth, or better still, a half-inch screw tapped into the bottom plate of stove, and the whole screwed firmly together. That, I think, is as cheap, simple, and *effective* as any device which can be gotten up, and when public sentiment, as well as public safety, demands it, stove makers will be compelled to adopt it.

M.

Ansonia, Conn.

Lockage Waste.

MESSRS. EDITORS:—In reading your article on the "Lockage Waste of Water on our Canals," it occurred to me that a considerable amount of the water now wasted can be economized by the very simple method of using a double lock instead of a single one.

Build two single locks, constructed in the ordinary manner, and parallel to each other; place a water gate in the pier between the two locks at the lower level, so that when said gate is open communication is made between the two locks. In this case one lock can be used for lowering and the other for elevating boats at the same time. Suppose, for instance, there are a number of boats to pass the lock each way—one lock open to the upper, and the other open to the lower level; boats are floated in, the lock-gates closed, and the water-gate in pier opened. The result is that the lowering of one boat from upper level has elevated a boat half way from the lower level; then close water gate in pier, and complete the raising and lowering in the ordinary manner. The next transfer of boats would be done by the same means using opposite locks.

When boats are to be transferred from upper to lower level only, a boat is floated into the lock open to the upper level; the lock gate is then closed behind it. We will suppose the gates on the other lock are closed with water in the lock at lower level; then open water gate in pier between locks, when the lowering of the boat half way will raise the water half way in opposite lock, thereby saving nearly one half of the water now wasted.

A similar means to that used for lowering boats from the upper to lower level, is applicable to raising boats from lower to upper level, when the passage of boats is entirely from lower to upper level.

Having two locks would also increase the usual means of transferring boats twofold.

Cleveland, Ohio. J. J. SMITH.

Liquid for Soft Soldering.

MESSRS. EDITORS:—A better liquid for soldering tin, iron or copper with soft solder, is obtained when the solution of zinc in muriatic acid is gradually heated, and then a proportionate quantity of oxide or carbonate of tin in powder is added, to neutralize the liquid. The same will not corrode the seams, like that made of zinc and acid alone.

For a fine job on tin, "Stearic acid" obtained from the candle factories, is much preferable to resin, etc., and will not run off so easily from the soldering iron.

Cement for stoves, etc.—1 part fine iron-filings, 1 part peroxide of manganese, made to a paste with liquid water-glass. Manganese and liquid water-glass will make a strong cement for glass and china ware, and gets hard quick.

To soften hard putty.—Break the putty in lumps of the size of a hen's egg, add a small portion of linseed oil, and water sufficient to cover the putty, boil this in an iron vessel for about ten minutes, and stir it when hot. The oil will mix with the putty. Then pour the water off and it will be like fresh made.

For removing hard putty from a window-sash, take a square piece of iron, make the same red-hot, and run it along the putty till it gets soft. The putty will peel off without injuring the wood work. Concentrated lye made of lime and alkali will effect the wood and make it rot quicker.

Beardstown, Ill. TH. A. HOFFMANN.

Boiler Inspection.

MESSRS. EDITORS:—There is, no doubt, much justice in the strictures made by "Nimrod," in your issue of March 26, respecting the testing of steam boilers in Connecticut.

If he pleases to give me his address, I will show how his desire to have thorough inspection of his boilers may be met.

106 Broadway, New York. THOS. S. CUNNINGHAM.

MENDING BROKEN CHINA.—Diamond cement for glass and china is made in the following manner: Take isinglass 1 oz., distilled water 6 ozs., alcohol 1½ ozs., warm in a water bath till dissolved, and strain the solution. Add to the clear solution, while hot, milky emulsion of gum ammoniac ½ oz., alcoholic solution of gum mastic 5 drachms; this possesses great adhesive qualities.

Effect of Sudden Loads on Cast Iron.

Brittle substances are usually defined by physicists as those in which the force of cohesion is comparatively weak. Their particles or component atoms are therefore held somewhat loosely together, and when exposed to strains of certain descriptions, possess little or no resistance. It will probably here be observed that many brittle substances are endowed with very considerable powers of resistance to a crushing force, although they display but very feeble tensile strength. This is no doubt true. Cast iron, for instance, will stand a direct crushing force of fifty tuns to the square inch, while its tensile strength is only eight tuns to the square inch. But the real strength of the material is only to be depended upon when the crushing force is applied in a particuler manner. It is not so much a question of the amount of the force, as of the manner in which its action is exerted. When it is stated that cast iron will bear a crushing or compressive strain of fifty tuns per square inch, it is always presumed that the strain is applied to the material in a similar mode to that which prevailed at the experiments which fixed that constant. Whenever the weight of fifty tuns, or other crushing weight, is imposed upon a square inch of cast iron, it is supposed to be by gradual and almost imperceptible increments, commencing with a very small weight, and terminating with that which ultimately determines the fracture of the specimen under experiment. If, on the contrary, the weight be applied suddenly and violently, the material will yield to one very much less in amount. It is this liability to give way under a sudden strain that has rendered engineers so very cautious in employing the material in any situation where it might perhaps inadvertently be exposed to its influence. By an excess of caution, cast iron is frequently, from the same cause, debarred from being applied to numerous useful purposes to which it is perfectly well suited, and in which it might be adopted without the slightest fear of disastrous or unforeseen consequences. It is, no doubt, advisable, especially for young members of the profession, to be "on the safe side," as it is termed, but nevertheless, while adhering to the example of precedence, and the result of experience, one must not be afraid to employ a constructive material simply because its employment has been in some instances attended by failure; however, it should not be forgotten that the majority of these failures occurred in the early days of railways, and were due more to the incompetency and rash judgment of the designers of the structures than to any real defect in the material.

At present it may be safely presumed that our knowledge of the nature, properties, and capabilities of cast iron under strain is more complete than it previously was, and it might therefore be concluded that bridges and other structures of that material were not likely in future to be subject to such contingencies. No doubt such accidents are rare, but that they still happen is demonstrated most absolutely by the occurrence that took place recently at the bridge of Elkantara, in Algeria. A description of this bridge will be *apropos* to our present article, and very instructive to those who may have the designing of works of the same or similar character. In the first place let us briefly relate the accident. A roller of five tuns in weight was traversing the bridge backward and forwards for the purpose of crushing the metalling and bringing it to a smooth surface. On a sudden the roadway gave way. The horses attached to the roller were able to maintain it for a few minutes in a suspended condition, while the driver cut the traces, when it disappeared into the gulf beneath with equal noise and rapidity. The ravine across which the bridge of Elkantara is thrown is nearly 400 feet in depth, so that both driver and horses had a very narrow escape of being dashed to pieces. The span of the bridge, which is wholly of cast iron, is 184 feet, and the clear width between parapets 33 feet. There is not the slightest difficulty in the present instance in arriving at the cause of the accident. It was the breaking of one of the cast-iron plates constituting the roadway, under the heavy rolling load brought upon it. There are altogether five arched ribs composing the framework or main girders of the bridge, two of which are the face or outside ribs, and the others the interior or intermediate ones. These latter are spaced about 9 feet 9 inches apart, and the whole are braced together by cross girders and trussing, also of cast iron. The transverse girders are of a plain T section. Upon the intermediate arched ribs are placed the cast-iron road plates, their span being nearly equal to the distance between the centres of those ribs, which is evidently a long span of cast-iron plates in the situation under description. The plates are slightly cambered, and their average thickness is 0·8in. That of the metalling is about 10½ inches. The framework of the structure was not in any degree affected by the accident.

A glance at the construction of the bridge at once points out that the contingency was, in the main, due to an attempt at false economy. The design clearly was to dispense with the usual transverse road beams, and make the cast-iron plates do the double duty of acting as road plates and girders at one and the same time. The shape and section of material that will answer perfectly for a road plate pure and simple, where the span does not exceed 3 feet or 4 feet, is not by any means adapted to situations where the span becomes nearly 10 feet. It is somewhat extraordinary that the French engineers, who, as a rule, calculate the action and effects of strains upon bridges a great deal more precisely than we do, should not have appreciated the exact nature of the case. At the very first sight, a road plate of cast iron nearly 10 feet in span is a very unusual piece of construction, and it could not fail to strike one that in that position it would be acted upon by other strains than that of compression. Cast iron in the shape of a road plate is not adapted to undergo tensile or transverse strain, and even in the best form, namely, that of Mr. Hodgkinson's girder, it is not altogether reliable under a heavy impactive or concussive load. In addition to these theoretical objections, there are also others of a practical nature. When the ratio of the thickness of the plates to their superficial dimensions is considered, it is not an easy task to insure that the casting should be thoroughly, uniformly, and homogeneously manufactured. Any flaw in it, which might, under less trying circumstances, be of no importance, would be fatal to a plate in the situation it was placed in at the bridge of Elkantara. On the score of weight, both cast-iron plates, and the still older practice of using brick arches to carry the roadway are objectionable. They are now nearly obsolete with us. Wrought iron corrugated or buckled plates are the means usually employed by English engineers for supporting the roadway of public bridges, but even in that case their span does not attain to the dimensions of the cast-iron plates which have been just described. The cross girders of a bridge require depth, the road plates, superficies, and it is impossible to combine the two in one without the chance of danger, or incurring an unwarrantable expense.—*Building News.*

New Photo-Engraving Process.

We have pleasure in announcing a new photo-engraving process, with half-tone, of great promise which has just been patented by Mr. Woodbury. The one example which we have seen strikes us as amongst the most perfect examples of photo-engraving we have hitherto met with. The process is based upon Mr. Woodbury's photo-relief process, part of the operations in which are employed to produce the printing-plate in the new method, which may indeed be regarded as a modification of the old one, although giving different results, printed at a different press, and with a different ink.

In order to make the matter clear to the reader not familiar with the technics of intaglio printing, we must briefly explain one or two details. Most of our readers know that copper-plate printing is effected with a plate having an image in intaglio; that is, the design is cut in or sunken, not in relief. They also know that Mr. Woodbury, in his photo-relief process, prints from a similar plate. It might naturally be asked, therefore, why Mr. Woodbury's intaglio plate might not be used in the ordinary process of copper-plate printing instead of requiring a special gelatinous ink and special presses. There are several reasons; but there is one of an especial and primary character; such a plate from a subject with half-tone has no ink-holding capacity. In a subject with half-tone there are broad spaces of flat or continuous tints out of which the ink would be wiped when used for copper-plate printing. It should be remembered that after inking a copper-plate it is wiped to remove all the ink which does not fill up the sunken design; and, if the plate have no grain or ink-holding spaces, the ink is wiped out of the widest and shallowest spaces, destroying much of the image. If, however, these spaces have a grained or cellular texture the ink is held by the grain or cells, and is not wiped out.

Various methods have been adopted to secure the requisite quality in photo-engraved plates, with greater or less degree of success, which it is not necessary to refer further to here. The method adopted by Mr. Woodbury is analogous to some of them; and, so far as we can judge from what we have seen, more efficient than the majority of them.

Like many other valuable discoveries, Mr. Woodbury's new process owes its origin partly to accident. About twelve months ago Mr. Woodbury gave us one of his gelatin reliefs, which had a singular defect. He was in the habit of adding a little coloring matter to the gelatin from which his reliefs were formed, as an aid to examining their progress in development. On this occasion, from some unexplained cause, the color, instead of diffusing itself as a flat tint or stain, granulated, and communicated to the gelatin relief a surface resembling that of a very fine aquatint plate. When this effect was first produced we discussed with Mr. Woodbury the chances of utilizing it as an aid to producing a photo-engraved plate for copperplate printing. The idea then canvassed, Mr. Woodbury has since worked out to the issue we mention. From a granulated relief an intaglio in lead or type metal is obtained by hydraulic pressure; but as such a plate would be too soft for valuable service in the mode of printing employed with copper-plates, it is desirable to proceed further. This soft metal plate is therefore placed in the battery, and a copper-plate in relief obtained; from this, as a mold, another intaglio plate is obtained in the battery. This last is the printing plate, and to give it enduring qualities it is submitted to the *acierage* process, whereby it acquires a steel face, so that a large number of impressions may be obtained without sensible wear.

How far this new process will bear out, in general practice, all that it now seems to promise, time alone can tell, but, so far as we can judge, a valuable addition is secured to the mechanical printing processes connected with photography.

Since writing the above we have seen specimens of a process in some respects analogous, patented by Mr. Courtenay, and described at the Photographic Society. We shall hope to see further examples before forming a decided opinion of the value of the process, as those we have seen scarcely suggest any great advance on what has already been achieved.—*Photographic News.*

Spare the Centers.

The practice of kocking off the centers of turned work is a mischievous one. It is merely doing work that is not only needless, but that, at some future day, will have to be done over again. When a center is once properly made in a shaft, or any other part, it is unalterable except by chipping or purposely changing its position; and work once turned true on good centers, will always be true, provided no damage occurs to it. It is just in this particular that the true center is useful, for if a shaft is bent, or an arm on one thrown out of line, the old centers are available, and the injured piece can be made as good as new in a short time. Suppose, however, that the journal of a shaft is worn oval, or that the collar is battered and jammed up, how is it possible to find the true center of the shaft? It never can be found; the shaft may be made to run straight, but not by its old centers if they have once been cut off. When shafts are forged too long, in cutting them to the right length great "tits" are left on the ends, which are both ungainly and in the way. This is the blacksmith's fault, and must be remedied by the machinist; cut the shaft to the right length first, knock off the centers if they are too long, and then re-center the job and finish it according to the drawing. In steam-engine work, especially, the centers of shafts are essential to nice adjustment, and they should never be removed.

A foolish notion prevails among some mechanics that centers injure the finished appearance of the work, but it seems to us that this is an erroneous view, which ought not to be tolerated. Drill every center, and drill it deep; countersink it so that it will have a good bearing on the centers of the lathe, and the workman will have the satisfaction of knowing that, all other things being equal, he will have a good job, and one that can at any time be easily repaired if damaged.—*Modern Practice of American Machinists and Engineers.*

Velocity of Shafts.

As the quality of the material employed for the construction of shafts enters largely into the calculation of their strength, so also the velocity at which they revolve becomes an important element in the calculation of the work transmitted by them. In all cases where machinery has to be driven at a high speed, it is advantageous and even essential to run the shafting at a proportionate velocity. If, for example, there are a series of machines running at five hundred revolutions per minute, it will be advisable to run the shafts at half that speed, by which means the following very important advantages will be gained.

There will be a great saving in the weight of the shafts, for with a slow motion of fifty revolutions per minute, fully three times the weight would be necessary to transmit the same power. There would also be a saving in original cost in the power absorbed, and in maintenance.

Shafts running at low velocities are cumbersome, heavy, and expensive to repair. They are costly in the first instance, and they block up the rooms of the mill with large drums and pulleys, obstructing the light, which, in factories, is a consideration of very great importance.

At the commencement of the present century, mills were geared with ponderous shafts, such as those just described. They were generally of cast iron, square, and badly coupled, and the power required to keep them in motion was, in some cases, almost equal to that required by the machinery they had to drive. In the present improved system, with light shafts, accurately fitted and running at high velocities, the work which previously was absored in transmission, is now conveyed to the machinery of the mill.

I may safely ascribe my own success in life, and that of my friend and late partner, Mr. James Lillie, to the saving of power effected by increasing, threefold, the velocity of the shafting in mills more than forty years ago. The introduction of light iron shafting not only enabled the manufacturer to effect a considerable saving in the original cost, but a still greater saving was effected in power, while it relieved the mills from the ponderous wooden drums and heavy shafting then in use, and established an entirely new system of operations in the machinery of transmission.—*Principles of Mechanism.*

The Trade in Masks.

Masks are an important article of trade in Paris. The houses which are engaged in this industry are generally respectable and long-established houses, who make their money out of folly in the soberest way. Paris produces masks, but the foreigner buys them. South America, New Orleans, New York, and especially Buenos Ayres and Brazil, are among the principal customers—the carnival being observed there with great enthusiasm. Parisian makers also receive orders from America for masks representing the types of the human race—negroes, Jews, Englishmen, Germans, etc.

Italy makes her own masks. Russia orders but few, as it pays but little attention to the Carnival; but Protestant England requires a great many masks for the anniversary of the Gunpowder Plot. What with one festival and what with another, this trade is never quite at a stand still. The workmen engaged in it are paid from 5 francs to 6 francs a day; the women from 2 francs to 3 francs. The commonest mask, worth one sou, passes through the hands of eight workpeople.

JUST before going to press with our last issue, we received the announcement of the successful launching of the caisson for the Brooklyn tower of the East River Bridge, of which we had only space to make a brief notice. Notwithstanding the giant dimensions of the structure, no difficulty whatever was experienced in making the launch. The caisson will have to support a weight of one hundred and thirty-five millions of pounds. The base of the towers will rest on an area of one hundred and thirty-four feet by fifty-six feet, and it will diminish at the top to an area of one hundred and twenty by forty feet.

THE direction in which plants twine is not a direct result of the position of the sun in regard to them; the French bean turns from right to left; the hop from left to right, and the common bryony either way.

Improved Vehicle Spring.

Our engravings illustrate an improved vehicle spring, constructed of wood and steel, which appears to be much superior to those hitherto employed for thorough-brace vehicles.

Fig. 1 represents the spring applied to a "Victoria" carriage to be driven with postillions, and Fig. 2 shows the construction of the spring in side elevation.

A represents the outer leaf which is of steel, and which is made longer and stronger than the other metal leaves.

The lower end, B, is bent perpendicular to the other part, to rest against the other side of the axle or rocker, C, as the case may be; and it may, if preferred, be connected to the strap, D, attached to the under side of the bar, E, of the frame, extending from the hind axle to the front rocker. The upper end is doubled under and laps back on the inner wood leaf, as shown at F.

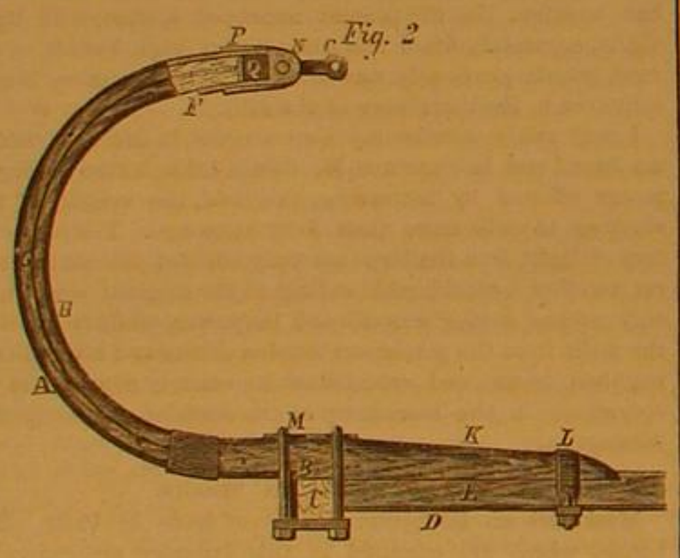
G and H represent the wood leaves of the spring, and I another metal spring between them. These wood leaves terminate in a common shank or stock, K, at the lower end, which is attached to the top of the bolster or axle, C, and the bar, E, by the clips, L and M.

The upper end, F, also laps around the pivot bolt, N, of the shackle, O, and a band, P, is arranged around this double end for straightening it, and for forming the two sides of the socket or recess at the end of the other leaves of the spring, the said leaves being shorter than the leaf, A. This socket is fitted with an india-rubber spring, Q, against which the shorter leaves bear, and which yields to make room for them, when by the springing action they push forward in the socket.

This arrangement is intended to give each leaf of the spring freedom to expand or contract relatively to the others, independently and unconfined by them; and by it each leaf performs its function to better advantage, than when all are confined together, as these springs have heretofore been arranged.

The straps or loops by which the body of the vehicle is supported are connected to the shackle, and may be arranged to extend over the leaf, A, and to be fastened to the plate, B, if preferred.

Fig. 2



Patented, through the Scientific American Patent Agency, February 8, 1870, by John Goller, of Los Angeles, California, whom address for further information.

RAPID TELEGRAPHY.

A new telegraph line is now being constructed between New York and Washington, forming a small section of wires that are intended to ramify in all directions through the country, by which cheaper and more rapid telegraphy is expected to be realized. This is the enterprize of the National Telegraph Co., and from the printed report of the Executive Committee to the stockholders, we gather a number of interesting particulars. The capital stock is ten millions of dollars. The instruments used are the recently patented telegraph improvements of George Little, of New Jersey. The messages to be sent are prepared by punching slots and circles through a strip of paper, which, on being drawn through the telegraph instrument, transmits corresponding electric signals. These are received and made visible upon strips of chemically-prepared paper.

Copies of messages may be dropped at all stations upon the line without interfering with the working of the instruments. The machines for preparing the messages are quite simple, and are operated by girls. Mr. D. H. Craig, one of the most experienced telegraph men in the country, states that as much business can be done with the Little instruments, using only one wire, and thirty-two girls to prepare and copy the messages, at a total expense of $48 per diem, as can be accomplished by means of fifteen wires and thirty first-class Morse operators at an expense of $120 per diem.

There is also a difference of fifteen to one in favor of the new system in the prime cost and maintenance of wires.

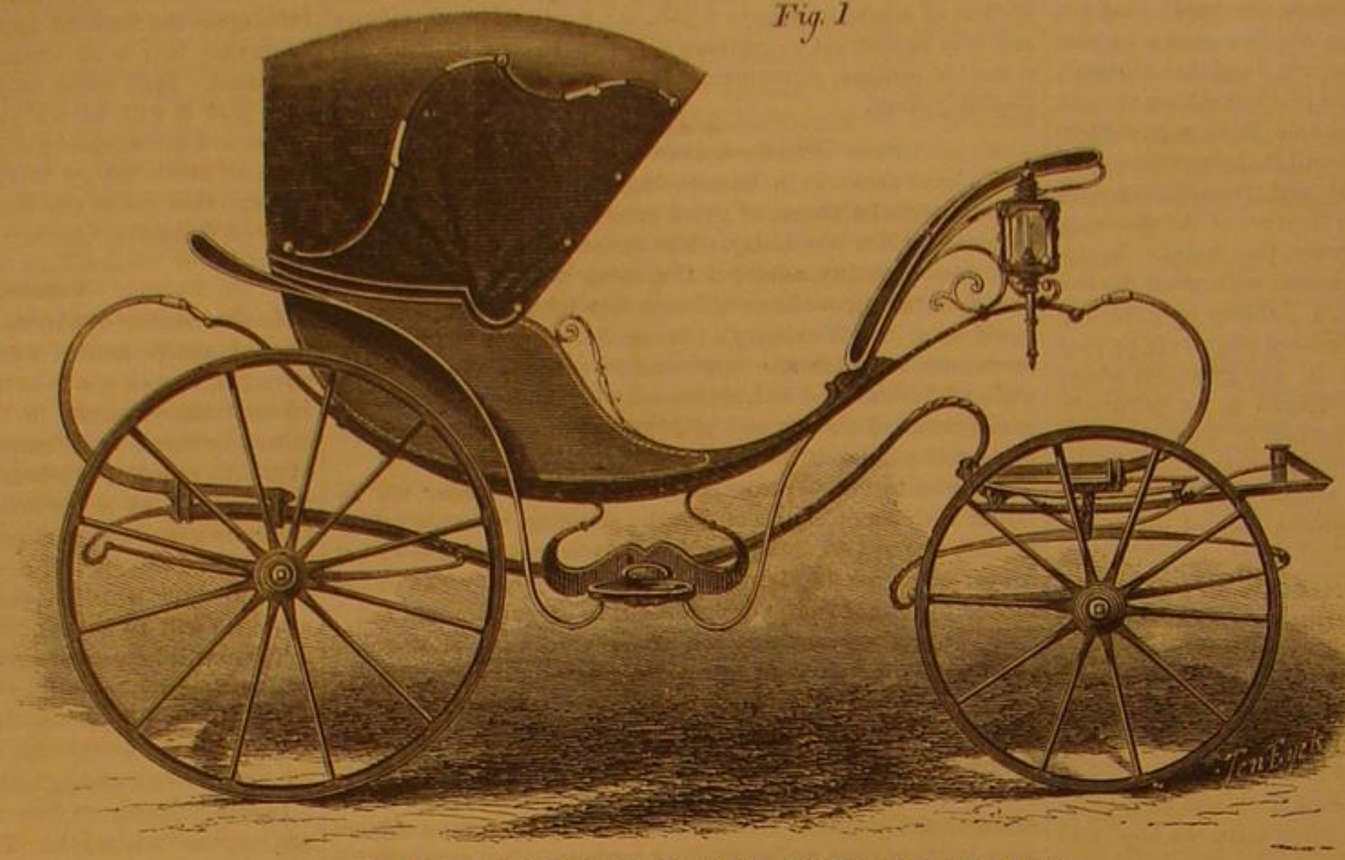
The new company expect that when, by their competition, they have brought down the tariff of the Western Union, and other telegraph companies, to the lowest paying point, the National Company will be able make a reduction below this of 50 per cent, and still have a good margin for profit. If the company can do this or anything like it, their business will be enormous. Next to cheap postage and quick mails the people want cheap telegraphy; and we therefore welcome anything that promises to bring it about. We notice among the active managers the names of Isaiah Blood, Erastus Corning, Jr., and other gentleman of wealth and energy, which is a guarantee that the new company means business. We certainly wish it every success.

IMPROVED COAL-BREAKING MACHINE.

In the ordinary method of breaking coal much of it is crushed into powder, in which condition, it is for ordinary consumption, practically valueless. The object of the present invention is the improvement of the construction of breaker rollers so as to split the coal into fragments, by the substitution of a wedge-like action for the crushing process heretofore employed.

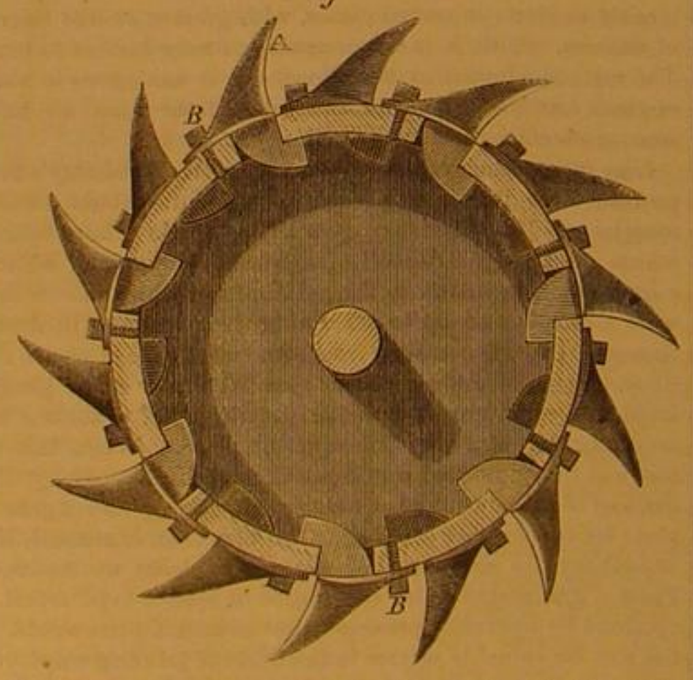
To this end, the rollers are furnished with detachable teeth of steel, of the form shown at A, Figs. 1 and 2. The inner

Fig. 1



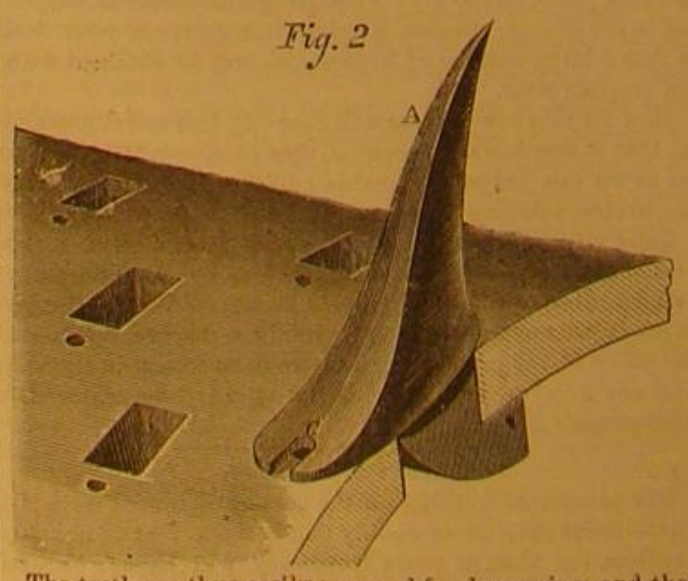
GOLLERS' THOROUGH-BRACE VEHICLE SPRING.

Fig. 1



ends of these teeth are made to hook on to the interior of the iron cylinder to which they are securely held by the bolts, B, Fig. 1, placed in slots, C, Fig. 2, formed in the bases of the teeth, as shown.

Fig. 2



The teeth are thus easily removed for sharpening, and their points being shaped, as shown, easily penetrate and split the coal, without the comminuting action of the old form of breakers.

It is claimed for this machine that it takes twenty-five per cent less power than any coal breaker heretofore used; that it is very much more durable, and that it at the outset makes twenty-five per cent less waste than machines using the common cast-iron tooth, while it saves a very large proportion of subsequent waste in transportation, because the coal is not so fractured as to break and pulverize in handling.

Patented, through the Scientific American Patent Agency, March 1, 1870, by Edwin Douden, of Lykens, Pa., assignor to himself and Charles Broome, of same place, either of whom may be addressed for a portion or the entire right for the United States.

THE YOSEMITE VALLEY.

In accordance with our general desire to give both sides of every question a candid hearing, we publish in another column a letter from Mr. Hutchings, who claims to have been a *bona fide* settler in the Yosemite valley previous to its cession to the State of California. If his claims are valid he is entitled to compensation, but we maintain that it would be disastrous to allow such a natural wonder to pass from the control of responsible and disinterested hands into the hands of private parties for purposes of speculation. We should as soon think of admitting a private claim to Niagara. If Mr. Hutchings is injured by the action of the government, by all means let him receive ample remuneration, but this great natural wonder should be, as Congress designed, held forever in trust for the people.

The feelings of attachment for his home, which Mr. Hutchings makes so prominent in his plea for the right to remain, ought to yield to considerations of public good; nevertheless, we should not object to their having weight in whatever pecuniary allowance may be made to him upon the full establishment of his claim.

PORTABLE LAUGHING GAS.

Protoxide of nitrogen, commonly called laughing gas, is a remarkable substance. It was discovered by Priestly in 1776, and quickly exhibited curious properties, which chemists thought might be utilized for a variety of purposes, particularly for the alleviation of pain. When inhaled, it produces the most agreeable sensations, being a species of intoxication, but very different from that of alcoholic liquors. The discovery of chloroform has superseded every other agency as an anæsthetic; still laughing gas continues to be used in dentistry to some extent. A great bar to the utilization of it, is that it is not to be had when wanted, except by special manufacture. Professor Doremus has put the gas into a portable shape. He condenses it into the liquid state, which is done by a pressure of about 800 pounds to the square inch. He bottles it up in a stout jar, or vessel, which contains an enormous quantity of the gas, compressed into a small compass. Another important property of the gas is that it vaporizes at something like 125 degrees below zero. Hence it is a powerful agent for the production of cold. The Professor exhibited this recently in a beautiful experiment. He poured some of his liquid gas into a glass tube, then put in some mercury. Vigorous ebullition presently commenced, and in a few seconds the mercury was frozen into a solid lump. It was curious to see the gas boiling furiously while freezing the mercury.

The Proposed International Exposition at Buffalo ---A Permanent Building.

A petition, signed by the leading firms and prominent citizens, has been forwarded to Albany, asking the Legislature to grant the City Council of Buffalo authority to lease Terrace Park to the Mechanics' Institute to erect a mammoth fire-proof building for the purpose of holding international industrial expositions and perpetual bazars.

Terrace Park, which is located in the heart of the business portion of the city, is accessible to railroad and steamboat depots, and is surrounded on all sides by broad streets. The main building is to cover an area of over one hundred thousand square feet for the exposition of goods. It is intended to make Buffalo the central point between the East and the West for annual exhibitions and national sales depot.

SOLAR SPOTS.—As the period for maximum occurrence of solar spots approaches, increased disturbance is apparent in the photosphere. Those interested in this class of phenomena may almost at any time see such spots, by protecting the eyes with smoked glass. It will be interesting to note whether the connection supposed to exist between solar disturbances and auroral displays, is verified by the observations which will be made during the period alluded to.

GILDING ON GLASS.—Mix powdered gold with thick gum-arabic and powdered borax. With this trace the design on the glass, and then bake it in a hot oven. Thus the gum is burnt, and the borax is vitrified, at the same time the gold is fixed on the glass. To make powdered gold: Rub down gold leaf with pure honey on a marble slab, wash the mixture, and the "precipitate" is the gold used.

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VOL. XXII., No. 14 . . [NEW SERIES.] . . *Twenty-fifth Year.*

NEW YORK, SATURDAY, APRIL 2, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

*Improved Bolt Cutter.....215
*Improved Self-Connecting Car Coupling.....215
Painting in Milk.....215
The Manufacture of Fire bricks..216
Something about Silver.....217
The Guava.....217
Chemical News.....217
*Improved Hominy Mill.....218
*Improvement in Railroad Car Springs.....218
Black-Bronzing Iron and Steel....218
The Architecture of the Human Body.....218
What are Condiments?.....218
Natural History—The Great Auk.119
Unhealthfulness of Iron Stoves....119
*Improved Implement for Drawing Nails.....119
The Production of Sulphur in California.....119
A Strong Cement for Iron.....119
The Yosemite Valley.....220
Easy Method of Restoring Jewelry to Original Luster.....220
Improved Stove Legs wanted.....220
Lockage Waste.....220
Liquid for Soft Soldering.....220
Boiler Inspection.....220
Effects of Sudden Loads on Cast Iron.....221
Editorial Summary.....221
New Photo-Engraving Process....221
Velocity of Shafts.....221
The Trade in Masks.....221
*Improved Vehicle Spring.....222
Rapid Telegraphy.....222
*Improved Coal-Breaking Machine.....222
The Yosemite Valley.....222
Portable Laughing Gas.....222
The Proposed Internation Exposition at Buffalo—A Permanent Building.....222
The Darien Canal—Will it pay to Build it?.....223
An Invisible Chain and a Silent Conflict.....223
The Study of Alloys.....224
Butter and its Adulterations.....224
How Fire Bricks are Made.....224
The Wind Month.....224
Economy in the Use of Time.....224
Glass Cutting.....225
Hartford Steam Boiler Inspection and Insurance Co.....225
Answers to Correspondents.....226
Recent American and Foreign Patents.....226
List of Patents.....227
New Books and Publications.....227

THE DARIEN CANAL---WILL IT PAY TO BUILD IT?

After all the surveys and reconnoissances that have been made (19 different routes and more than twice as many surveys) of the narrow strip which divides North and South America, extending between and inclusive of Tehauntepec and Darien, general opinion seems to have settled upon the latter Isthmus as the point for an interoceanic canal.

Admiral Davis in his report to Congress says: "It is evident that to this point we must look for the solution of the great problem of a union of the two oceans. On this Isthmus the two great waters are divided only by a distance of 27 miles, and waters flowing into the Pacific actually come within three miles of the Atlantic Ocean, and tradition says in days gone by that, in some of the great tidal waves which volcanic action heaves up from the quiet Pacific, they have been united. Certain it is that at that point is not only the narrowest part but also the lowest elevation between the two continents. Yet with these facts before the world, there never has been a careful examination of any route on this Isthmus. Expeditions, one after another, have failed, and, we fear, with all its excellent preparation, that another is to be added to the list of failures.

All who have visited the Isthmus agree that it is folly to attempt a passage after the 1st of May. A French party disregarding the warnings given them, attempted to cross early in that month, found themselves caught by a flood, and were scattered over the plains on little hillocks like so many pelicans, whence they were picked off with boats. It is now but a few days to that time when the rainy season commences, and as yet the well-equipped United States Government expedition has hardly effected a landing at Caledonia Bay. But be theirs a success or a failure, it does not alter the fact that a ship canal must at some time be dug, and that Darien is the location. It simply puts off the day; the accomplishment of the great enterprise is inevitable.

Dr. Cullen, an Englishman, claims to have made the most complete reconnoissance of the Isthmus of Darien. He claims to have found a practicable route, with an elevation of not over 190 feet, and he thinks even less may be found. We submit his map.

It will be seen that he has a canal of 21 miles, and deepens the Sucubti 12 miles, then navigates the deep streams, Lara, Savana, and Tuyara, 14 miles more, in all 47, with one or two tidal locks—no other. He estimates this to cost about $34,000,000, but his estimates are only for a canal 24 feet deep and 150 feet wide through the mountain or deep cuttings. It would be folly to dig such a small canal at the present day. The harbors at each end will accommodate ships of the largest class now known, and at low tide the depth of water at the mouth of the Lara is 50 feet. The tide rises there 12 to 14 feet.

What should the Darien Canal be? what should it cost? and can it be built?

The canal to meet the requirements of modern commerce of all characters should be 50 feet deep its entire distance, and 500 feet wide at top, throughout the earth or valley cutting, and at least 150 feet through the mountain section. Without the most wasteful extravagance such a canal would not cost near $100,000,000. The actual mountain section is not over three miles long, the rock is soft dolomite, and coralline, limestone, and gravel. The climate, unlike that of Panama, is comparatively healthy, and there need be no such mortality as was witnessed in the construction of the railroad. We estimate that 10,000 Chinese laborers would in five years add another to the great works of modern engineering skill.

There are remains of greater works in Mexico, built by a people we know nothing of. Ancient Rome had aqueducts almost rivaling this project, and it does not equal those monuments of regal pride and folly the pyramids. The Grand Canal of China, said, by the lowest estimate, to be 863 miles long, is claimed to have taken 43 years to build. It has no locks, and the Morris Canal Company borrowed the idea of drawing boats over inclined planes from that nation. The Holstein Canal is 50 miles long, 100 feet wide at top, 54 feet at bottom, 10 feet deep, cost $30,000 per mile, and was nine years in being built. The Caledonian Canal has 23 miles of cutting, is 122 feet wide, 20 feet deep, and took six years to finish. The Welland Canal has a main trunk of 28 miles, and 22 miles of feeders. It cost £1,800,000, and is navigable for vessels of 800 tuns.

These are some of the great works of engineering skill in effecting inland navigation from which we may draw inferences; but it is with our own Erie Canal that we especially desire to make an analogy. Its main line is 363 miles long, was originally cut 4 feet deep, 40 feet wide at top, and 28 feet at the bottom, was 8 years in building, and cost, in total, $9,474,373, though only $7,143,789 is stated to have been the cost of the canal proper.

Now if we condense the Erie Canal one tenth we have a canal 36·3 miles long, 40 feet deep, 400 feet wide at top, and 280 feet at the bottom. Thus putting the work of 363 miles into 36·3. Taking into consideration the greater lift of dirt, etc., from a depth of 40 feet instead of 4, and the greater length of haul, such a canal should not cost more than five times the amount of the Erie. Then, too, we must remember that labor-saving appliances are more frequent, that the steam dredge now digs, and the steam drill now bores, where once slow hands toiled, and nitro-glycerin does ten times the work of old style gunpowder. The Erie Canal was, in its day, a greater work for the State of New York and the United States than the Darien Canal is to-day for New York city alone. The same spirit of enterprise which animated the one should, and must, build the other.

We have not yet alluded to the cost of the Suez Canal.

Apparently it was much less work to cut through the soft sands of the desert than the rocks and mud and gravel of Darien; but we must remember the manufacture of a harbor at Port Said, and, too, the fact that in the item of "operating expenses, repairs," the rocky sides of Darien will tell vastly in its favor. While, too, the Suez Canal is a great work of universal importance yet it can never be what that of Darien will be if properly constructed.

Mr. F. M. Kelly, of New York, has for years been investigating the various routes for a ship canal between the two oceans, and has done more than any American to bring to light its advantages and the most advantageous route. In 1859, he had a table prepared from the public records of France, England, and the United States of the trade of each of those countries likely to pass through the Darien Canal, namely

	Value.	Tuns.
France	$ 59,073,859	162,735
United States	100,291,687	1,857,485
England	139,184,834	1,029,295
	Value of tunnage.	**Estimated saving.**
France	$ 8,136,750	$ 2,183,930
United States	92,874,250	35,995,930
England	51,464,750	9,950,348

English vessels would use the canal only on their outward passage to China, etc. Statistics from commercial relations, for 1868, put our foreign Pacific trade at only $44,400,000, gold. England, on the other hand, has greatly increased hers, as she has all her commerce. A new commercial power has also arisen in the Confederated German States, or Prussia. The Suez Canal, too, will take some of this trade, especially if it be permanently and properly kept up

Mr. Kelly publishes a list of distances as follows:

New York to	Via Cape Good Hope.	Via Cape Horn.	Via Darien Canal.
Calcutta	17,500	23,000	13,400
Shanghai	20,000	22,000	10,400
Valparaiso		12,900	4 800
Melbourne	13,230	12,720	9,890
Canton	20,000	22,000	10,400

Hence we see that to leave out other countries, the saving to the United States alone makes the canal a necessity. In all these estimates, too, but little if any notice is taken of our California trade, which has become so large, and the trade of that country with Europe direct.

We gather from various sources the following tables:

London to	Via Cape Good Hope.	Via Darien Canal.
Canton	13,650	11,200
Nagasaki	14,675	10,400
San Francisco via Cape Horn	13,000	8,000
New York to	**Via Cape Horn.**	**Via Darien Canal.**
San Francisco	13,140	5,140
Nagasaki	14,925	8,000

The advantage of this route is apparent, and all know the present great and increasing commerce of San Francisco. The trips via Cape Horn from New York to San Francisco range from 90 to 130 days. By the Darien Canal the same could be made in 45 days. Any commercial man can estimate the difference in favor of the canal.

1st. The difference of amount of wages to be paid.
2d. Shorter time and less rate of insurance.
3d. Wear and tear.
4th. Less insurance on cargo.
5th. Less damage to cargo.

The Suez Canal has cost over $80,000,000, and it is estimated to cost $20,000,000 more to make it what was originally intended—that is, 100 yards wide at top and 26 feet deep. We are told that, with its present imperfection, they have taken nearly $100,000 of tolls. Our Darien Canal costing, say $75,000,000, if the estimates we have given are correct, and we have used every effort to be accurate, would at least pay ten per cent profit, and Dr. Cullen estimates the actual saving to the commerce of the world in 1857 would have been $48,130,208, nearly enough to have built it.

AN INVISIBLE CHAIN AND A SILENT CONFLICT.

Of all the forces of nature there is, perhaps, no one more peculiar in its manifestations than that called the attraction of cohesion. This force is the invisible chain which binds molecules into masses, against which another unseen force is constantly tugging.

When particles of matter, of the same kind are brought into so close proximity that the spaces between them are no longer sensible, this force seizes upon them and binds them into a mass, provided heat, the great antagonist of cohesion, does not act with sufficient force to prevent the union. This is illustrated in many ways. A machinist can file two pieces of iron to such a perfect plane surface that, when placed together, thin particles come within the range of this force and cohere. Two clean surfaces of lead may be pressed together till they cohere. Two plane surfaces of ground glass placed together will cohere very strongly.

The ordinary process of welding is an example of simple cohesion. In this process, two pieces of iron are heated, placed together, and hammered so as to bring the molecules within the range of cohesion. Here we see one of the anomalies of this force. We have said that heat is the antagonist of cohesion—how is it, then, that, in welding iron, these forces assist each other?

When we look a little more closely into the philosophy of welding, we find that heat does not assist the cohesive force at all. In the case of filing two pieces of metal so that they cohere, the union is weak, because only a few of the particles are brought within the range of this force. A plane surface has only been approximated, however perfect it may appear. It is, in reality, a series of mountains and valleys, only the summits of which are brought sufficiently near to each other to be linked together by this invisible chain. If, when this is done, we render the molecules sufficiently mobile by heat, so that the force of blows with a hammer, or the compression of rollers would force them within the range of cohesion, the bond would be complete. The object of heating, in making a weld, is to render the particles movable without entirely overcoming their cohesive attraction, so that they will cohere under the hammer, with such diminished energy as remains. As the iron subsequently cools, cohesive attraction acts more and more, until it reaches its maximum intensity.

In considering the various manifestations of this force, it is important to avoid confounding it with adhesion, a force which acts only between particles of matter of different kinds. Thus, two lumps of soft clay may be made to cohere, and become one mass, but, when the clay sticks to a body composed of different material, it is the force of adhesion which holds it there.

Regnault has called cohesion the "force of aggregation," a very appropriate and significant term. It is upon the degree of antagonism between this force and heat that the solid, liquid, and gaseous states of bodies depend. When the antagonism is small, we have a solid. When cohesion is nearly balanced by the disruptive force of heat, bodies exist in the liquid condition. When the force of cohesion is entirely overcome by heat, the gaseous state is produced, in which the particles seek to remove themselves as far as possible from each other, and are only retained within ordinary limits by the action of external forces.

When, however, we come to examine these states of matter, we shall find in the solid and liquid states, where the force of

cohesion is not entirely overcome, some striking peculiarities. In the case of liquids, we can ascribe these peculiarities to the degree of approximation of the action of heat to that of the attraction of cohesion. Thus, water is very fluid; molasses, tar, and some oils are viscid, they move sluggishly, and draw out into threads when poured from vessels, etc. This is, probably, the result of a diminished action of heat in proportion to the force of aggregation.

It will be well to state here, that the heat opposed to cohesion need not be sensible heat, or that which the thermometer indicates. Latent heat is,in many cases,far greater in amount than sensible heat, and there is no difference in the essential qualities of latent and sensible heat; both alike oppose cohesion.

In solids, where the force of aggregation acts with the greatest vigor, we find still more numerous peculiarities. The most obvious of its manifestations is the quality of hardness, or the quality by which bodies resist the displacement of their particles. It is quite difficult to give a definition of the term hardness without either including more or less than is really implied. We think so long as scratching is the means employed to determine relative hardness,it would be well to limit the meaning of the term when used in scientific works to simple resistance to abrasion.

How this quality can exist simultaneously with the quality of brittleness, is a puzzle which has never been satisfactorily solved. Equally puzzling is the fact, that a body less hard than another may resist a total rupture of its particles, or possess the quality of toughness to a much greater degree. Thus one may easily scratch a rod of hickory or cut it with a knife. A rod of glass is not easily scratched, and a knife will not cut it; yet the hickory rod will withstand an astonishingly greater pressure than a glass rod of equal size without breaking.

Another peculiarity of the action of this force, is its susceptibility to external influences. This is shown in the hardening and tempering of steel; in the crystallization of iron exposed to continual vibration; and in the brittleness which has been observed in copper wires long exposed to the action of the galvanic current.

Another peculiarity, which gives rise to some of the most beautiful natural phenomena, is the tendency of the particles of bodies, when drawn together by cohesion, to assume definite and regular geometrical forms, which, in the case of solids, are called crystals. The variety and beauty of these forms are indescribable, within the limits of anything less than an extensive treatise on crystallography. These forms, combined with all degrees of translucence, from opacity to perfect transparency, and with the most beautiful colors, produce some of the most delightful and pleasing objects known to man. Whether the regularity of form in crystals depends solely upon the force of cohesion, or upon it in connection with some other force, is not yet determined; but it is certain that, among all the seeming vagaries in the action of natural forces, nothing can compare with some of the mysteries of crystallization.

An example of one of these vagaries is the fact that many substances remain fluid, when allowed to cool slowly, until acted upon by an external influence, when they suddenly assume the crystalline form. A common lecture experiment is performed with Glauber's salt, to illustrate this point. If a hot saturated solution of this salt is allowed to cool down slowly, and entirely undisturbed by any motion, it will remain perfectly fluid and limpid, until a tremor be imparted to the mass by any means whatever, when it instantly strikes into a solid mass of crystals. Even the slight ruffle upon its surface, caused by setting the air in motion with the breath will produce this result.

But we might go on, filling column after column with matter pertaining to this ever-acting invisible chain, and its silent, unceasing conflict with heat. We might show, also, that the condensing steam engine depends for its action upon the alternate operation of heat and cohesion, the operation of generating steam being simply the overcoming of cohesion by heat, and that of condensation, being merely the resumption of the cohesion by the loss of heat. But we forbear to dwell longer upon this fertile subject. At some future time we may return to it, and take another glance at some interesting facts not alluded to in the present article.

THE STUDY OF ALLOYS.

No field of modern investigation offers greater promise of reward to the patient and systematic investigator than the subject of alloys. That so few have devoted themselves exclusively to their study, may be accounted for, perhaps, by the great extent of the subject, the expensive nature of the experiments, and the cost of appliances to properly conduct them.

All the alloys known do not, probably, equal those possible between a pair of the common metals which might be selected. When we speak of an alloy of tin and lead, or of iron and zinc, etc., it is common to regard the term indefinitely as any alloy possible to these metals. But different alloys of the same metals often present very striking differences in character, according to the proportions in which their elements are present; and as the variation in properties may be extended indefinitely, and as, when alloyed in new proportions, no prediction can be made of the properties which will result, it follows that the number of possible alloys, having distinct physical characteristics, of which any two metals are capable, is yet undetermined.

It may be said that, theoretically, this number is undeterminable. But within practical limits, it is determinable. Combinations might be sought in all integral ratios, from 1 to 1000, for all the known metals; for binary, ternary, and quaternary alloys; the physical properties of each alloy, tabulated for reference, and a combination of specimens, consisting of small ingots preserved.

This will, however, hardly be accomplished by a single individual. We should like to see a laboratory fitted up and liberally endowed to see a corps of able metallurgists, and to furnish all needful appliances and materials for experiments; the results obtained to be published in annual reports for distribution to public libraries, and for sale to private individuals.

This suggestion has in it,we believe, nothing impracticable. Money has been donated freely for the establishment of Astronomical Observatories, calling for an expenditure much larger than that necessary to establish a metallurgic laboratory, and the prospective benefits of the latter would be, in our opinion, much greater than that of an observatory.

In such a laboratory the subject of alloys might receive systematic treatment, and the investigation would be pursued in that consecutive manner which is so important to success.

There can be little doubt that such a course of investigation, conducted by men of scientific attainments and great inventive talent, would result in many brilliant discoveries. Who will doubt,that if a Tyndall and a Matthiessen had spent their lives in researches on alloys, metallurgic science would have received an immense impulse from their labors?

Should some man of wealth wish to secure a lasting fame, as well as to confer an inestimable benefit upon mankind at large, we know of no way in which he could more certainly secure both objects than by founding an institution of the kind we have suggested. The examination of so large a number of substances as would be produced in such an extended course of experiment would necessitate new standards of comparison from which to tabulate the qualities of hardness, ductility, tenacity, etc., and more accurate and philosophical scales by which these qualities can be generally expressed. The construction of such scales, and the invention of improved methods of testing, so that the work might proceed with facility, do not appear to present special difficulties.

BUTTER AND ITS ADULTERATIONS.

There is perhaps no other country in the world where butter is made so staple an article of food as in the United States. Bread is rarely eaten by Yankees without the accompaniment of butter or what purports to be butter. There is reason to believe, however, that a very large proportion of what is sold in our markets under this name, is, to say the least, open to suspicion.

The pound of butter to the quart of milk swindle, in which a vile mixture of caseine, semi-saponified butter, and water was represented as butter, seems to have subsided; but there are more ways of sophisticating butter than one, and, as rogues always learn the tricks of trade before honest men, it may be well to let consumers into their secrets.

Pure butter is a fatty substance of rather a complex nature, extracted from the milk globules. In this country, very little butter is sold without being previously salted; the salting being performed in the dairy at the time the butter is made. Salt, therefore, can hardly be considered as an adulteration, unless it is present in excess. Most butter also contains more or less buttermilk retained mechanically. This can generally be seen without the microscope; but the use of a magnifying glass will show that no specimen of butter in market is wholly free from it. When present in an undue degree it greatly impairs the keeping quality of the butter.

Butter is adulterated by water, silicate of soda, or "water glass," tallow, lard, and starch, and various coloring matters, as anotta, pulp of carrots, etc.

Water is held in it, suspended by the addition of mucilaginous substances, as starch, etc. It may be detected by placing a given weight of butter in a flask, and suspending the flask in boiling water. The water surrounding the flask should be kept boiling for eight or ten hours, at the end of which time the water contained in the butter will have evaporated, and the loss in weight will be that due to its admixture.

To determine the presence of silicate of soda, an ounce of butter must be burned in a crucible, a little at a time. When the ash has assumed a white color, it must be removed from the fire. As soon as the crucible is cool a drachm of hydrochloric (muriatic) acid must be poured upon the ash. Evaporate to dryness, scrape out the mass into a glass beaker, and add a gill of boiling water. If silica is present an undissolved residue will remain in the bottom of the glass. To prove that this is silica will require further tests, but the probabilities that the substance undissolved is silica are so great that further tests will be in general unnecessary.

Tallow and lard may be detected by the microscope, and by chemical tests, but they may ordinarily be detected by the smell when the butter is burned.

Starch may also be detected by the microscope, and excess of salt by the taste. The amount of salt and of water that ought to be present may be estimated by performing the above assays with butter of standard good quality.

The most common adulterations of butter in American markets are lard and tallow. Out of several specimens of low priced butter purchased at random, we have found lard in four and tallow in one; the others seemed to have been butter of ordinary purity deteriorated by long keeping.

HOW FIRE BRICKS ARE MADE.

We desire to call attention to an article entitled, "The Manufacture of Fire Bricks," published in another column. In response to our request, Mr. Alfred Hall, Ex-Mayor of Perth Amboy, N. J., and the head of the firm of A. Hall & Sons, Perth Amboy, and Hall & Sons, Buffalo, N. Y., extensive fire brick manufacturers, has furnished us with the practical details of the art. Books have been written which deal with this subject theoretically, and to some extent practically; but it is well known that all the book knowledge attainable has not availed to save from utter failure many who have entered upon the business in this country. The description of the process will be found of great interest, both from the facts given and its graphic character.

THE WIND MONTH.

The month of March, the most windy, disagreeable, and trying to health of all the months in the year, has been this year more than ordinarily prolific of raw and unpleasant weather. Few people have been so fortunate as to avoid taking cold. Pocket handkerchiefs are in demand, and cough remedies are having a large sale.

The colds acquired in March are, however, generally carried through the month of April, and are very liable to receive additions during the subsequent fickle weather of spring. But the fickle weather is not all to blame; personal carelessness increases the peril. Untimely neglect to wear the accustomed overcoat or overshoes, overheating of apartments, and opening of windows to cool down overheated rooms, will all combine to aid the weather in disseminating colds, coughs, and catarrh, with their attendant category of discomforts and dangers.

In our latitude, March nearly always over-laps April, and even May is not entirely free from bitter blasts, and raw, damp air, extremely favorable to the development of influenza.

The prevention of these unwelcome affections cannot be accomplished by attention to dress, and temperature of apartments alone. Whatever may be the ultimate cause of colds, it is quite certain that the state of the skin has much to do with exemption from them. If the skin be healthy, and the performance of its functions be consequently perfect, a cold can scarcely be possible. On the contrary, if the skin be relaxed, and incapable of reacting from the influence of a chill, a cold is almost an absolute certainty, even in the mildest weather.

A healthy state of the skin can only be maintained under the avoidance of all excesses of whatever nature they may be; but the particular excess most common and most likely to produce derangement in this respect, is over-eating, and indulgence in too rich and hearty food, with copious drink, whereby the excretory function of the skin becomes overtaxed, and congestion of the mucous membrane results.

Then commences a series of ails, which together consitute what is known as the symptoms of a cold. The nose becomes stopped by the thickening of its lining membranes. The throat becomes inflamed and often ulcerates. Decayed teeth begin to remind the sufferer of the dentist. The eyes sympathize with the other organs involved, and weep anything but tears of joy. Congestion of the lungs often accompanies the other symptoms, and is in itself often very dangerous, especially with old people.

While a too rich and copious diet ought to be avoided during spring weather, the tone of the skin may be increased by a cold sponge bath taken every morning. This bath should not occupy more than a minute and a half, and should be followed by brisk rubbing with a towel until the skin assumes a roseate hue, and a genial warmth pervades the whole body. By this process the skin becomes accustomed to changes of temperature, and gradually gains power to react against them.

Another practice which we know from long practice and experience to be an admirable prophylactic against colds, is wetting the head and the back of the neck on rising in the morning with cold water. Those unaccustomed to practice this must begin it sparingly at first; but the dose may be prolonged after a while, and will be found to be agreeable and refreshing rather than otherwise. As a prevention of what is popularly called "cold in the head," we believe it to be the best in use, and it has the sanction of high medical authority.

There is, perhaps, no climate on the face of the earth more subject to sudden and perverse changes than that of central New York and the New England States. In all this region diseases having their origin in colds are prevalent. But if people would realize the full force of the proverb "an ounce of prevention is worth a pound of cure," death and the doctors might have something less to do, while the superior advantages of our temperate climate in other respects would go far to compensate for the little time and trouble necessary to purchase almost total immunity from its greatest discomfort.

ECONOMY IN THE USE OF TIME.

The importance of economizing time is an exceedingly trite subject, yet it may well be doubted whether those who moralize most upon it, really know what they mean by it. The expression has become one of those cant phrases, with which the ears of youth and age are perfectly familiar, yet which has attached to it only the vague idea, that not to be engaged in something which will be recognized by all as a useful occupation, is a sinful waste of time.

But all do not recognize recreation as needful; while there are some, among whom we count, who see that even a useful occupation may involve a grievous and sinful waste of time. Perhaps in no other particular are people so penny wise and pound foolish, as in the employment of time.

One individual engaged in business, gets worn out, dyspeptic, and nervous; a month's relaxation would restore his

health; yet rather than give himself the needful rest, he takes the risk of years of suffering and inability.

Another in the mistaken idea that he is economical, blacks his own boots, and occupies time in other comparatively profitless occupations, when his time may be worth twenty times as much in his regular calling.

Another, the one whom moralists unite in condemning—the standard type of the idle man—squanders all his time on frivolous things; yet he is the only consistent man of the lot. He makes no pretense of economy, he makes idleness a profession. True economy in the use of time consists in getting as large a return as possible for its expenditure. The man who ruins his eyes by reading in railroad cars, under the mistaken idea that he is economizing time, is not getting the largest return possible for the use of that time. Good vision in advancing age, is worth more than all the information thus obtained.

The student who spends a couple of hours a day with his skates, or oars, or football, is probably earning more in his recreation, than in any similar period of time spent in study. The man who by a hearty frolic with his children in the morning before he starts to his work, gets good humor for the day, earns as much in his play as he does in his work.

The man who does any kind of work, when he might do other work which would pay better, wastes time. One of the most economical men in the employment of time, we know, is Captain Ericsson. He fully recognizes the truth we have just enunciated. All work which he can avoid is performed by subordinates, and yet he wastes not a minute of his own time. It is thus that he has accomplished so much.

The point we would wish to make is, that men may waste time as well in work as in play, and economize it as well in play as in work, provided the latter is not indulged in inordinately and unreasonably.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections for the month of February, 1870:

During the month, 385 visits of inspection have been made; 698 boilers examined, 650 externally and 123 internally; while 63 have been tested by hydraulic pressure. The number of defects in all discovered, 190; of which 35 were dangerous. These defects in detail are as follows:

Furnaces out of shape, 9; fractures in all, 13—3 dangerous; burned plates, 17—3 dangerous; blistered plates, 30—1 dangerous; cases of incrustation and scale, 36—8 dangerous; cases of external corrosion, 26—2 dangerous; cases of internal grooving, 4; water gages out of order, 5; blow-out apparatus out of order, 7—3 dangerous; safety valves overloaded 10—3 dangerous; pressure gages out of order, 36—4 dangerous. These gages varied from—10 to + 30. Broken braces and rivets, 4—1 dangerous; corrosion of tubes, 2—1 dangerous; stop valves between boiler and safety valves, 2—2 dangerous; fire line of furnace above water line, 4—4 dangerous. And one inspector reports: "Engineer dead drunk while on duty, 1—1 dangerous."

To show how careless some are who call themselves engineers, can be, we mention the two following cases of inoperative safety valves. The inspector for the district writes: "In the first case I found a joist used to support a large tank, resting on the end of the safety valve, leaving the valve entirely inoperative." In the second case: "I found the engineer (?) had placed a piece of board between the end of the safety valve lever and beams overhead to prevent the disagreeable (and to him annoying) hissing the valve made when steam raised to blowing-off point."

This boiler is situated under, and in the center of a manufactory where a large number of persons are employed; and we will say further, that both of these boilers had been under the supervision of an inspector appointed by law. Two instances have been found where there were stop valves between the safety valve and boiler. This pernicious practice is altogether too common. We are unable to understand how a boiler maker of reputation can be guilty of it. A disastrous explosion occurred a few weeks since, where a boiler was provided with this dangerous appliance.

Both the boilers mentioned above had been supervised by an inspector appointed by law. Neglect to remove deposit from fire surfaces and water legs, has necessitated the renewing of plates. This expense might have been saved by timely care and attention. Dangerous points in boilers can only be found by the most careful and rigid examination. The hydraulic test, merely, will not discover the defects enumerated above.

Glass Cutting.

There has, says *Morgan's British Trade Journal*, been a very laudable desire of late, by many glass manufacturers, to make glass so beautiful in its finish when it leaves the hands of the glass blower, as not to require any ornamentation afterwards. But the great demand is for cut glass, especially for table use. This cutting, or, if the term may be allowed, sculptured glass, is effected as an after process, and is a separate and distinct business from glass-blowing. In the glass-cutting room there are, in most manufactories, from forty to seventy workmen. Each man has in front of him a revolving wheel, first of iron, then of stone, then of wood. The iron wheel is for the first process, in which the forming of patterns or figures upon the plain surface of the glass is effected. The stone is for cutting off the rough surface left by the iron, and the wood for polishing to a brilliant luster. Supposing a certain pattern is designed, the workman etches it on the body of the article which is to be cut. He then holds his glass to the edge of the iron wheel, changes his hands to all the positions required for the form he wants, until the whole surface is covered, and the pattern is indented in the article. To prevent fracture from friction, as well as to accelerate the process, sand and water is allowed slowly to drop on the wheel from a wooden vessel hanging over it. Thus is the glass kept at a proper temperature. Sometimes the wheel will of necessity have to be changed to suit the character of the work, many sizes being used for the purpose. The edge of the wheel is that part by which the cutting is effected, and different shapes and thicknesses are given to the edges, in order to produce different results. The stone wheel then passes over these indentations, with water dropping upon it, giving it a semi or half polish. Run the wooden wheel with pumice stone emery continually used on its surface, until the pattern is thoroughly brilliant. The object to be attained in cutting glass is to present such a surface to the rays of light that instead of their passing directly through the glass, they may be broken or refracted, so that there may be a "play of light," as it may be termed, upon its surface. To effect this, it is necessary that the lines forming the figure or pattern upon the exterior of the glass be the reverse of the line of the interior, and that the indentations upon the surface, as well as the projections left by them, be such as to form angles. In the cutting called diamond or prism cutting, this object is at once attained. The same effect is also produced by fluting or flat cutting; because whenever two flat cuttings meet at the edge, they form an angle, forming with the line of the interior an imperfect prism. The broader the flat cuts are, the more acute the angle, and consequently the greater the refraction of light. As these flat cuts are always made with the cutter's wheel upon a circular surface, the broader the flats the more expensive they will be.

The same theory holds good of all lapidary or flat cutting upon solid glass; that is, when the cutting is all over the surface. To produce the requisite effect, it is essential that whatever the patterns, flats must be opposite angles. It is by due attention to this that the refraction so necessary to luster and chandelier work is obtained.

When two or more colors are seen in the same article, it is because the glass cutter cuts off the skin of ruby or blue which has been put on by the glass blower; these edges of ruby produce a most beautiful effect by contrast with the flint glass beneath it.

In addition to the cut surfaces of glass vessels whereby such a lustrous play of colors is produced, there are others engraved, which is a more delicate process of cutting than that we have described. The glass engraver, seated at a bench, has before him a lathe; he has at hand a series of small metallic disks or wheels, generally made of copper, and varying from an eighth of an inch to two inches in diameter. He attaches one of those to his lathe, and keeps it in constant rotation, as in the case of glass cutting, either by steam power or by the action of the foot. He touches the edge of the rotating wheel constantly with a little emery moistened with oil, and then holds the glass against the edge of his wheel, by which the desired effect is produced. By dexterous changes in the position of the glass and in the different forms and sizes of his wheels employed, he combines the delicate indentations so as to produce beautiful intaglios or sunken pictures; our opinion of this delicate process is that it is strictly a branch of the "Fine Arts," and places the glass engraver on a different level to the other workmen. Taste, both natural and cultivated, and a knowledge of the external forms of natural objects, and great delicacy both of eye and hand, are all required in this operation, and it says much for the artisans of this beautiful calling, that they were quite equal to all foreign competitors in the Paris Exhibition. Such operations as glass cutting and engraving afford an ample field for the display of art knowledge and design. The reader may, perhaps, form some conception of the high artistic finish of engraving upon glass, when we inform him that one shallow dish in the English department of the Paris Exhibition, only 7 in. across, was valued at 300 guineas.

Another kind of ornamental manufacture is what is termed the crystallo-ceramic, or glass incrustation. It consists of an opaque substance, embedded in a mass of colorless glass. A medallion or bas-relief, representing any device whatever, is molded in a peculiar kind of clay capable of resisting the heat of melted glass. The medallion is inclosed between the two pieces of soft glass in their melted state; the main difficulty of this process consists in so placing the medallion that all the air bubbles shall be excluded. The glass in its molten state is dropped upon the surface of the medallion with such skill and cleverness, that when annealed and polished by the glass cutter, its appearance is singularly chaste and beautiful, for the white clay seen within the clean and highly-refractive glass presents an appearance nearly resembling that of unburnished silver. This process of art, *i. e.*, incrustation of clay devices, was invented about seventy-three years ago by a Bohemian. At a later period some French manufacturers invented medallions of Napoleon in this way, which sold at enormous prices; but since the introduction into England under an improved form, a wide extension has been given to its applicability. This incrustation may be painted in metallic colors which will remain uninjured by the heat required in the process.

PROTECTION OF LEAD WATER PIPES.—Dr. Schwarz, of Breslau, notes a simple method of protecting lead pipes from the action of water, by forming on the inside surface of the pipes an insoluble sulphide of lead. The operation, which is a very simple one, consists in filling the pipes with a warm and concentrated solution of sulphide of potassium or sodium; the solution is left in contact with the lead for about fifteen minutes.

U. S. Patent Office.

How to Obtain Letters Patent FOR NEW INVENTIONS.

Information about Caveats, Extensions, Interferences, Designs, Trade Marks; also, Foreign Patents.

For a period of nearly twenty-five years, MUNN & CO. have occupied the position of leading Solicitors of American and European Patents, and during this extended experience of nearly a quarter of a century, they have examined not less than fifty thousand alleged new inventions, and have prosecuted upward of thirty thousand applications for patents, and, in addition to this, they have made, at the Patent Office, over twenty thousand preliminary examinations into the novelty of inventions, with a careful report on the same.

The important advantages of MUNN & CO.'S Agency are, that their practice has been ten-fold greater than that of any other Agency in existence, with the additional advantage of having the assistance of the best professional skill in every department, and a Branch Office at Washington, which watches and supervises, when necessary, cases as they pass through official examination.

CONSULTATIONS AND OPINIONS FREE.

Those who have made inventions and desire a consultation are cordially invited to advise with MUNN & CO. who will be happy to see them in person at the office, or to advise them by letter. In all cases, they may expect an HONEST OPINION. For such consultations, opinion, and advice, NO CHARGE is made. A pen-and-ink sketch and a description of the invention should be sent.

TO APPLY FOR A PATENT,

A model must be furnished, not over a foot in any dimension. Send model to MUNN & CO., 37 Park Row, New York, by express, charges paid, also, a description of the improvement, and remit $16 to cover first Government fee, and revenue and postage stamps.

The model should be neatly made, of any suitable materials, strongly fastened, without glue, and neatly painted. The name of the inventor should be engraved or painted upon it. When the invention consists of an improvement upon some other machine, a full working model of the whole machine will not be necessary. But the model must be sufficiently perfect to show with clearness the nature and operation of the improvement.

PRELIMINARY EXAMINATION

Is made into the patentability of an invention by persons search at the Patent Office, among the models of the patents pertaining to the class to which the improvement relates. For this special search, and a report in writing, a fee of $5 is charged. This search is made by a corps of examiner of long experience.

Inventors who employ us are not required to incur the cost of a preliminary examination. But it is advised in doubtful cases.

COST OF APPLICATIONS.

When the model is received, and first Government fee paid, the drawings and specification are carefully prepared and forwarded to the applicant for his signature and oath, at which time the agency fee is called for. This fee is generally not over $25. The cases are exceptionally complex if a higher fee than $25 is called for, and, upon the return of the papers, they are filed at the Patent Office to await Official examination. If the case should be rejected for any cause, or objections made to a claim, the reasons are inquired into and communicated to the applicant, with sketches and explanations of the references; and should it appear that the reasons given are insufficient, the claims are prosecuted immediately, and the rejection set aside, and usually

Without Extra Charge to the Applicant.

MUNN & CO. are determined to place within the reach of those who confide to them their business, the best facilities and the highest professional skill and experience.

The only cases of this character, in which MUNN & CO. expect an extra fee, are those wherein appeals are taken from the decision of the Examiner after a second rejection; and MUNN & CO. wish to state very distinctly, that they have but few cases which can not be settled without the necessity of an appeal; and before an appeal is taken, in any case, the applicant is fully advised of all facts and charges, and no proceedings are had without his sanction; so that all inventors who employ MUNN & CO. know in advance what their applications and patents are to cost.

MUNN & CO. make no charge for prosecuting the rejected claims of their own clients before the Examiners and when their patents are granted, the invention is noticed editorially in the SCIENTIFIC AMERICAN.

REJECTED CASES.

MUNN & CO. give very special attention to the examination and prosecution of rejected cases filed by inventors and other attorneys. In such cases a fee of $5 is required for special examination and report, and in case of probable success by further prosecution, and the papers are found tolerably well prepared, MUNN & CO. will take up the case and endeavor to get it through for a reasonable fee, to be agreed upon in advance of prosecution

CAVEATS

Are desirable if an inventor is not fully prepared to apply for a Patent. A Caveat affords protection, for one year, against the issue of a patent to another for the same invention. Caveat papers should be carefully prepared.

The Government fee on filing a Caveat is $10, and MUNN & CO.'s charges for preparing the necessary papers are usually from $10 to $12.

REISSUES,

A patent when discovered to be defective, may be reissued by the surrender of the original patent, and the filing of amended papers. This proceeding should be taken with great care.

DESIGNS, TRADE MARKS, AND COMPOSITIONS

Can be patented for a term of years, also, new medicines or medical compounds, and useful mixtures of all kinds. When the invention consists of a medicine or compound, or a new article of manufacture, or a new composition, samples of the article must be furnished, neatly put up. Also, send a full statement of the ingredients, proportions, mode of preparation, uses, and merits.

PATENTS CAN BE EXTENDED.

All patents issued prior to 1861, and now in force, may be extended for a period of seven years upon the presentation of proper testimony. The extended term of a patent is frequently of much greater value than the first term; but an application for an extension, to be successful, must be carefully prepared. MUNN & CO. have had a large experience in obtaining extensions, and are prepared to give reliable advice.

INTERFERENCES

Between pending applications before the Commissioners are managed and testimony taken; also, Assignments, Agreements, and Licenses prepared. In fact, there is no branch of the Patent Business which MUNN & CO. are not fully prepared to undertake and manage with fidelity and dispatch.

FOREIGN PATENTS.

American inventors should bear in mind that five Patents—American, English, French, Belgian, and Prussian—will secure an inventor exclusive monopoly to his discovery among ONE HUNDRED AND THIRTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such, that patents can be obtained abroad by our citizens almost as easily as at home. MUNN & CO. have prepared and taken a larger number of European Patents than any other American Agency. They have Agents of great experience in London, Paris, Berlin, and other Capitals.

A Pamphlet, containing a synopsis of the Foreign Patent Laws, sent free.

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

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Published in the United States may be found on file at the Advertising Agency of G. P. Rowell & Co. No. 40, Park Row, New York.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line.

Peck's patent drop press. For circulars, address the sole manufacturers, Milo Peck & Co., New Haven, Ct.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

For Sale.—One Stave Planer, at a bargain. Apply to Hartmann, Laist & Co., Cincinnati, Ohio.

The Tennessee Manufacturing Co., Nashville, Tenn., wish to contract for water, gas, and steam piping for a large cotton mill. Address S. D. Morgan, Pres't T. M. Co.

The Pew Hat Rack.—E. S. Blake, Pittsburgh, Pa.

The Pedespeed, patented May 4, 1869, is adapted to Ladies' use by an elastic band at top of stirrup, conforming, without a buckle, to its place. Send stamp for price list. Thos. L. Luders, Olney, Ill.

For description of the best lath and blind slat sawing machine in use, address W. B. Noyes, Gen'l Ag't, P. O. Box 558, Manchester, N. H.

Belting.—See advertisement of Page Brothers on page 230.

Wanted.—Address of parties making Grain Dryers, prices, etc., by Wm. Benjes, Memphis, Tenn.

Lumbermen and Manufacturers. See adv't of Pat. Metallic Elevator Belting for conveying sawdust, etc., in No. 10 Scientific American, March 5. It is just what you want. Send for circulars to W. P. Powers, North La Crosse, Wis.

Thomas & Robinson, manufacturers of presses and dies for fruit cans, etc., No. 222 West 2d st., Cincinnati, Ohio.

Machines for manufacturing Screw Bolts and Nuts of all kinds. Makers will please send price lists and other information to C. G. Berryman, Saint John, N. B.

Henry Clark, Pawtucket, R.I. Instruction in spelling by mail.

J. Carter, Warsaw, Ind., wants to know where the Requa concave lamp chimneys are manufactured.

Builders of Water Wheels address Berry & Place, San Francisco, Cal.

Eagle Carpet Stretcher.—Manufacturers desiring to engage in a new article destined to supersede all others in its line, are referred to an advertisement on another page, of a new carpet stretcher. It weighs but 2½ lbs., is cheaply made, and is the most effective stretcher out.

Get your models and experimental machinery made, and your patent articles manufactured at the New York Model and Experimental Machine Works, 125 Eldridge st., New York.

H. Franke's Pat. Gravel Heater.—Address Pioneer Iron Works, Conover st., Brooklyn, N. Y.

Important advance on the draft and easement of carriage. See Jackson's Patent Oscillating Wagon, with tests of draft, models, etc., No. 149 High st., Newark, Essex Co., N. J. See Scientific American, Sept. 25, 1869.

The "Anti-Friction" Lever Horse Power, for from one to eight horses, is the best for driving every kind of farm or factory machinery. Send stamp for circular to R. H. Allen & Co., Postoffice Box 376, N. Y.

Our Catalogue of Agricultural and Horticultural Implements, Machines, and Tools (300 pages, 600 illustrations) is sent, postpaid, for $1. This is refunded on receipt of first order. Every manufacturer or dealer should have a copy. R. H. Allen & Co., Postoffice Box 376, New York.

Photographs.—Rockwood & Co., 839 Broadway, for five dollars, make 8x10 photographs of machinery or views within the city.

Machinery Wanted.—Good Calender Mills, suitable for working India-rubber. Address (stating description and prices), Postoffice Box 2213, Boston, Mass.

A "Wood & Light" Patent Shafting Lathe, 28-in. swing, 25ft. bed, used 3 mos., at a sacrifice. E. P. Hampson, 38 Courtlandt st., N. Y.

An experienced master mechanic and draftsman desires an engagement. References unquestionable. Address Postoffice drawer 370 Watertown, N. Y.

1250 lbs. portable platform scales, $25; hay scales, 4-ton, $75. Send for free price list, No. 373. Edward F. Jones, Binghamton, N. Y.

American Boiler Powder.—A safe, sure, and cheap remedy for scale. Send for circular to Am. B. P. Co., P. O. Box 315, Pittsburgh, Pa.

Right For Sale.—Action and Reversion Water Wheel (self-governing). Will vent large or small volumes of water. Will retain its power under back water. Address William E. Hill, Erie, Pa.

Kidder's Pastilles.—A sure relief for Asthma. Price 40 cents by mail. Stowell & Co., Charlestown, Mass.

Needles for all sewing machines at Bartlett's, 569 Broadway, N. Y.

Pat. paper for buildings, inside & out, C. J. Fay, Camden, N. J.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For first-quality new 14, 17, and 20-in. screw lathes, milling machines, and one-spindle drills, at small advance from cost, apply to Geo. S. Lincoln & Co., Hartford, Conn.

Hackle, Gill Pins, etc., at Bartlett's, 569 Broadway, New York.

Perforated Zinc and Sheet Iron for separators, smut machines grain dryers, tubular wells, malt kilns, etc. R. Aitchison & Co., Chicago

T. F. Randolph, Steam Model Works, Cincinnati, Ohio.

Portable Pumping or Hoisting Machinery to Hire for Coffer Dams, Wells, Sewers, etc. Wm. D. Andrews & Bro., 414 Water st., N. Y.

Keuffel & Esser, 71 Nassau st., N. Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Two 60-Horse Locomotive Boilers, used 5 mos., $1,300 each. The machinery of two 500-ton iron propellers, in good order, for sale by Wm. D. Andrews & Bro., 414 Water st., New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

S. S., of N. J., asks our advice about his plan to burn the stumps off his land. He proposes to build a concave mirror 4 feet in diameter, of plaster and wood, faced with tin foil, the focus to be 10 feet or more. He asks if this plan of the great Archimedes for firing the enemy's ships, would be patentable if applied to burning stumps. We think it doubtful as to a patent on the application of the reflector to the stump; but probably the construction of the reflector might be claimed. When the sun shines probably the machine could produce the fire. But we will tell our correspondent a better plan. Bore a hole into the stump, fill it with coal oil, plug, and leave standing for 30 days. The oil will penetrate the wood, and when set on fire will burn until the stump is consumed—so we are told. We have not tried it.

B. A. R., of Tenn.—Undue weight in proportion to power obtained is one principal defect in the application of caloric engines to the propulsion of vessels. A one half inch wire cable, made of good material, may be relied upon to withstand a tensile force of at least 12,800 pounds. The buoyancy of all substances, whether solid, fluid, or gaseous, is reduced by compression. Your fifth query cannot be answered without the performance of experiments which, so far as we know, have never been performed. Alcohol expands much more for the same temperature than spirits of turpentine.

P. J., of Mass.—The molten iron enters the Bessemer converters at 2 800° to 3,000° Fah., and the heat to which it rises on the admission of the blast, has been estimated to be as high as 5,000°. It is probably as high a degree of heat as ever attained by artificial means, except that obtained by the oxyhydrogen blow-pipe, and the electric light. The latter is probably an example of the greatest artificial heat. You will find the subject of pyrometers fully treated in recent works on physics. We cannot now enter upon the discussion of that subject.

B. F. D., of N. Y.—"*Lap*" is an addition to either the outer or inner edge of the valve, for purposes of cut off, and exhaust closure. "*Lead*" is a motion of the valve, in advance of the crank, obtained by setting the eccentric at an angular advance from the position in which it would open the valve at the end of the full stroke of the piston. Lead opens the valve a little before the end of the stroke, admitting steam against the advancing piston, and taking up the momentum of the parts.

S. H. K., of Minn.—A body placed in the interior of a hollow sphere, and uninfluenced by any attraction other than that of the shell, will remain at rest in any part of the void. A body freely moving in a fluid sphere, and with a specific gravity greater than that of the fluid, will move to the center of gravity of that sphere. If of the same specific gravity, a body will remain in any portion of the fluid sphere.

C. J. P., of Ky.—The brass alluded to in the recipe for silver solder is the most common variety—2 parts copper and 1 of zinc. This correspondent states that an application of benzine is quite as effective as acid in restoring old files, and does less injury. The action of benzine can, however, be only to clean the file from dirt. The action of acid is claimed to sharpen the teeth, and deepen the cuts.

W. S., of N. Y.—To remove zinc and iron from plumbers' solder, digest the fragments in dilute sulphuric acid. The acid will dissolve the particles of zinc first, the iron, next, and all traces of these metals will be removed by subsequent washing. The solder will not be materially affected by the acid, if the vessel be kept cool. Organic matter will be burned out in melting the solder.

R. B., of Mass.—You can color castings of lead, tin, and antimony blue, by shellac varnish colored with prussian blue. You should use the best and purest shellac, and should mix thoroughly. By putting on a sufficient number of coats, you can polish the surface, and make a very handsome finish. Common lacquer will give such castings the appearance of copper or brass.

J. M. F., of N. Y.—Our opinion is that hemlock knots are harder than lignum vitæ. We have also seen specimens of locust wood as hard as any lignum vitæ we ever saw. We know of no way by which an inexperienced person can distinguish the hard lignum vitæ from the soft, except by trial, until he becomes familiar with the appearance of the different qualities.

A. G., of N. Y.—A bar of inch and a quarter steel nine feet in length, bent into a triangle in the usual way, will sound sufficiently loud to be heard ¼ of a mile in the absence of other sounds which would obscure it. It should, however, be struck with either a bar of copper, or some very hard wood, as it is liable to break if struck with harder substances.

A. M. C., of Ohio.—The attractions of the positive and negative poles of magnets of equal power, exactly neutralize each other. At any point between each pair of positive poles on the wheel you propose, the repulsion of similar poles would exactly equal the attraction of the dissimilar poles, and no motion would therefore be produced.

R. S., of Mich.—To coat glass with gold, add to a solution of chloride of gold an equal quantity of sulphuric ether. The gold will leave the acid and be taken up by the spirit. Separate and flood the glass with ether, which will evaporate and leave a fine deposit of the metal; rinse in clean water, and either burnish or varnish.

J. D., of Vt.—You will find your query answered in the one to W. S., of N. Y., above, and a rule for the computation of dimensions of safety valve for bridge walls of boilers on page 146 current volume of the Scientific American.

J. R., of La.—Pulleys take their names from the planes in which they revolve. If they revolve in vertical planes, they are vertical pulleys. If in horizontal planes, they are horizontal pulleys.

G. D., of N. Y.—There is no difficulty in melting and casting brass on a small scale. The "Brass and Iron Founder's Guide," published by Henry Carey Baird, Philadelphia, contains practical details.

T. J. H., of Ohio, and others.—We do not know of any electric machinery that we can recommend to you for the purpose of driving small machinery. The number you want has been sent.

J. A., of N. J.—Glue will remain hard and insoluble under naphtha. Should you state the purpose for which you wish the cement, we could answer more definitely.

J. H. P., of N. Y., wishes to know what is the rule for estimating the weight of hay in the mow.

J. R., of Pa.—The stone you send appears to be a conglomerate, showing some iron ores.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Roofing Compound.—Thomas E. Wood, Waseca, Minn.—This invention has for its object to furnish an improved compound to be used upon or in connection with the inventor's elastic roofing (patented September 29, 1868, and numbered 82,567), upon roofs and walks, to preserve it from being injured by the heat or frost, and keep it permanently elastic by preventing the evaporation of its gases.

Churn Dash Crank Fixtures.—C. Blust and M. Harbster, Lucas, Ohio.—This invention has for its object to improve the construction of the crank and other fixtures by means of which a horizontal churn dasher is operated, so as to simplify their construction, and at the same time to enable the dasher to be easily operated, and conveniently removed from the churn body when required.

Vegetable Grater.—John Maxson and Warren Kinyon, Scott, N. Y.—This invention has for its object to furnish an improved machine designed especially for grating carrots for coloring butter, but which may be used with equal advantage for grating other kinds of vegetables.

Electro-Plating Apparatus.—Howell W. Wright, Taunton, Mass.—This invention has for its object to furnish an improved apparatus for use in electro-plating tacks, nails, screws, and other small articles with copper, or other metal, which will enable the said articles to be quickly, conveniently, and thoroughly plated in any desired quantity.

Steam Generator and Water Heater.—Orlando Clarke, Rockford, Ill.—This invention relates to a new and useful improvement in a boiler for generating steam or heating water, to be used for all the purposes to which it is adapted, wherein the maximum of steam generating or fire surface, is combined with the minimum of space and metal.

Rubber Connections for Mosquito Net Frames.—U. W. Armstrong and Ira Keeney, Evansville, Ind.—This invention has for its object to furnish improved means for connecting the upright and horizontal bars of a mosquito net frame to each other, which shall be simple in construction, and will enable the frame to be easily put up and taken down when required.

Beehive.—John M. Price, Buffalo Grove, Iowa.—This invention relates to improvements in beehives, and consists in a hive made of sections consisting of four slats or bars, attached at the corners in rectangular form, two of which are wider than the others, and provided at the inside with slots for the comb bars, the said sections being confined in a rack, or casket, and laid on a platform having a deep angular groove, in which the hive is laid on one corner, and may be turned from time to time, as may be required. The hive so constructed is designed to be wrapped in cold weather with canvas, and the whole is inclosed in an exterior case.

Forge.—George Campbell, North Buffalo, N. Y.—This invention relates to improvements in blacksmiths' forges, having for its object to provide an improved arrangement of means whereby the supporting frame of a portable forge may be readily transferred from the wheels on which it is moved to the ground, and *vice versa*; also, certain improvements in the tweers, irons, and valves for varying the position and form of the fire.

Footstool for Churches, Lecture Rooms, etc.—William G. Brown, Monmouth, Me.—The object of this invention is to construct a footstool, which may be applied to the seats and pews of lecture rooms, churches, etc., and which cannot be upset, and can be brought forward or moved out of the way without noise and difficulty.

Churn.—N. A. Prentiss, Talleyrand, Iowa.—This invention has for its object to furnish an improved churn, simple in construction and effective in operation, doing its work quickly and well.

Gun Slide and Carriage.—John Ericsson, New York city.—This invention was described, and illustrated in No. 8 of the Scientific American, current volume.

Device for Applying and Retaining Sash Pulleys.—Melvin R. Green, Warwick, N. Y.—This invention has for its object to facilitate the attachment of sash pulleys to the window frames and to simplify the construction of the device by which such pulleys are held in place.

Skate.—Jacob Friedrich Schneider, Brooklyn, N. Y.—This invention has for its object to so construct a skate that it may be used by beginners, also by experts, like an ordinary skate. The invention consists in making the back part of the runner of two pivoted pieces, which may be swung apart on their pivots to form a V-shaped broad support, and which, when brought together, will form a simple ordinary runner.

Tinners' and Sheet-iron Workers' Rolls.—A. W. Whitney, P. A. Whitney, and F. A. Whitney, Woodstock, Vt.—This invention relates to a new and useful improvement in the construction of rollers for tinners' machines for working tin and sheet iron, or other sheet metal, whereby such rolls are rendered more durable than they have hitherto been, while the cost of manufacturing them is greatly reduced.

Machine for Pressing and Graining Powder.—Paul A. Oliver, New York city.—This invention relates to a new and useful machine for facilitating the manfacture of gun and blasting powder, and consists in a new and improved method of pressing the material into sheets and in cutting the sheets into grains.

Ash Sifter.—Robert Jacob Schaffer Thompson, Washington, Pa.—This invention relates to a new manner of constructing the perforated bottom of a shovel which is used for sifting ashes; and consists in the application of rods, which are fitted between two sets of corrugated plates.

Stove for Burning Shavings and Fine Fuel.—Orlando Clarke, Rockford, Ill.—This invention relates to a new and useful improvement in stoves for heating purposes, more especially designed for shops where shavings, sawdust, and other light and fine fuel are used.

Steam Protection for Safes, Vaults, etc.—John A. Robertson, Boston, Mass.—This invention relates to the employment of steam as a means of protecting safes, bank vaults, etc., and for giving alarm when they are attacked by burglars, and it consists in covering the safes, vaults, and the like, with coils of pipe or jackets of any kind, to be kept full of steam by connection in any suitable way with steam boilers, at all times when burglars might work upon them, and so arranged that access cannot be had to the safe or vault at any part without cutting away the steam pipe or through the jacket, and allowing the steam to escape, which will prevent further operation by filling the room with an atmosphere of steam in which it would be impossible to work.

Loom.—Alphonse Gouilloud, Barcelona, Spain.—This invention relates to looms for weaving stays and similar unevenly-woven articles, and consists 1st, in a system of pulling temples; 2d, in a system of separate yarn beams and let-off apparatus for varying the delivery as required for weaving articles with gussets and other irregular forms.

Railroad Rail Joint.—John Freeland and Daniel Ward, New York city.—This invention relates to improvements in joining the ends of railroad rails, and consists in an improved combination of chair and fish plates, whereby a cheap arrangement of devices, capable of forming a strong and reliable joint, is produced.

Harvester.—J. B. McCormick, Dayton, Ohio.—This invention has for its object to improve the construction of that class of harvesters in which the binders ride upon the machine, so as to make them of lighter draft and more convenient in use.

Table-leaf Support.—Aaron Anderson, South Bend, Ind.—This invention has for its object to furnish an improved table-leaf support, which shall be simple in construction, effective in operation, and conveniently operated, and which may be attached to any style of table having a falling leaf or leaves.

Horse Hoe.—H. W. Hasslock, Nashville, Tenn.—This invention has for its object to furnish an improved horse hoe for cutting up the grass and weeds about cotton, corn, and other plants planted in hills or drills, and which shall, at the same time, be simple in construction, and effective in operation leaving the soil thoroughly loosened.

PLOW.—D. T. Singleton, Eatonton, Ga.—This invention has for its object to improve the construction of plows so as to make them simpler in construction and more convenient in use.

GANG PLOWS.—Jacob Price, San Leandro, Cal.—This invention has for its object to furnish an improved gang plow which shall be so constructed and arranged that the driver can raise the plows from the ground without having to raise himself at the same time, and so that the "near" wheel may be adjusted at a higher or lower level, according to the depth of the furrows.

PORTABLE HEAD REST.—Elbert P. Cook, Cartersville, Ga.—This invention has for its object to furnish an improved portable extension head rest for travelers, which shall be so constructed that it may be conveniently connected with the back of a seat or chair in any conveyance, and adjusted to support the head so that the traveler can rest and sleep comfortably in his seat while traveling.

COMBINED CORN AND COTTON SEED PLANTER, GUANO DISTRIBUTER, AND HARROW.—Samuel L. Donnell, Humboldt, Tenn.—This invention has for its object to furnish an improved machine for planting corn and cotton seed, and for distributing guano and other fine fertilizers, and which shall at the same time harrow the ridge, open the furrow for the seed, and cover the seed, crushing the clods, and smoothing off the ridge.

APPARATUS FOR PITCHING BARRELS.—Richard Rosochacki, Cleveland, Ohio.—This invention has for its object to remove from beer barrels the pitch lining which is usually added to them for purposes of lightness, when such lining becomes inoperative through age, in order to replacing it with a fresh lining.

SADDLE.—George Horter, New Orleans, La.—This improvement in the construction of side saddles combines three important considerations, viz: durability, cheapness, and beauty of form and finish. The seat of this patent saddle is constructed in the usual manner, the only difference being in the materials of which the skirts are made. The foundation of these is "trunk board," specially prepared, which is covered in a neat and most substantial manner, with either hog skin, enameled leather, or enameled muslin, according to the quality or price. This is protected on the edges by a fore-and-aft "safe" of leather, either patent or plain. Hog skins and patent leather have been used, for years, in the construction of saddles, from the costly English shaftoe to the commoner kinds. The cheapest of these patent saddles, which are covered with enameled muslin, and protected on the edges, as before described, will be very durable, far more so than a buggy top thus covered, as they will not be subject to the same exposure to the sun and rain. Patented March 15th, 1870.

CAST IRON COPING FOR WALLS.—John Grindrod, Albany, N. Y.—This invention relates to improvements in coping for fire and other walls for buildings, and consists in providing coping made of cast iron, the same being arranged in sections, for joining together, and to fit on the walls, to protect the same.

CASTING METAL.—Robert Ross, Middlebury, Vt.—This invention relates to improvements in casting molten metal, whereby it is designed to provide sounder castings than can be made by the present mode. The invention consists in providing traps in the passages through which the molten metal flows when running into the molds, to take out the dirt and all impurities in the metal, which rise to the surface after the molten metal has settled.

APPARATUS FOR PRODUCING DISSOLVED SULPHUROUS ACID.—Moritz Hatschek, Pesth, Hungary.—This invention has for its object to provide an apparatus by which a solution of sulphurous acid may be readily produced, such acid being used for distilling and brewing, and for other useful purposes. The invention consists in the arrangement and construction of a furnace, in which the sulphur is burnt, and a current of air brought to it, and of a detaining chamber and combining column, the latter receiving the water at the upper end, and spreading it into a fine spray, in which state it is most apt to take up the sulphur and the oxygen of the air, while the nitrogen passes off.

TAIL HOLDER FOR HORSES AND OTHER ANIMALS.—F. A. Roberts, North Vassalboro', Me.—This invention has for its object to construct a device by means of which the folds of horses tails can be held together without injuring the hair, and which can be rapidly and conveniently applied. The invention consists in the use of a partly flexible, partly rigid buckle which is strapped around the folds of the tail, and which has teeth or prongs projecting through the tail, to hold the device in place.

CORSET FASTENING.—M. P. Bray, Ansonia, Conn.—This invention relates to a new and useful improvement in the mode of fastening corsets, whereby they are made more elastic and more durable than such fastenings have hitherto been; and it consists in the method of fastening the double spring together, and also in the method of confining the smaller spring to the larger one, and the clasps to the large spring.

TRANSPARENT SIGN.—P. A. La France and J. D. Densmore, Elmira, N. Y.—This invention relates to a new method of constructing openwork signs, with an object of making them more simple, stronger, and more readily adjustable than those now in use.

MOP HEAD.—W. S. Crinklaw, Lanark, Ill.—The object of this invention is to furnish a cheap and durable head for mops, one that is not likely to break or get out of order.

BOILER FURNACES AND FLUES.—W. H. Burns, Unionville, Mo.—The object of this invention is to provide certain improvements in setting and adjusting boilers for generating steam for power in the furnaces, and arranging the flues to promote the draft to the best advantage; also to adapt the furnaces for burning saw dust and other similar waste matter.

GAGE AND STOP COCKS.—J. B. Christoffel, Williamsburgh, N. Y.—This invention has for its object to furnish an improved cock designed for use as a gage cock for steam boilers, and for a stop cock for reservoirs, in which water, oil, or any volatile liquid is contained, and which shall be so constructed as to allow the valve or piston to be repacked without removing the cock or allowing any of the steam or liquid to escape.

NEW BOOKS AND PUBLICATIONS.

THE BOWDOIN SCIENTIFIC REVIEW. Edited by Professors Brackett and Goodale, Bowdoin College, Brunswick, Maine.

We are in receipt of the first two numbers of this periodical, containing digests, translations, and summaries of valuable scientific essays and memoirs. The introduction of diagrams would however materially aid the comprehension of the text. This review will probably be well received, and it encroaches upon none of the departments of physics or natural history now well occupied in this country by other scientific journals.

THE CANADIAN ENTOMOLOGIST. Edited by the Rev. C. J. S. Bethune, M. A., Secretary to the Entomological Society of Canada. Toronto: Copp, Clark & Co., King street East.

This illustrated serial appears to be carefully edited, and it will be found a welcome visitor by students of the delightful branch of natural history to which it is specially devoted. The practical aspect of entomology has also considerable attention bestowed upon it.

SOUTHERN NEWSPAPER ENTERPRISE.—Messrs. Hoe & Co. have just built for the *Mobile Register* one of their fast double-cylinder presses. This journal, the oldest Democratic paper, and, with one exception, the oldest newspaper in the entire South, and well known as John Forsyth's paper, was purchased since the war by Col. W. D. Mann, a live Yankee, who consolidated with it the *Daily Times*, *Advertiser*, and *Evening News*, three cotemporary dailies, and by his energy and skillful management has given it a circulation never reached by a Southern newspaper before. The *Weekly Register* has, in addition to an almost universal circulation in the States tributary to Mobile, a large and rapidly increasing list of subscribers throughout the North and West, where many desire to read some reliable representative Southern journal. It is a very large sheet—twelve pages N. Y. *Herald* size—and is published at the low price of $3·00 per annum. It employs the best talent in the South in its various departments. Col. Forsyth fills the position of Editor-in-Chief. We can commend the *Register* to all who want a first-class Southern newspaper. As an advertising medium, we claim it unequaled in the South.

Official List of Patents.

Issued by the United States Patent Office

FOR THE WEEK ENDING March 22, 1870.

Reported Officially for the Scientific American.

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MUNN & CO.,
Patent Solicitors, No. 37 *Park Row, New York*

100,961.—ELECTRO DEPOSITION OF METALS.—Isaac Adams, Jr., Boston, Mass.
100,962.—PHOTOGRAPHIC SHOW CASE.—J. F. Adams, Buffalo, N. Y.
100,963.—BUCKLE.—Moses Adams, Chilmrak, Mass.
100,964.—WATER METER.—A. W. Almqvist, and F. W. Ofeldt, New York city.
100,965.—TABLE-LEAF SUPPORT.—Aaron Anderson, South Bend, Ind.
100,966.—RUBBER CONNECTION FOR MOSQUITO-NET FRAMES.—U. W. Armstrong and Ira Keeney, Evansville, Ind., assignors to U. W. Armstrong.
100,967.—INSTRUMENT FOR DOSING ANIMALS.—Osborne Barker, Brooklyn, N. Y.
100,968.—BOOT AND SHOE HEELS.—Ferdinand Bliesenick, New York city.
100,969.—CHURN DASHER CRANK FIXTURE.—C. Blust, Lucas, Ohio, and Matthau Harbster, Reading, Pa., assignors to C. Blust.
100,970.—FASTENING FOR CORSETS.—M. P. Bray, Ansonia, Conn.
100,971.—FOOTSTOOL FOR CHURCHES, ETC.—Wm. G. Brown, Monmouth, Me.
100,972.—HAY TEDDER.—J. M. Burdick, Ilion, N. Y.
100,973.—CARRIAGE-WHEEL HUB.—Bradley Burr, Batavia, Ill.
100,974.—CORN-PLANTING ATTACHMENT FOR PLOWS.—J. F. Byland, Walton, Ky.
100,975.—FORGE.—George Campbell, North Buffalo, N. Y. Antedated March 11, 1870.
100,976.—DEADEYE FOR WIRE RIGGING.—D. H. Chamberlain, West Roxbury, Mass.
100,977.—FRICTIONAL GEARING.—D. H. Chamberlain, West Roxbury, Mass.
100,978.—WRENCH.—Luke Chapman, Collinsville, Conn.
100,979.—HOT-AIR FURNACE.—Thomas W. Chatfield, Utica, N. Y.
100,980.—TOILET MIRROR.—George H. Chinnock, New York city.
100,981.—GAGE COCK.—John B. Christoffel, Williamsburgh, N. Y.
100,982.—BASE-BURNING STOVE FOR SHAVINGS AND OTHER LIGHT FUEL.—Orlando Clarke, Rockford, Ill.
100,983.—STEAM GENERATOR.—Orlando Clarke, Rockford, Ill.
100,984.—DIRT GAGE FOR PLOWS.—Joseph Cluckner, Arcadia, Ind.
100,985.—CUFF SUPPORTER.—Thomas Cogswell, Boston, Mass.
100,986.—LOCKING DEVICE FOR TRAPS.—Jasper E. Corning, Rye, N. Y.
100,987.—MOP HEAD.—W. S. Crinklaw, Lanark, Ill.
100,988.—FASTENING FOR STUDS OR BUTTONS.—E. M. Deey, New York city.
100,989.—FLUTING MACHINE.—Edward M. Deey, New York city.
100,990.—COMBINED CORN AND COTTON SEED PLANTER AND GUANO DISTRIBUTER.—S. L. Donnell, Humboldt, Tenn.
100,991.—WASHING MACHINE.—J. T. Dorton and S. G. Eubank, Wellington, Mo.
100,992.—BASE-BURNING PARLOR COOKING STOVE.—W. Doyle, Albany, N. Y.
100,993.—BEDSTEAD FASTENING.—C. H. Fessenden, Candor, N. Y.
100,994.—LEDGER INDEX.—C. A. Fitch, San Francisco, and W. O. St. John, Oakland, Cal.
100,995.—SPOOL CASE.—W. F. Foster, Chicago, Ill.
100,996.—RAILWAY RAIL JOINT.—John Freeland and Daniel Ward, New York city.
100,997.—REMOVING COLORS FROM LEATHER.—E. S. Frye, Salem, Mass.
100,998.—GRAIN DRILL.—J. P. Fulghum, Dublin, Ind., assignor to himself and Davis Lawrence & Co.
100,999.—RAILWAY CAR COUPLING.—Adolph Geiss, Buffalo, N. Y.
101,000.—BASE-BURNING STOVE.—Henry G. Giles, Troy, N. Y.
101,001.—BASE-BURNING STOVE.—Henry G. Giles, Troy, N. Y.
101,002.—STOP VALVE.—L. D. Gilman, Lansingburg, N. Y.
101,003.—RESTORING WASTE ALKALI USED IN OIL REFINERIES.—Wm. Goodaire and Geo. Stead (assignors to O. J. Benham), Cleveland, Ohio.
101,004.—PROPELLING CANAL BOATS.—W. F. Goodwin, Metuchen, N. J.
101,005.—WASHING MACHINE.—William F. Goodwin, Metuchen, N. J.
101,006.—LOOM FOR WEAVING IRREGULAR FABRICS.—Alphonse Gouilloud, Barcelona, Spain.
101,007.—SASH BALANCE.—Mellvin R. Green (assignor to himself, Benjamin T. Clemence, and Grinnell Burt), Warwick, N. Y.
101,008.—BED PLATE FOR RAG OR PAPER ENGINES.—Anthony Hankey (assignor to himself and George A. Corser), Leicester, Mass.
101,009.—EXTRACTING COPPER FROM ITS ORES.—Nathaniel Haskell (assignor to himself and J. F. Steen), San Francisco, Cal.
101,010.—HORSE HOE.—Hermann W. Hasslock, Nashville, Tenn.
101,011.—APPARATUS FOR PRODUCING SULPHUROUS ACID.—Moritz Hatschek, Pesth, Hungary.
101,012.—PROCESS AND APPARATUS FOR TREATING WOOD.—Ira Hayford, Boston, Mass.
101,013.—BOLSTER AND AXLE BED PLATE FOR VEHICLES.—John Henry, Suisun, Cal. Antedated March 1, 1870.
101,014.—WAGON STANDARD.—John Henry, Suisun, Cal. Antedated March 1, 1870.
101,015.—METALLIC BEAM.—Laurence Holms, Paterson, N. J. Antedated March 5, 1870.
101,016.—METHOD OF PRODUCING SELVAGES ON MACHINE-KNIT STOCKINGS, ETC.—Henry A. House, Bridgeport, Conn., assignor to himself and Frank Armstrong, Hamburg, Germany. Antedated March 17, 1870.
101,017.—HEATING AND OTHER FURNACES.—Thos. Hydes and Joseph Bennet, Sheffield, England.
101,018.—CAR COUPLING.—Wm. M. Ingstrum, Hornellsville, N. Y.
101,019.—APPARATUS FOR COOLING AND SAVING CHARCOAL.—G. A. Jasper, Charlestown, Mass.
101,020.—MANUFACTURE OF REVENUE AND OTHER STAMPS.—G. T. Jones, Cincinnati, Ohio.
101,021.—MACHINE FOR CUTTING BASKET STUFF.—Chas. Jordan, Wrentham, Mass.
101,022.—TOILET MIRROR.—W. H. King, Newark, N. J.
101,023.—GRATER.—Warren Kinyon and John Maxson, Scott, N. Y.
101,024.—FRUIT CAN.—Isaac Kling, Seymour, Ind.
101,025.—SIGN.—Peter A. Le France and J. D. Densmore, Elmira, N. Y.
101,026.—WOVEN TRIMMING.—Catholina Lambert (assignor to Dexter, Lambert & Co.), Paterson, N. J.
101,027.—MEDICINAL BEVERAGE.—Luigi F. Lastreto, San Francisco, Cal.
101,028.—COTTON PLANT PROTECTOR.—Auguste Le Blanc Louisiana, La.
101,029.—SPRING BED BOTTOM.—George W. Loomis, Hartford, Conn.
101,030.—DUMPING WAGON.—Virgil H. Lyon, Plainfield, assignor to himself and J. L. Snipes, Indianapolis, Ind.
101,031.—HARVESTER.—John B. McCormick, Dayton, Ohio.
101,032.—MACHINE FOR PRESSING AND GRAINING POWDER.—P. A. Oliver, New York city.
101,033.—MACHINE FOR FORMING MOLDS.—Samuel Joseph Peet and Daniel Sawyer, Boston, Mass., assignor to Samuel Joseph Peet.
101,034.—SAW MILL.—A. Perin, Paris, France.
100,035.—APPARATUS FOR PURIFYING WATER FOR THE MANUFACTURE OF ICE.—T. F. Peterson, New Orleans, La.
101,036.—WATER WHEEL.—Thomas H. Powers (assignor to himself, George E. Burnham, and Daniel G. Rogers), Milwaukee Wis.
101,037.—TICKET HOLDER.—Onsville E. Pray, Portsmouth, N. H.
101,038.—GANG PLOW.—Jacob Price, San Leandro, Cal.
101,039.—BEEHIVE.—J. M. Price, Buffalo Grove, Iowa.
101,040.—MACHINE FOR PICKING CRANBERRIES.—Joshua P Prickett (assignor to himself and J. C. Hinchman), Medford, N. J.
101,041.—KNIFE FOR SPLITTING WOOD.—Saxon J. Raymond, Brooklyn, N. Y.
101,042.—STOMACH BITTERS.—David Rinkle, Indianapolis, Ind., assignor to himself and C. C. Hunt.
101,043.—TAIL HOLDER FOR HORSES.—F. A. Roberts, North Vassalborough, Me.
101,044.—STEAM PROTECTION FOR SAFES, VAULTS, ETC.—John A. Robertson, Boston, Mass.
101,045.—HORSE POWER.—Francis W. Robinson, Richmond, Ind.
101,046.—CASTING METAL.—Robert Ross, Middlebury, assignor to himself, Wyatt W. Pierce, and George Ross, Vergennes, Vt.
101,047.—SHAFT COUPLING.—Theodore Rowell, Beaver Dam, Wis.
101,048.—TREATING COAL PRODUCTS TO OBTAIN BENZOLE, ETC.—John Rowley, No. 77 Wells street, Camberwell, assignor to the "India Dye Company" (limited), London, Eng. Patented in England July 22, 1869.
101,049.—SKATE.—J. F. Schneider, Brooklyn, N. Y.
101,050.—WATER WHEEL.—W. L. Selleck, Milwaukee, Wis.
101,051.—BOLT FOR SAFES.—Wm. Sharts, Athens, N. Y.
101,052.—ADJUSTABLE GARMENT PATTERN.—Samuel Shawcross, Freeport, Ill.
101,053.—HAND SCREW AND CLIP FOR SPLICING BROKEN CARRIAGE TIRES.—A. B. Sheaffer (assignor to himself and J. Walter) Ephrata, Pa.
101,054.—MILK RACK AND COOLER.—L. Shipman, Barker, N. Y.
101,055.—LATCH FOR GATES.—Warren Shumard, Richmond, Ind.
101,056.—PLOW.—D. T. Singleton, Eatonton, Ga.
101,057.—DUMPING CAR.—O. L. Smith, Providence, R. I.
101,058.—EMERY WHEEL CLAMP.—Edward A. Suwerkrop Washington, D. C.
101,059.—WATER METER.—Thomas Sweeney, Boston, Mass.
101,060.—COMBINED MOWER AND HEDGE TRIMMER.—J. O. Taber, Salem, Ohio. Antedated March 16, 1870.
101,061.—SHARPENING HARVESTER KNIFE.—A. P. Taylor, Darien, assignor to himself and G. R. Clark, Buffalo, N. Y.
101,062.—CLAMP FOR HOLDING BROOMS, BRUSHES, ETC.—A. B. Thompson (assignor to himself and Albert Cleveland), Owego, N. Y. Antedated March 7, 1870.
101,063.—STAIR ROD.—H. Uhry (assignor to the American Stair Rod Co.), New York city.
101,064.—STAIR ROD.—H. Uhry (assignor to W. C. Gould), New York city.
101,065.—SHEET METAL SEAMING MACHINE.—J. M. Veasey, Denver, Colorado Territory.
101,066.—ATTACHMENT FOR LAMP BURNERS.—Wm. Westlake, Chicago, Ill.
101,067.—MANUFACTURE OF IRON AND APPARATUS THEREFOR.—James Davenport Whelpley and Jacob Jones Storer, Boston, Mass.
101,068.—TINNERS' AND SHEET-IRON WORKERS' ROLL.—A. W. Whitney, P. A. Whitney, and F. A. Whitney, Woodstock, Vt.
101,069.—APPARATUS FOR MEASURING LIQUIDS.—Eli F. Wilder, Lowell, Mass. Antedated Sept. 22, 1869.
101,070.—OIL CABINET.—M. H. Wiley (assignor to himself, Thomas Miller, and J. H. B. Lang), East Boston, Mass.
101,071.—COMPOUND TO BE APPLIED TO ROOFING.—Thos. E. Wood, Waseca, Minn.
101,072.—PLANING MACHINE.—G. E. Woodbury, Cambridge, Mass.
101,073.—LAMP BURNER.—D. P. Wright and Cephas Butler, Birmingham, Eng.
101,074.—CAP FOR FRUIT JARS.—Homer Wright (assignor to himself, Henry H., and Benjamin F. Collins), Pittsburgh, Pa.
101,075.—ELECTROPLATING APPARATUS.—H. W. Wright, Taunton, Mass.
101,076.—TOY ROLLING CAGE.—Arthur M. Allen, New York city.
101,077.—COTTON CULTIVATOR.—W. J. Andrews, Columbia, Tenn.
101,078.—BUNG.—J. F. Applegate and Casper Felock, New Albany, Ind.
101,079.—VAPOR BURNER.—William Aurich, Chicago, Ill.
101,080.—SPRING FOR RAILROAD CAR.—J. F. Babcock, Boston, Mass.
101,081.—MACHINE FOR SCRAPING LEATHER.—Jas. T. Barnstead, Peabody, Mass.
101,082.—HEATING FURNACE.—Wm. D. Bartlett, Amesbury, Mass.
101,083.—ADJUSTABLE BEARINGS FOR WATER WHEEL SHAFTS.—Wm. Bayley, Baltimore, Md.
101,084.—TURBINE WATER WHEEL.—Wm. Bailey and A. B. Crowell, Baltimore, Md.
101,085.—VEGETABLE ROASTER.—Charles G. Baylor, Quincy, Mass.
101,086.—CREAM HEATER.—J. C. Reddoe and John S. Coon, Branchport, N. Y.
101,087.—WASHING MACHINE.—Alva Belcher, Delhi, N. Y.
101,088.—LOOM.—Erastus Brigham Bigelow, Boston, Mass.
101,089.—MACHINE FOR CRUSHING RAMIE AND OTHER FIBROUS STALKS.—E. B. Bigelow, Boston, Mass.
101,090.—CHAIR SEAT.—O. A. Bingham, Cavendish, Vt., assignor to G. C. Winchester, Ashburnham, Mass.
101,091.—CHURN.—G. C. Brown, Atlanta, Ga.
101,092.—EGG CARRIER.—A. H. Bryant, Chicago, Ill.
101,093.—EGG CARRIER.—A. H. Bryant, Chicago, Ill.
101,094.—MEDICAL COMPOUND.—Edgar D. Burrill, Providence, R. I.
101,095.—DRILL GUIDE.—G. F. Case (assignor to Windsor Manufacturing Co.), Windsor, Vt.
101,096.—MEDICINE OR COUGH SIRUP.—Geo. W. Chatfield, New Haven, Conn.
101,097.—CARRIAGE AXLE.—William A. Clark, Woodbridge, Conn.
101,098.—EARTH CLOSET.—W. R. C. Clark, New Orleans, La.
101,099.—SAW SWAGE.—Wm. Clemson, Middletown, N. Y.
101,100.—STREET PAVEMENT.—D. C. Colby, Washington, D. C.
101,101.—COMPOSITION FOR THE MANUFACTURE OF TOBACCO PIPES, STEMS, AND CIGAR HOLDERS.—J. R. Cole, Demopolis, Ala.
101,102.—END GATE FOR GRAIN WAGON.—C. H. Comstock, Chebanse, Ill.
101,103.—WASHING MACHINE.—H. W. Connor, Richmond, Ind

101,104.—TREADLE.—W. S. Coon, Rochester, N. Y.

101,105.—STOPPING AND STARTING MILL BURR.—William Crawford and Samuel Clarke, Attica, Ind., assignors to themselves and J. D. McDonald, Telford & Co. Antedated March 15, 1870.

101,106.—KNITTING MACHINE.—Anthony G. Davis and Charles W. Blakeslee, Watertown, and Alpheus N. Allen, Westville, assignors to "The Chapin Knitting Machine Company," New Hartford, Conn.

101,107.—MACHINE FOR WIRING WINDOW BLIND.—Biram C. Davis, Binghampton, N. Y.

101,108.—SKATE.—Charles T. Day, Newark, N. J.

101,109.—STEP SPINDLE.—Eliphalet Dougherty, North Lewisburg, Ohio, assignor to himself and J. M. Flood.

101,110.—DROP-WIRE SUPPORTING-BAR OR PLATE OF WARPING MACHINES.—I. C. Downes and Horace Denk (assignors to themselves and S. J. Abbott), Lewiston, Me.

101,111.—HOLDER FOR DIAMONDS.—G. D. Dunham, Chicago, Ill.

101,112.—STEAM DITCHING MACHINE.—A. J. Dye, New Orleans, La.

101,113.—LUNCH BOX.—John Erpelding, Chicago, Ill.

101,114.—WRENCH.—John Faessler, Bloomington, Ill.

101,115.—CAR, TRACK, AND OPERATING APPARATUS FOR MINES.—W. B. Frue, Houghton, Mich.

101,116.—COOKING STOVE AND RANGE.—Wm. Gardner and Geo. Gardner, (assignors to themselves, O.L. Gardner, and R.W. Myers), Glen Gardner Station, N. J.

101,117.—SAWING MACHINE.—H. D. Gillespie, Huntington, Ind.

101,118.—FOLDING DESK.—E. W. Gilles and Jules Wendell (assignors for one-third their right, to A. P. Grant), Oswego, N. Y.

101,119.—COMPOSITION HANDLE OR PULL.—W. B. Gleason, Boston, Mass.

101,120.—HARVESTER.—William F. Goodwin, Metuchen, N. J.

101,121.—HOLDER FOR METALLIC CARTRIDGE CASES.—S. C. Greene, Vicksburg, Miss.

101,122.—HORSE HAY FORK.—Charles T. Grimes, Lancaster, Ky.

101,123.—CHIMNEY COWL.—David Hahn, Reserve, Ind.

101,124.—BRICK KILN.—Silas M. Hamilton, Baltimore, Md.

101,125.—LIQUID METER.—T. C. Hargrave, Boston, Mass. Antedated March 15, 1870.

101,126.—CLAMP.—E. B. Hays, Vergennes, Vt.

101,127.—COOKING STOVE.—Philip W. Hertick, Louisville, Ky.

101,128.—LEMON SQUEEZER.—Vitalis Himmer, New York city.

101,129.—DISH WASHER.—Mary Hobson, Williamsburg, Mo.

101,130.—PAPER FILE.—Amos Hockett, Wilmington, Ohio.

101,131.—FERTILIZER.—H. A. Hogel, Brooklyn, N. Y., assignor to himself and C. C. Bruce, New York city.

101,132.—ORE SEPARATOR.—William Hooper, Ticonderoga, N. Y.

101,133.—GAME REGISTER.—E. H. Keith (assignor for one-half to C. S. Doty), Peoria, Ill.

101,134.—HARVESTER CRANK AND PIN.—Jacob Kline, Mechanicsburg, assignor to himself and Geo. Winters, Harrisburg, Pa.

101,135.—TREE PROTECTOR.—Henry Knapp, Walworth, N. Y.

101,136.—BROADCAST SEEDER.—J. C. Kurtz, Wooster, Ohio.

101,137.—SEWING MACHINE.—Thomas Lamb, Philadelphia, Pa.

101,138.—PUMP.—Edson Lamphear, Stepney, Conn.

101,139.—TABLE CUTLERY.—Ebenezer G. Lamson, Windsor, Vt.

101,140.—SEWING MACHINE.—Ralph Lawyer and J. C. Gasten, Pittsburgh, Pa.

101,141.—HARNESS FASTENING.—S. S. Little and H. P. Westcott (assignors to Smith, Westcott, & Co.), Macon, Ga.

101,142.—DIES FOR THE MANUFACTURE OF IMITATION STRAW GOODS.—Henry Loewenberg, New York city, assignor to Modena Hat Company.

101,143.—TWEER.—Albert G. Mann, Worcester, Mass.

101,144.—MONEY BOX, ETC.—G. W. McDaniel, Georgetown, assignor to himself, C. G. Fisher, and Nisbet Turnbull, Washington, D. C.

101,145.—MEDICAL COMPOUND FOR THE CURE OF COLIC.—John A. McKinnon, Selma, Ala.

101,146.—MEAT SAFE.—George L. Michael, Farmersville, Ohio.

101,147.—HEMMER FOR SEWING MACHINE.—Clark Morehouse, Wayland, assignor to S. A. Tozier and O. N. Crane, Canandaigua, N. Y.

101,148.—SAND SCREEN FOR IRON TUBE WELLS.—Robt. M. Morrill, Plymouth, Ind.

101,149.—DIES FOR FORMING T-BOLTS FOR WHIFFLETREES.—F. B. Morse (assignor to himself and H. D. Smith & Co.), Plantsville, Conn. Antedated Feb. 22, 1870.

101,150.—CARRIAGE STEP.—F. B. Morse (assignor to himself and H. D. Smith & Co.), Plantsville, Conn. Antedated Feb. 22, 1870.

101,151.—LASTING MACHINE.—H. N. Moyon and Jacques E. Lemercier, Paris, France.

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REISSUES.

3,881.—FIRE AND WATER-PROOF PAINT AND CEMENT.—Theodore Brinkmann, Greenville, Tenn. Patent No. 98,022, dated December 21, 1869.

3,882.—SETTEE.—Wesley Chase, Buffalo, N. Y. Patent No. 90,078, dated May 18, 1869.

3,883.—VISE.—Edwin Crawley and Thomas L. Baylies, Richmond, Ind. Patent No. 89,469, dated April 27, 1869.

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3,885.—OPERATING SLIDE VALVES IN DIRECT-ACTING ENGINES.—W. H. Guild and W. F. Garrison, Brooklyn, E. D., N. Y., assignees of G. W. Hubbard and W. E. Conant. Patent No. 12,203, dated January 9, 1855; reissue 2,359, dated September 18, 1866; extended seven years.

3,886.—PROJECTILE.—John D. Richards, Muscatine, Iowa.—Patent No. 96,647, dated September 7, 1869.

3,887.—SAFE.—T. J. Sullivan, Albany, N. Y. Patent No. 97,529, dated December 14, 1869.

3,888.—PUMP.—The Forrester Manufacturing Co., Bridgeport, Conn., assignee by mesne assignments, of I. N. Forrester and J. H. Luddington. Patent No. 85,577, dated January 5, 1869.

3,889.—SHEEP SHEARS.—R. M. Wilder, Coldwater, Mich., for himself and Hiram B. Robinson, assignee of R. M. Wilder. Patent No. 14,840, dated May 6, 1856.

3,890.—CHAIR SEAT.—G. C. Winchester, Ashburnham, Mass., assignee of Osmore A. Bingham. Patent No. 94,555, dated September 7, 1869.

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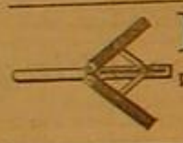

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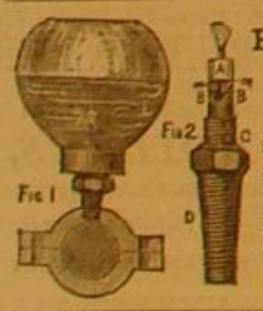

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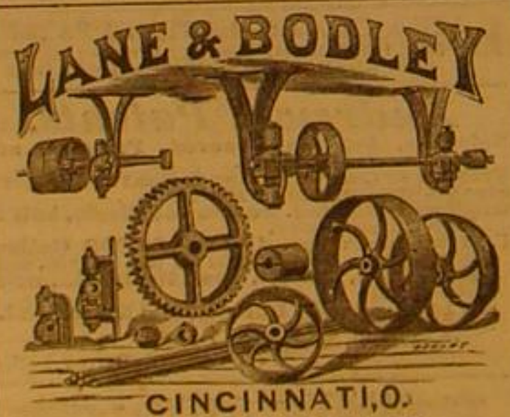

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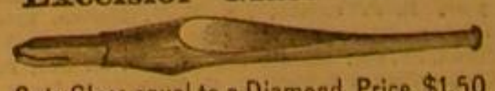

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