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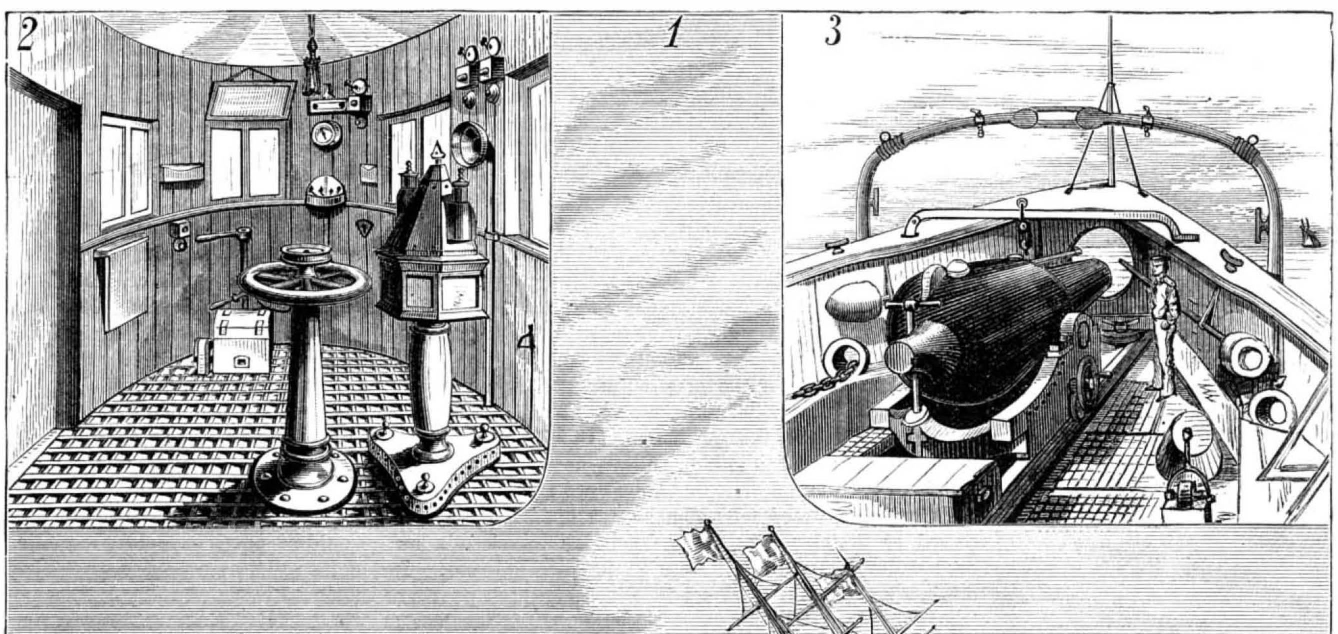
THE UNITED STATES TORPEDO STEAMER ALARM.

While, in preparing for the wars of the future, foreign nations have bestowed chief attention upon immensely costly experiments on guns and armor, here, in the United States, the principal aim has been the perfection of the torpedo system. An admirably organized and thoroughly equipped torpedo school for the navy has for several years been in existence in Newport, R. I. The work which there is done is not published, but many of its results are of great importance. There is also an army torpedo station at Willet's Point, L. I. We have also constructed one torpedo vessel which is probably the most formidable craft afloat (not excepting the Italian ironclads with their 100-ton guns), and in time of war will form the model for a fleet of like steamers. This vessel is the Alarm; and in the annexed engravings we represent all that we are permitted to make publicly known relative to her construction.

The Alarm, we should premise by explaining, does not fight according to any established rules of naval tactics. Having sighted an enemy—say at night—her compound engines drive her headlong at him at the rate of 15 knots per hour. As she nears him, the immense electric light on her bow flashes out its glare, blinding her adversary to her own hull (which is already sunk so low that her deck is but three feet above the sea), while displaying his every proportion. The roar of her 15-inch gun, as it hurls its huge shot or shell into the attacked vessel, is followed by the crash of the bow spar torpedo striking the devoted craft thirteen feet below the water line. Then, perhaps after a momentary check due to the torpedo recoil, the Alarm plunges forward, driving her immense ram into her adversary's crushed side. As she swings broadside on to her foe, another torpedo spar shoots out from her side, and another torpedo is exploded under the unguarded bottom of the enemy; while the machine guns on the torpedo boat's rail keep up a deadly fire of thousands of bullets per minute, sweeping her opponent's decks. We need scarcely add that the Alarm is a disagreeable craft for a heavy ironclad (one like the Vanguard, for instance, which went down like a shot on being slightly rammed) to encounter. She is well provided with defensive means, but of these we shall write further on.

An excellent idea of the shape of the Alarm may be obtained from the large illustration, Fig. 1. Her length is 172 feet, of which 32 feet is snout or ram; her beam is 27 feet 6 inches, and she draws 11 feet of water, displacing about 700 tons. She is built of thoroughly tested charcoal iron, and on the English bracket plate system: that is to say, she has really a double hull, one shell being constructed inside the other. Within the outside shell three longitudinals of great strength run the entire length of the vessel, and are connected with bars running in a horizontal direction by brackets. The different sections can be entered through man-holes, so that a person can pass from stem to stern between the inner and outer vessels. These compartments are all watertight, so that, in event of a leak, only one section could fill. The whole interior of the vessel is also built in compartments which may be hermetically closed, so that, in case of rupture of both shells at any point, it would still be impossible to fill the entire ship with water. The side plating is not thick, as it is not intended as armor, the vessel, as already explained, being almost wholly submerged while in action.



ADMIRAL PORTER'S SYSTEM OF TORPEDO WARFARE.

In order to attack an enemy suddenly, and to pursue him in case of flight with success, and also to be possessed of a very necessary mode of self-protection, it is evident that a vessel such as the Alarm requires not only the means of speed but of handling her with the utmost readiness. The theory is that she is always to meet her adversary bows on; and as her most formidable enemy is the ram, she must be able to turn in so small a space and so quickly that it would be impossible for her to receive a fair broadside blow. This is effected by the total abolition of a rudder, and by steering her with the same apparatus which propels her, the Fowler wheel, which is represented in Fig. 5. The wheel turns on a vertical shaft; and its paddles are feathered by an eccentric cam in such a manner that, at one part of their revolution, they have a pushing and drawing action on the water, while at another part they present only their edges. The device, in fact, is simply a feathering paddle wheel, turned horizontally instead of vertically. By suitably turning the cam wheel, which is done from the helm, the feathering of the paddles is caused to occur at different points; and in this way the ship may be turned, or rather her stern twisted, around as if on a pivot. At the same time, by suitably adjusting the paddles, the vessel goes ahead or backs, the engine meanwhile running always in the same direction.

The steering is accomplished from the wheel house located aft on the deck, an interior view of which is given in Fig. 2. By means of the hand lever, shown beneath the wheel, steam is admitted to the little engine which works the cam that adjusts the paddles. Then, by turning the horizontal hand wheel in either direction, the helmsman controls the movement of the cam as desired. Just above the wheel is a dial with a pointer, which enables him to note the exact position of the paddles, and so to place them as ordered. This contrivance shocks the feelings of ancient tars; for with the advent of the machinery the time-honored hand wheel and the yells of "starboard," "port," "steady," etc., to the helmsman, disappeared; and in lieu of the latter orders, the pilot quietly remarks "sixteen," "ten," "two," or other proper numbers on the dial, in accordance with which the man at the wheel places his paddles.

Inside the wheel house (which may or may not be used in action as desired, as all its appliances are duplicated below deck) are devices for communicating with the men working the big gun in the bow, Fig. 3, or those managing the torpedoes. For instance, on nearing an enemy, the captain would press a certain button. A signal sounds at the gun, meaning "get ready;" a bell then rings in the wheel house, meaning that the order is understood. At another signal, the gun is fired. Then another button pressed sounds a bell in the portion of the ship where the torpedo spars are located; and at once those in charge run out the designated spar. Fig. 6 shows the spar, which is a long hollow iron cylinder lying on its supports between decks. Its outboard end rests in a kind of

[*Continued on page* 162.]

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WHAT IT COSTS TO FEED INSECTS.

There are about a thousand species of insects in this country which are injurious to our grain, forage, and field crops, our garden vegetables, fruit crops, and forest and fruit trees. Among them a few are specially destructive. In 1875, it is said, as many as ten thousand settlers were driven out of Kansas by grasshoppers. In Missouri, according to State Entomologist Riley, the damage done by these insects in 1874 exceeded $15,000,000, and he estimates the losses in other parts of the West at twice as much more, in all, $45,000,000 for one year's support of these pests. During the same year, the destruction of growing crops by the chinch bug amounted to $19,000,000 in Missouri alone. Just ten years before, in Illinois, the same insect occasioned a loss of over $73,000,000 in a single season. The average annual damage to the cotton crop of the country by the cotton army worm is estimated at $50,000,000. The devastating potato beetle is capable of deducting other millions from the annual profits of our agriculture, and the thousand other insect plagues are easily competent to swell the aggregate annual board-bill of their kind to something like $200,000,000, according to the estimates of Professor Packard, whose conclusions on a subject like this are well worthy of respect.

If this enormous sum, or even half of it, could be saved, it would soon amount to enough to pay the national debt. The question whether it can be saved, or any portion of it, is certainly worth considering. Professor Packard is confident that, with care and forethought, based on the observation of facts by scientific men, from fifty to a hundred million dollars of this annual loss could easily be prevented by a little co-operation between the several States and the General Government. He would have the former emulate the practical good sense of Missouri and each appoint a salaried entomologist. Then these gentlemen, acting in connection with a United States Commissioner of Entomologists, might issue weekly bulletins, perhaps in combination with the Weather Signal Bureau, reporting the condition of the insect world, forewarning farmers and gardeners from week to week of the insect enemies to be guarded against, and suggesting the preventive and remediable means that should be adopted. The cost would be comparatively slight; the possible good immense.

Take for illustration the grasshoppers, or, more properly, locusts, of the West. They breed chiefly on the great plains beyond the Mississippi, from Minnesota to Texas. In summers of unusual drouth they multiply enormously, and the supply of food being short they are forced to migrate.

Professor Packard tells of a swarm of locusts, first observed at Boulder City, Colorado, which traveled six hundred miles to devastate Eastern Kansas and Missouri. Its original home was somewhere in Wyoming, perhaps two or three hundred miles northward of Boulder City. The locusts fly with the wind; and as the general direction of the wind in those parts during the summer season is pretty well known, the movements of the locust armies can already be predicted with tolerable accuracy. But more knowledge is needed, particularly with regard to the meteorological features of the Western country, and the relation of locust migrations to wind and weather. In the pursuit of these investigations, Professor Packard justly urges that the meteorologists and entomologists must go hand in hand. The government has provided a well organized corps of weather observers, and the addition of a few competent entomologists would increase the outlay but little, while the resultant good would, in all probability, be very great. It would certainly be so if, as seems by no means unreasonable, the service should be able to master the conditions of "locust years," and be able to tell with a good degree of certainty when locust invasions are likely to occur, and how they may be prevented.

In his plea for such observations in the West, Professor Packard observes that "not only should the border States, especially Texas, Kansas, Nebraska, Minnesota, and Iowa, employ entomologists, following the liberal policy of Missouri, which for eight years has had a State entomologist, whose reports have proved of incalculable practical value to the people of that State: but the habits of the locust need first of all to be thoroughly studied in the Territories, particularly in those of Wyoming, Montana, Idaho, Dakota, Utah, New Mexico, Arizona, and in the new State of Colorado. A commission of entomologists should be appointed to make a thorough study of the locusts in the Territories mentioned. It would seem that the recommendation made at the recent meeting of Western Governors, at Omaha, to the effect that an appropriation be passed by Congress, and a commission be attached to the existing United States Geological and Geographical Survey of the Territories (Hayden's), is the most feasible and economical method of securing the speediest and best results."

This is but one feature of the work that might be done with profit toward forestalling the depredations of insects, regular and periodical: a work which must, sooner or later, be undertaken, and which may ultimately prove as beneficial to the country as the weather predictions have been.

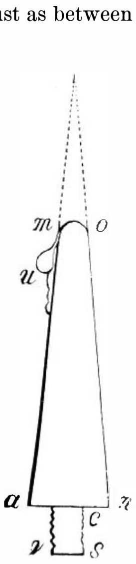
PUBLISHERS' NOTICE.

New subscriptions to the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT will, for the present, be entered upon our books to commence with the year, and the back numbers will be sent to each new subscriber unless a request to the contrary accompanies the order.

Instead of a notice being printed on the wrapper, announcing that a subscription is about to end, the time of expiration is now denoted in the printed address each week.

EXPLOSIONS ON LIGHTNING ROD POINTS.

It is a well known fact that, if a metallic point communicating with the earth be presented to the conductor of an electric machine charged with positive electricity, the angle of the electroscope of the apparatus becomes small. The reason is that negative electricity escapes from the point as soon as developed, and serves to neutralize a quantity of the positive electricity of the conductor, no spark being produced. This phenomenon, as Professor Stroumbo, of the University of Athens, points out, is produced differently when the Holtz electric machine is used. If, while sparks are passing between the two balls of the apparatus, a third ball, having a metallic point attached to it, be taken in the hand and moved nearer one of the fixed balls, when the intervening distance becomes so small that the negative electricity of the point may escape the sparks at once cease. Yet, if the point be removed, they begin passing again between the two balls. This experiment can be repeated indefinitely. Now if the distance between movable and fixed balls above mentioned, at which no sparks pass, be gradually augmented, at a certain stage sparks will reappear between point and fixed ball. The conclusion from this is that, if the negative electricity of the point has great intensity, sufficient to enable it to escape from the point and pass over the interval, there will be no spark between point and fixed ball; but if the negative electricity of the point has not intensity sufficient to cause it to escape as soon as developed (the attraction then diminishing inversely as the square of the distance), there will be an explosion on the point itself, and electric sparks will occur constantly between the point and fixed ball, just as between the two balls of the machine.



During storms, the atmosphere is charged with enormous quantities of electricity, which, however, in their action should follow the same law as the smaller quantities produced in electric machines. If then a cloud, having positive electricity in determinate quantity, passes not too far away from the lightning rod point, analogous effects will take place. Then electricity developed by induction on the lightning rod will continue to escape at the point as soon as it gets there, and will go to neutralize the positive electricity of the cloud, neither thunder nor lightning being produced; but in case the same cloud were placed too far away, according to the experiments above detailed, an explosion might follow at the point of the rod, an intense heat would be developed, and the platinum point of the rod would be fused. This phenomenon occurred at the Royal Palace of Athens, where the platinum point was found melted, as shown in our illustration, which represents the rod in its full size.

THE INDUSTRIES AND RESOURCES OF NEW SOUTH WALES.

There is no people for whom we as Americans may cherish a more genuine fellow-feeling than for the colonists of the British Australian possessions. Sprung from the same parent stock as ourselves, daring the hardships and privations incident to the settlement of a new and distant region as did our own ancestors, they have achieved results and can point to a progress which may justly claim to find its only parallel in our American advancement. No better proof could be asked to show that the energy and industry of the Anglo-Saxon are race characteristics, and that they will manifest themselves irrespective of the region which may chance to be their field of exertion.

Not three generations ago, Australia was but a frontier of barbarism. Now the continent is fringed with infant States already able to exercise the powers of elaborate political systems. Within thirty years, the population has risen from 214,000 to 2,000,000 souls, the trade from $30,000,000 to $315,000,000. There are nearly 5,000,000 acres of land under cultivation, 70,000,000 head of live stock on the pastures, 2,000 miles of railway and 26,000 miles of telegraph completed, and the revenue of the several governments aggregates $350,000,000.

The mother colony of those which thus far have been established upon the Australian continent is New South Wales; and for a most valuable exposition of the resources, industries, and requirements of that political division we are indebted to Mr. George H. Reid, of Sydney, a copy of whose essay is now before us. The great need of the colonies—the need which overtops all others—is for men. The chief articles of her export trade are raw materials; and that these exist in abundance there is no question. But enterprise is paralyzed when hands fail; and therefore New South Wales now asks all nations, not for their custom nor for their money, but for their surplus population. The underpaid agricultural laborers of England, the great throngs of working men of the United States who, when the panic of 1873 checked enterprise here, were thrown out of employment—any one, in fact, blessed with good health and sturdy muscles, the new colony will gladly welcome, and provide with steady and remunerative work.

Mr. Reid's essay is primarily designed to exhibit in some detail the inducements which the colony offers to immigrants, and of these we summarize below those regarding which a workman would naturally first ask to be informed. The area of the colony is 323,437 square miles, that is about as large as the New England States, New York, Pennsylvania, New Jersey, Delaware, Ohio, Indiana, Illinois, and about a third of Iowa, combined. The climate is remarkably salubrious, the death rate is low, and epidemic diseases are rare. Means of intercommunication consist of 692½ miles of finished railway and 8,012 miles of telegraph wire, and 561 additional miles of railway are projected. The telegraph is under government control, and a message of ten words may be sent to any part for one shilling. The Post Office includes a system of government savings banks. The public debt is not more than three years' revenue. Land for settlement can be obtained of the government in any area between 40 and 320 acres for $4.84 per acre, payable on easy terms.

The present mainstay of Australian prosperity is live stock, and this is conspicuously true of New South Wales. The value of cattle, horses, etc., in the colony in 1875 was over $35,000,000, and the wool export is very large. There is no part of the country where sheep and cattle will not thrive; and with the improvements which are constantly being made in the preservation of meat, it is likely that before long the rearing of live stock for consumption in Europe will become a great and valuable industry. The soil is suitable for the cultivation of all northern cereals, coffee, tea, tobacco, cotton, sugar, olives, cinchona, indigo, and rice, besides the fruits of the temperate and semi-tropical zones. The demand for agricultural laborers is therefore especially marked. There are abundant coal resources, the approximate coal area being 24,840 square miles. The gold mines are believed to be extensive, but labor must be had before they can be developed. Tin and copper are largely mined, and a fine quality of iron is obtained. There is a diamond area of 500 square miles, and in gems of all kinds the country is remarkably rich. The larger manufacturing industries include ship and boat building, brick making, milling, tanning, engineering, foundry work and pottery—all of which are carried on in extensive establishments. Of the minor industries, nearly all are represented as in a flourishing condition. The eight hour rule in labor is generally followed. Taxes and rents are low, while wages are fair. A bricklayer, for example, can earn in Sydney from $2.50 to $2.75 per day. Building laborers get from $1.60 to $1.75. In the iron trades the pay for eight hours' work ranges from $2 to $3 per day. Painters receive from $8 to $15 per week. In the gold mines, a days' wages is, for eight hours, $1.87 to $2.08; in copper mines, same time, $2.08 to $2.60; in coal mines, five hours' work, $2.35; in iron mines, nine hours' work, $1.75 to $3.50. As regards the cost of living, a house containing 6 rooms may be hired in Sydney for from $3.50 to $5 per week; in the suburbs this rent falls as low as $2.50 to $3.50 per week. Smaller houses ranging down to three rooms are proportionately lower in price. In the matter of food, beef sells for 8 cents per lb., flour 3½ cents, bread the same, sugar 6 to 8 cents. Generally the prices are high, in some respects notably so, as butter is quoted at 50 cents per lb., milk 16 cents per quart, and bacon 25 cents per lb.: but these are Sydney rates, and the cost of living appears to be somewhat less in the country, while wages out of the city average rather higher.

Of course the chief advantage offered to the immigrant is steady work, which is to be supplied both by private enterprise and by the expenditure of some $20,000,000 of surplus public revenue for the construction of railways.

THE WORLD'S POPULATION.

The present population of the world is somewhere between fourteen and fifteen hundred millions, the latest and perhaps most trustworthy estimate, that of Drs. Behur and Wagner, placing it about midway between the limits we have mentioned. The impossibility of estimating the number more closely will be apparent when it is remembered that only in a comparatively small part of the world have careful censuses, or indeed censuses of any kind, ever been made. A systematic enumeration of the inhabitants of India a year ago discovered that the population of that great empire had previously been under-estimated by upwards of 25,000,000, or as many nearly as the population of England, Scotland, and Wales. The census returns of Europe are tolerably complete, the leading States standing in the following order in point of numbers:

Russia	1870	71,731,000
Germany	1876	42,723,000
Austro-Hungary	1876	37,700,000
France	1872	36,103,000
Great Britain	1876	33,450,000
Italy	1875	27,482,000
Spain	1870	16,552,000
European Turkey	——	8,500,000
Belgium	1874	5,337,000
Roumania	1873	5,073,000

Sweden and Portugal slightly exceed 4,000,000 inhabitants each; the Netherlands fall a little short of that number; Switzerland fails to reach 3,000,000; while Denmark and Norway fall somewhat below 2,000,000. Greece and Servia fall short of a million and a half each, and the smaller States together add less than half a million more. The aggregate population of Europe is thus a little over 309,000,000, giving a density of 82 to the square mile.

The population of Asia, according to the same authorities, is about 824,500,000, or 48 to the square mile. The most populous nation is China, with over 400,000,000 people. British India has about half as many; Japan over 33,000,000; Turkey in Asia about 13,500,000; Asiatic Russia about 15,000,000. Africa has a population close upon 200,000,000, America about 85,520,000; Australia and Polynesia less than 5,000,000. The density of the African population is 17½ to the square mile; of America, 5½; of Australia and Polynesia, about 1⅓ to the square mile.

There are ten cities in the world that have a population of a million or more, namely: London, with 3,490,000; Paris, 1,852,000; New York (with Brooklyn), 1,596,000; Constantinople, 1,075,000; Berlin, 1,045,000; Vienna, 1,001,000; and Canton, Seangtan, Shanchowfu, and Siangfu, in China, with 1,000,000 each. There are twenty-nine cities with 500,000 or more each; and 215 with 100,000 or more people.

PATENT RIGHTS AND PATENT WRONGS.

The old saying, "out of the frying pan into the fire," is always worth heeding. The single circumstance that a degree of mischief is the outcome of any custom or law is not in itself a sufficient reason for the condemnation of such law or custom. As this world of ours is constituted, good and evil ever go together. There is nothing so beneficent that it may not sometimes do harm. Even the Gospel of Peace has more than once brought discord and the sword. Reform is always in order; but before it is undertaken in any case, it should first be made clear that something better is possible, and that the harm likely to be done in the process of substitution will not be greater than will result from leaving things as they are.

We have little sympathy with those who persist in regarding the patent system of the United States as the source of unalloyed good. We are equally far from sympathizing with those who cry "away with it," or would change its provisions at a venture simply because it is, or appears to be in some cases, the instrument of "oppression." Like everything else we have to do with, it is something experimental, aiming to secure the greatest good to the greatest number, but making no pretence to infallibility or absolute beneficence.

That strong *ex parte* arguments can be brought against its workings in some particulars is undeniable; but on the other hand, the advantages directly traceable to it are enormous, vastly overbalancing, we believe, the evils wrought by it or in its name. The part of true statesmanship therefore seems to be, not to abolish the system outright as some demand, nor to emasculate it as others would like to do; but to determine the sources of the evils which attend its workings, and then, if possible, modify the system so as to obviate those evils without opening the door for the entrance of greater evils.

The charges against the patent system as it now stands are certainly serious, or, more correctly, some of them are. Others, like the following from a late issue of the Chicago *Times*, are simply ridiculous, to wit: "That the patent system is an oppressive nuisance; that it has proved itself the reverse of a stimulant to the inventive faculties of the American people; that its original purpose, to secure to inventors a reasonable recompense for their study and ingenuity, has been prevented, and that not one inventor in a thousand receives any substantial benefit from his invention."

The patent falsity of charges of this sort prevents their imposing upon anybody capable of observation or honest thinking. Not so, however, the charges based upon truth and experience: for example, that a patent right is for a time the monopoly of the possessor; that it allows the patentee to restrict the liberty of all other men to the extent of denying them the privilege of using something they want except on such terms as he may dictate; that it allows a patentee to prevent absolutely, if he will, the use of a patented device or process, for a term of years, to the manifest detriment of the common wealth; and that it allows the owner of a patent or a combination of patents to levy enormous taxes on the country's industrial or natural resources, while the inventors, for whose benefit the patents were issued, get little or nothing for their rights.

Let such charges—the worst that can be brought against the patent system—be granted as true. Does it follow that the system should be abolished? Certainly not, whatever the Chicago *Times* or others of the anti-patent school may demand, unless it be first clearly demonstrated—

That the patent system as a whole has been no help, but rather a hindrance to the development of the country:

That the owners of patents have been more favored by law than the owners of other species of property:

That the admitted evils of the patent system are inseparable from it, and that no mitigation of them is possible except with the abolition of the system.

Touching the first very little need be said. The verdict of history, of common sense and common fact, is against it. Even in the case of the patents which have given rise to the most "oppressive" monopolies—mowing machines, cultivators, sewing machines, vulcanized rubber, telegraphy, railways, and the rest—it is easy to show that they have been of enormous advantage to the country, and have added vastly more to the wealth of the people who have been "oppressed" by them than they have taken away. It is true that the owners of such patents have often been greedy of gain and have amassed great wealth; but what are their fortunes compared to the aggregate wealth of those who owe what they have almost entirely to the aid they have received from the very patents they complain of?

The chief opponents of the patent system are the Western Grangers, whose narrow views have been represented in the recent anti-patent enactments of their State legislatures and also in the bill now pending in the United States Senate. Have those same Grangers ever seriously asked themselves the question where their organization and the wealth it represents would have been—where they personally would have been—had there been no patent system to encourage inventions, and no fruits of such a system to make the cultivation of the interior wilderness possible, or to enable its pioneers to send its products to a profitable market? We hazard the assertion that the "obnoxious" patent system, and the inventions it has encouraged, have done more for the Grangers than they have ever done for themselves.

But, it is objected, on their part, the owners of patents have been and are unduly favored in the struggle for existence. They have been too much protected, to the grievous injury of the users of their inventions, particularly the agricultural classes.

Let us see: Let M., a mechanic, represent the patentees, inventors, and owners of patents, as a class. Similarly let F., a farmer, represent the Grangers. F., strong in hope and health and muscle, goes to the wilderness and clears a farm. For the work so done, or for a merely nominal payment, the general government grants him a section of land. The grant is absolute and for all time. Meanwhile M. is devoting his energies to the perfecting of some useful device. He succeeds, and the general government gives him the right to make and sell his invention—for all time? No; but for a period of a few years only. So far, certainly, the inventor is not unduly favored.

We will suppose that the invention is so important and useful that, before the life of the patent expires, the inventor has amassed a noble fortune; or better, suppose that the inventor, unaware of its importance, sells it at the current rate for patents, according to the opponents of the system, "a song," and the property passes into the control of a soulless corporation, which is enabled thereby to monopolize an extensive line of manufacture, and so acquire no end of riches. Better still, suppose this grasping corporation, which owns something that the multitude cannot afford to be without, and charges accordingly, becomes so rich that before the expiration of the patent it is able to secure a renewal of it, and so continues for another term of years to "prey upon the people." The end comes at last, and then the invention becomes a portion of the common wealth. The patentee or his successors have been greatly favored truly; but is their case entirely unique?

Let us see how our pioneer Granger has fared meanwhile: The title made out, the land is his to use or let alone as he will. He can let it lie unproductive, not merely for seventeen years (like an undeveloped patent), but for any time he may choose; and he can keep anyone else from cultivating it except on such terms as he may dictate. His monopoly is, then, as complete while it lasts as a patentee's, and it lasts for ever. Suppose he has made a happy selection and has chosen a valuable site for water power, or that the land is found to contain precious metals, or that it happens to be where a great commercial center is destined to be. He, unlike the inventor, has added nothing to the world's wealth, yet purely through the necessities of others he may gain great wealth by what is called the natural rise in value of real estate; and the law of the land defends his title.

To parallel the case of M., suppose F. to be ignorant of the present or prospective value of his homestead, and that he sells it, as M. did his patent, for a song. The buyer may improve the property or let it lie fallow, just as he pleases. He may leave it for generations, a serious bar to the development of the surrounding community, who may sorely need the water power, the useful minerals, or the advantage of the commercial situation it covers; or he may turn their necessities to his advantage and charge enormously for what owes its real value not to the owner's efforts but to the labors of others who have been hindered rather than helped by his negative action. We might point as an illustration to one of the oldest cities of New England, which from its natural advantages might have been one of the most prosperous, but is now a tenth-rate place simply because those advantages have been monopolized by a family that would neither develop them or allow them to be developed by others. The vast fortunes that have come to the Astors and similar owners of landed property, which has been made valuable through the energy of other men, tell the same story.

The worst possible cases of patent "oppressions" are trivial compared with the burdens which rising communities have had to bear through speculations in land. Shall we say, therefore, that private ownership of land is injurious and ought to be abolished? Or, because the great landed fortunes have not fallen to the working pioneers, that the land laws of our country have not encouraged emigration or hastened the development of the country?

The inventors, if they would, could make out a far stronger case against the landowners than the latter against the patentees; but only by overlooking, as the Grangers do, the very important circumstance that, however great the local evils of either system may have been, the good has preponderated enormously. And the charge of favoritism can be returned with interest, for the patentee's monopoly is limited, and in a few years his invention becomes public property, whereas the landowner's monopoly is perpetual.

There remains the question whether the patent system can be modified so as to mitigate the alleged evils of its workings without impairing in any serious degree its efficiency as a stimulant to invention. We are inclined to think it may; but the case is not as clear that sudden or reckless changes are advisable. This question, however, is too important to be discussed at the tail of a long article. We reserve it, therefore, for subsequent consideration.

[*Continued from first page.*]

trough; and to this extremity the torpedo, Fig. 7, a metal shell containing a hundred lbs. or so of powder, is fastened.

Fig. 4

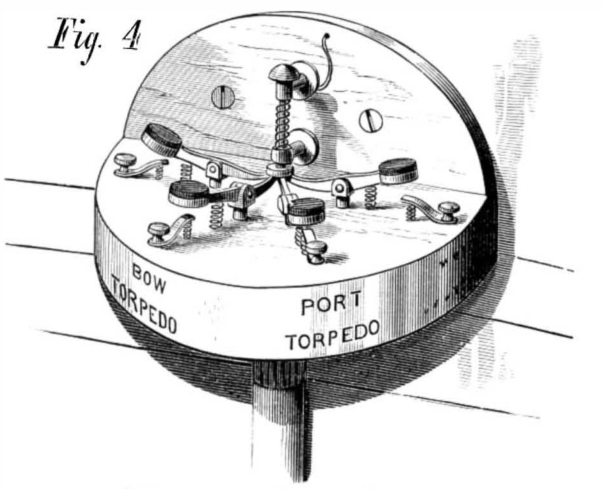
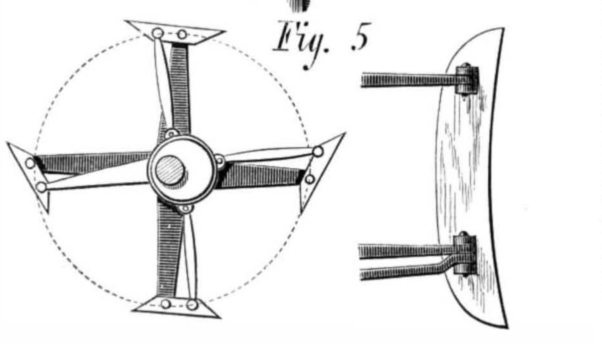
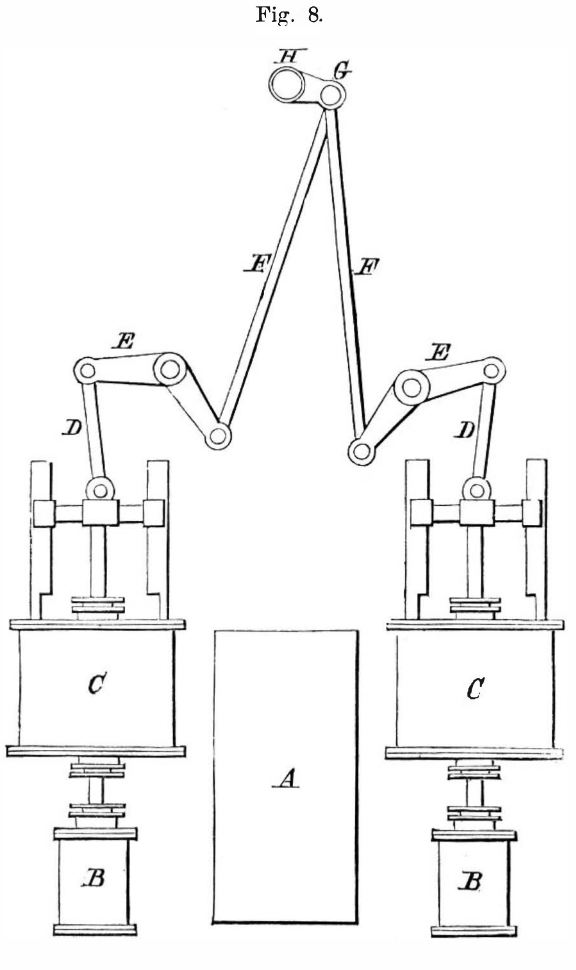


Fig. 5



An electric fuse, also shown in Fig. 7, is adjusted, so that its platinum wire will become white hot, and so fire the torpedo when the current passes. To the cradle in which the torpedo spar lies are attached heavy tackles hooked to the beams overhead, so that the spar can be tilted to different angles in order that its extremity, when pushed out, may be at a greater or less depth under water. The valve through which the spar passes through the side of the vessel is so constructed that no water can enter during the protruding of the spar. The latter operation is effected by a tackle brought to a steam winch provided for the purpose. The side spars are 18 feet and the bow spar 32 feet in length. On receiving the signal above noted, the men below affix the torpedo and run out the spar. If the vessel to be attacked has torpedo guards out (heavy nettings of rope sunk down to keep torpedoes at a safe distance from the bottom), an ingenious mechanical contrivance on the torpedo signals that fact, and the person stationed at the exploding wire does not press the key. The Alarm then tries to break or push through the obstruction, and her success is announced by the same signalling arrangement. Then the impact of the torpedo with the vessel's hull is announced, and then the captain, in the wheel house, touches the key, and the explosion follows.

Fig. 8.



The firing may be done either below decks at the place where the torpedoes are pushed out or from the wheel house. In both places, electric machines are located which may be set in action by the ship's engines. Fig. 4 represents the firing keys in the wheel house; and in Fig. 2 the electric machine is indicated. By pressing one of the keys in Fig. 4, connection between the torpedo with which it communicates and the electric apparatus is at once established. The gun in the bow, Fig. 3, is mounted on an ordinary naval carriage, and is manœuvred by its tackles being carried to a steam capstan, which is also used for hoisting anchor. Shot and cartridges are whipped up from below by a tackle attached to a carriage which travels on the horizontal bar across from rail to rail, so that the charge can be easily swung directly in view of the muzzle. The gun, when run out, points directly ahead, as the large engraving indicates.

The engines of the Alarm, a diagram of which we give in Fig. 8, are of the compound variety, with four cylinders, the condenser, A, being placed between them. There are two high pressure cylinders, B, diameter 20 inches, stroke 30 inches, and two low pressure cylinders, C, 38 by 30 inches. The low pressure cylinders are jacketed. Short connecting rods from the crossheads are attached to two bell crank levers, E, which have a throw of 27 inches. The crank connecting rods, F, are attached to the other ends of these bell crank levers, and to a common pin in the driving crank, G, which latter crank has a throw of 15 inches. The valves (not shown in the engraving) are on top of the cylinders, and are operated by eccentrics working on an intermediate shaft, which is actuated by levers from the crossheads. No links are fitted to the valve gear of these engines, for the reason, already stated, that the engine need never be reversed. The propeller shaft, H, is, of course, vertical.

The air and circulating pumps for the condenser are independent. There are four cylindrical tubular boilers, with an aggregate heating surface of 4,600 square feet.

The question of how the Alarm herself would fare against the heavy guns of a modern ironclad at close quarters is really of little moment. As we have shown, it would require several hard hits delivered in a number of different places to cause her to sink. All her vulnerable parts are entirely submerged, and any injury to her engines, etc., must come through her steel-plated deck, at which no projectile can be fired other than at a sharp and consequently disadvantageous angle. Probably a second torpedo from the Alarm would not be necessary to insure the destruction of any war vessel now afloat. At the distance under water at which she explodes her mines, no plating is ever affixed to vessels; and the crushing-in of their timbers must inevitably follow the explosion. If the torpedo boat should become fastened in her enemy and go down with her, or succumb to a near fire, the loss would not be on our side. Lives are to be lost in war in any event; and if, by the sacrifice of a torpedo vessel costing a couple of hundred thousand dollars, we ever sink a great ironclad worth a million, the life mission of the former craft may well be deemed as fulfilled.

The Alarm was built according to designs prepared by Admiral David D. Porter. She is an admirable sea boat, rising lightly and buoyantly to the largest waves. Her ventilating arrangements are excellent, and the quarters of both officers and men remarkably large and commodious. Her present commander is Lieutenant Frederick H. Paine, U.S.N., to whom we are indebted for the greater part of the facts here presented.

Fig. 6

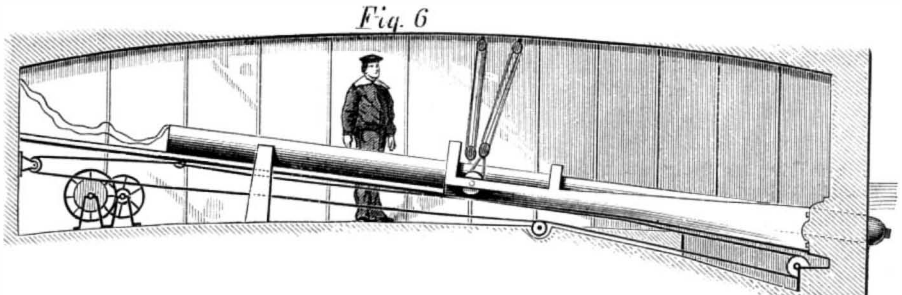
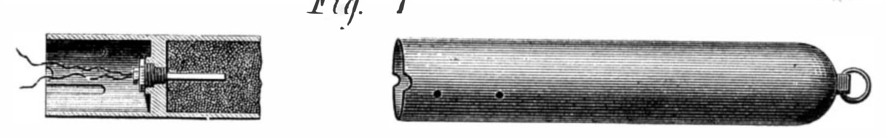


Fig. 7



ADMIRAL PORTER'S TORPEDO SPAR.

British Patent Documents.

The clumsiness of the British Patent Office is exemplified in the form of its patent documents and the ponderosity of its printed copies. Although other nations discarded years ago the feudal method of sheepskins and dangling seals, the Britishers still adhere to it. A British patent document consists of an animal skin, 2½ feet long and 2 feet wide, filled with a long rigmarole reciting the titles of Her Majesty, and what she hath done by these presents. Scattered here and there on the margin of the skin are certain scrawls, supposed to be the official signatures of my lord this or his highness that, each of whom receives from twenty to fifty thousand dollars a year for suchlike exhaustive labor. The skin is further authenticated by the royal seal, consisting of a large disk of wax, bearing an embossed effigy of Her Majesty, seated on horseback, carrying a club or scepter. This beeswax seal is six inches in diameter, one inch thick, set in a round tin box, and attached to the skin by cords. The weight of the document, with seal and appurtenances, is two pounds four ounces avoirdupois. The object of this formidable affair is to let the common people know that the government has granted a patent to Smith for a birdcage or a flat iron.

In addition to the patent, the government also prints the drawings and specifications of each patent; and these are also unnecessarily spread out, covering a large area of paper. So bulky is the large majority of these copies that the government has been compelled to curtail; a smaller and more compact style of printing has lately been adopted. An order has also recently been given to destroy nearly all the copies of printed specifications of expired patents: 250 tons of these valuable documents have already been carted away, and the process of destruction still continues. The only reason given for this is that it is difficult to find storage room, and it has, therefore, been determined to reduce the stock of copies to five apiece. The amount which these have cost to print is over $3,500,000, more than that sum having been spent in this way since 1852, when the Patent Law Reform Act authorized the printing of specifications. Large numbers have, of course, been given away from time to time, and still greater numbers have been sold; but the stock which still remains is a very large one, and by far the greater part of it is in constant demand. This wholesale destruction of public property is causing bitter complaints among the patent agents and consulting engineers who have been informed of it, as it will give much additional trouble to those employed in patent cases. The usual practice has been to purchase copies of the specification required for such purposes, and the agents were then able to work in their own offices. It will now be necessary for them to do much of their work at the Patent Office Library. It is also stated that the library of the Patent Office is to be "weeded" in order to give more space.

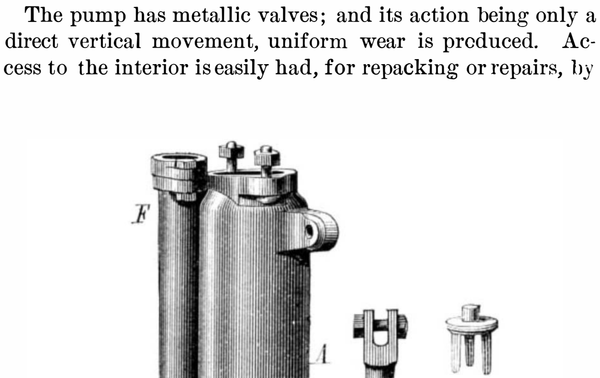
ROBAUGH'S LITTLE GIANT PUMP.

We illustrate herewith a new hand pump adapted for almost any purpose where such a machine is required. It combines the action of a lifting and a force pump, supplying a continuous stream of water, and working, we are informed, easily and regularly.

The various parts are represented separately in the engraving. A is the outer or main cylinder, the upper portion of which is enlarged. Extending down nearly to the bottom of said enlarged part is an interior tube, B, in which works a piston, C. Attached to an extension of the rod of piston, C, is a second piston, D, which moves in the smaller portion of tube, A, both pistons operating simultaneously. In piston, D, is an upward opening valve; and in the portion, E, by which the body of the pump is connected to its supply tube, is an ordinary conical valve. F is the discharge pipe.

The water is raised by the upstroke of the lower piston, through the bottom valve, into the lower part of the main tube. Thence it passes on the down stroke, through the valve in said lower piston, into the upper part of the main tube until the same is nearly filled. Each up and down stroke forces, then, by the joint action of the pistons, the water through the discharge pipe in a steady stream

The pump has metallic valves; and its action being only a direct vertical movement, uniform wear is produced. Access to the interior is easily had, for repacking or repairs, by



simply removing the bolts from the top of the pump, and lifting out the inside tube with piston, without disturbing either suction or discharge pipe. It is well adapted for windmill purposes, on account of equal pressure of the pistons on the up and the down stroke. It cannot freeze up, and may be operated in either deep or shallow wells.

Patented April 21, 1874. For further particulars, Messrs. Cook & McCue, general agents, of Ottumwa, Iowa, may be addressed.

Japanese Mushroom Culture.

The mushroom is gradually leaving its position as a luxury; and if the interest, which has been manifested in its cultivation in this country and in England of late years, continues, we may look to see the fungus as plentiful and as cheap in our markets as any other vegetable now in common use. Dried mushrooms, we learn, already constitute an important staple of Japanese and Chinese trade.

The best of the edible species of mushrooms of these countries are known as "matsu-take" and "shü-take." The difficulties attendant on preserving the former kind almost exclude them from the market for export; for not only do they decompose very rapidly, but even when successfully dried they are nearly tasteless, and thus useless in cookery. The shü-take species, however, have this peculiar excellence, that, though they are all but tasteless in their raw state, when they are dried they have an extremely fine flavor. The quantity that grows naturally on the decayed roots or cut stumps of the shü tree is not sufficient to meet the demand felt for them, consequently much skill has been brought to bear on their cultivation, notably by cutting off the trunks of the shü and other trees and forcing the growth of the mushroom on them. The shü tree grows abundantly in warm places having a southeasterly aspect; it attains to a height of about eighteen or nineteen feet. It has a long narrow leaf, thin and stiff, the front surface of a deep green color, the back of a brownish tint and glazed. The tree is an evergreen, the fruit (acorn) small, with a rough cupule. The acorns are steamed and eaten. The wood of the tree is used in the making of boats' oars, also for fuel and charcoal. Another oak, the kashiwa, from which mushrooms are obtained, is also plentiful in warm localities, and attains to a height of thirty or forty feet. The leaves are used in cookery, and the wood is in great demand for divining sticks, for which it is considered the best. The donguri, another species, is to be found all over the country; it grows to about eighteen or nineteen feet, has very thick branches and dense foliage; the leaf is slightly oval and slightly wrinkled. The fruit (acorn), after being pounded and steeped in water, is made into dumplings and eaten in this form. The wood is much used for boat-making and also for carts. Mushrooms are obtained from any of the above in the following manner: About the beginning of autumn the trunk, about five or six inches in diameter, of any one of these trees, is selected and cut up into lengths of four or five feet; each piece is then split down lengthwise into four, and on the outer bark slight incisions are either made at once with a hatchet or the cut logs are left till the following spring, and then deep wounds seven or eight inches long are incised on them. Assuming the first course to have been pursued, the logs, after having received several slight incisions, are placed in a wood or grove where they can get the full benefit of the air and heat. In about three years they will be tolerably rotten in parts. After the more rotten parts are removed, they are placed against a rack in a slanting position, and about the middle of the ensuing spring the mushrooms will come forth in abundance. They are then gathered. The logs are, however, still kept, and are submitted to the following process: Every morning they are put in water, where they remain till afternoon, when they are taken out, laid lengthwise on the ground, and beaten with a mallet. They are then ranged on end in the same slanting position as before, and in two or three days mushrooms will again make their appearance in plenty.

In Yenshin the custom is to beat the logs so heavily that the wood swells, and this induces mushrooms of a more than ordinarily large growth. If the logs are beaten gently, a greater number of small-sized mushrooms grow up in succession. In places where there is a scarcity of water, rain water should be kept for steeping the logs in. There is yet another plan. The cut logs are at once buried in the earth, and in a year's time are dug out and beaten in the manner as above described. The mushrooms thus grown are stored in a barn on shelves ranged along three sides, with braziers lighted under. Afterwards they are placed in small boxes, the bottoms of which are lined either with straw or bamboo mats. These boxes are then ranged on the shelves and all approaches carefully closed. An even degree of warmth is thus diffused. The boxes ranged on the upper or lower tiers are constantly changed, so that the contents of each are thoroughly dried. Another mode of drying is to string the mushrooms on thin strips of bamboos, which are piled together near the brazier; the heat is well kept in by inverting a closely woven basket over them. Dried mushrooms are much esteemed in China, and they are also largely consumed by Japanese either as a dish by themselves or as a condiment with other dishes. Dried mushrooms retain their flavor for a great length of time, and thus bear transport to any distance very well.

A New Use for Glycerin.

Physicians and dentists who use small mirrors to explore the throat and teeth, astronomers employing large mirrors out of doors, all who have occasion to use spy glasses in foggy weather, and especially those near-sighted persons who cannot shave themselves without bringing their noses almost in contact with the looking glass, are doubtless aware that the luster of mirrors becomes soon dimmed by the breath, by dew, and generally by water in a vaporous state. The way to prevent this troublesome fog is simply to wipe the surface of the mirror before using with a rag moistened with glycerin. By this substance, watery vapor is completely taken up.

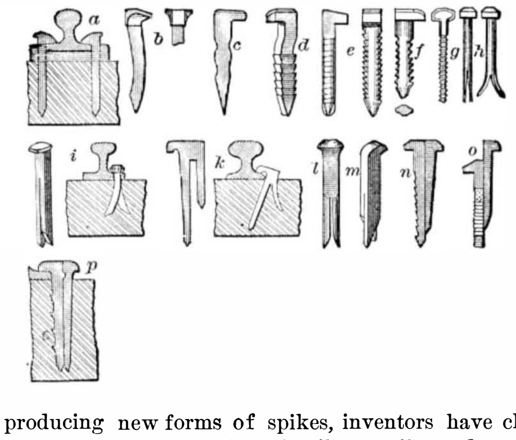
SPIKE MACHINERY.

We extract this week from Knight's "Mechanical Dictionary"* an interesting series of illustrations representing various forms of spikes and the mode of manufacturing the same.

SPIKES

are nails, above the tenpenny size. Twelvepenny spikes are 3¼ inches long, and weigh 45 to the lb.; the succeeding sizes are sixteenpenny, twentypenny, and thirtypenny, and then follow the railroad spikes, of large size and various patterns.

Fig. 1.



In producing new forms of spikes, inventors have chiefly adapted them to the securing of railway rails; and the commonest expedient for increasing the holding power is to serrate the edge of the spike, or to construct it so that its points will spread apart on its being driven home. In Fig. 1 we illustrate several forms of spikes.

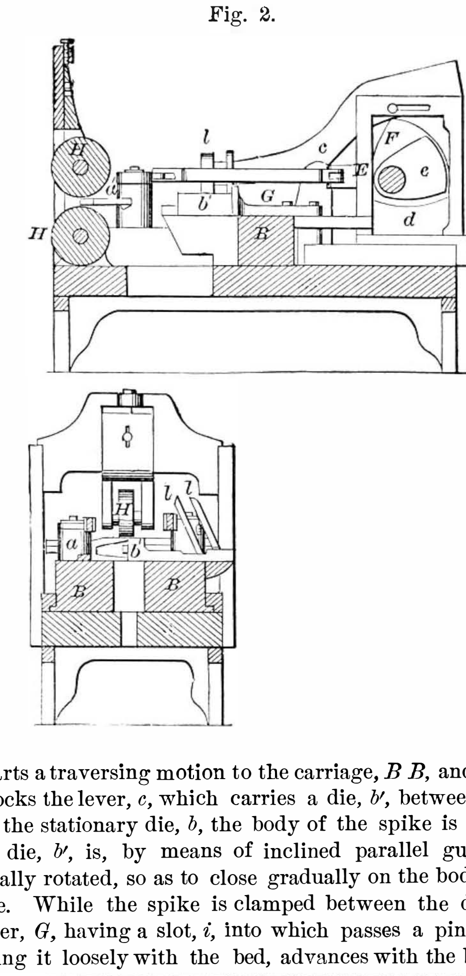
a shows a rail composed of an upper rail and a grooved bedding-piece, secured by spikes of the ordinary kind. *b* is curved, to cause it to bear more strongly against the rail, and the head has a shoulder at the back, which comes in contact with the wood before the hooked forepart touches the flange of the rail, in order to lessen and equalize the strain on the head, and prevent its being broken off in driving. In *c*, the sides are corrugated, so that the wood may swell into the indentations, but not hold the spike too tightly to prevent its being drawn. In *d* a part of the shank has a winding surface, so as to cause the spike to twist, engaging the serrations in the wood. In *e*, the spike has winged point and spiral barbs upon two of its edges. In *f*, the shank has a serrated wing on each side. *g* is a screw spike, having the under side of its head so beveled as to bear firmly on the flange of the rail. *h i k l m* are split spikes, having prongs which diverge when driven into the wood. *n o p* are spikes having serrations on one side, and held firmly by keys; in the latter a projection on the spike enters a notch in the key to keep the key in place after being driven.

For the manufacture, the

SPIKE MACHINERY

represented in Figs. 2, 3, and 4 is used. In Fig. 2, the rod is fed between the rolls, *H H*, the upper one of which rotates in adjustable and the lower in fixed bearings, and is presented to the action of a pair of cutters carried upon two vertical posts, *a a'*, which, by means of a cam, *d*, and connections, are opened to receive the rod, and closed to form the point of the spike and cut it off. A cam, *e*, turning in a yoke, *E*,

Fig. 2.

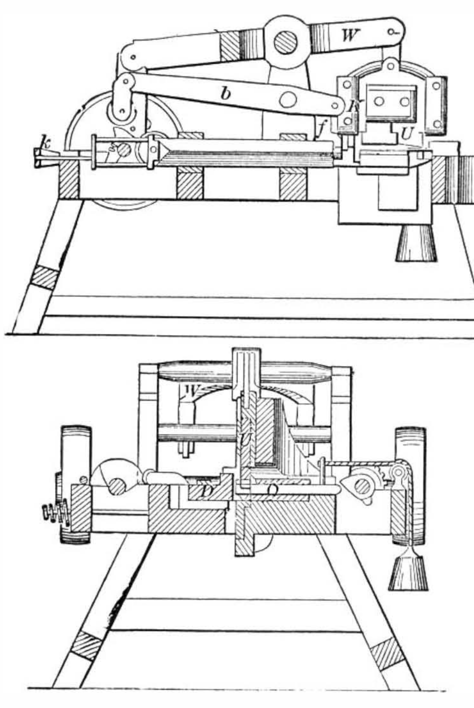


imparts a traversing motion to the carriage, *B B*, and a cam, *F*, rocks the lever, *c*, which carries a die, *b'*, between which and the stationary die, *b*, the body of the spike is formed. The die, *b'*, is, by means of inclined parallel guides, *l l*, partially rotated, so as to close gradually on the body of the spike. While the spike is clamped between the dies, the header, *G*, having a slot, *i*, into which passes a pin, *i'*, connecting it loosely with the bed, advances with the bed, and is brought in contact with the end of the blank, which projects beyond the dies, at the same time turning on its pivot, so that its pressure is first applied to one side of the head, and is gradually brought to bear squarely upon it at the completion of its stroke.

* Published in numbers by Messrs. Hurd & Houghton, New York city.

In Fig. 3, a gage, *K*, is adjusted to determine the length

Fig. 3.

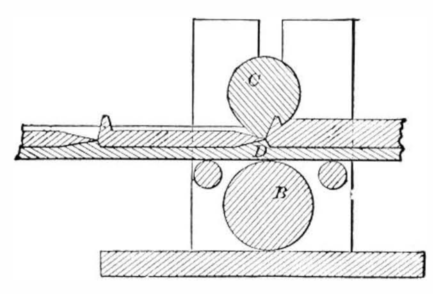


of the spike or bolt, which is first grasped between two moving dies, *C D*, that shape the body. A vertically moving die, *U*, operated by the lever, *W*, forms the point, and a second vertically moving die, *f*, operated by the lever, *b*, the head. The levers, *W b*, have pivoted arms, which are turned down, so as to be acted on by cams when spikes are to be made, but are lifted out of contact with the cams in making plain bolts.

A cutter, *O*, advanced by a cam and retracted by a cord and weight, or a spring, severs the blanks.

In Fig. 4, the bed, *D*, is traversed by gearing from the

Fig. 4.



roller, *B*, which also has gear connection with the cam roller, *C*. The bed is grooved to form the lower half of the spike, the upper half being formed by the cam roller, which has a transverse notch that shapes the head as the rod enters between it and the table, and the point is tapered as the spike emerges from between them. Small supporting rolls beneath steady the table and prevent it from tilting.

Slide Valve Friction.

We published in our SUPPLEMENT, No. 62, a communication on the subject of friction of plain slide valves, by Mr. John W. Hill, M.E., taken from the columns of the *Engineering and Mining Journal*. The writer quotes from an article in the SCIENTIFIC AMERICAN of September 20, 1876, wherein was contained a brief calculation as to the loss due to friction of an unrelieved valve, wherein it was stated that, under circumstances in nowise phenomenal, a total waste of 58 per cent. of the "power" of the engine would obtain. This error is so obvious that it scarcely needs the care which the above writer has taken to refute it; and we can only regret that our attention was not directed to the subject at an earlier date, in order that we might have more promptly made this correction. The loss referred to is clearly a very much less percentage of the power.

In any journal such as the SCIENTIFIC AMERICAN, where a large staff of contributors, selected on account of their superior attainments in the various branches of Science and Mechanics, is constantly employed, the editor is naturally apt to rely in some measure on the special knowledge of the writers; and for this reason their contributions are, as a rule, not subjected to close analysis, as experience proves the same rarely to reveal a material error. Mr. Joshua Rose, who is now in fault, is so able an expert in mechanical matters, and one usually so correct in his opinions, that the above inadvertence on his part will scarcely vitiate an otherwise excellent article.

A CONCRETE WALL.—The United States Government has built a concrete wall at Minneapolis, Minn., for the protection of St. Anthony's Falls. The wall, which cost $900,000 is 1,875 feet long, 40 feet high, 7 feet wide at the base, and 4 feet at the top.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American :

Since my last a bill has been introduced by Mr. Wadleigh into the Senate "to cure defects in certain letters patent for inventions and designs," which is as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That all instruments purporting to be letters patent of the United States for inventions and designs heretofore issued under the seal of the Patent Office, and signed by the Secretary of the Interior, and countersigned by an Assistant Commissioner of Patents, under the title of Acting Commissioner of Patents, when there was no Commissioner of Patents, be, and be held to be, valid and of the same force and effect as if such Acting Commissioner of Patents had been Commissioner of Patents, and had countersigned as such.

This bill is supposed to have reference to patents signed by Assistant Commissioner Doolittle during the time when there was no Commissioner, before General Spear was confirmed.

Another Senate bill, which was introduced by Mr. Dawes, will, if it becomes a law, extend the wood pulp machine patent of Henry Voelter, now about to expire, for seven years longer, thus making its duration twenty-eight years.

Senator Boutwell has presented a petition from E. N. Horsford, for an extension of his patent on making baking powder.

Senator Logan presented resolutions of the Illinois legislature instructing the senators and representatives from their State to use their utmost efforts to secure such amendments to the patent laws of the United States as will allow any person to use any patented invention upon executing a bond in such sum and with such security as the Circuit Court of the United States for the District, in which such use is to be made, shall direct, such person to pay to the owners of such inventions a proper license fee for the use of the same: which bond shall be filed in the office of the clerk of said court, and that in all cases the measure of the license shall be such sum as will give the inventor reasonable compensation for his time, labor, ingenuity, and expense, not in any case to exceed the fee fixed for such use in contracts made by the inventor or owner, and such license fee to be the measure of damages in all actions and proceedings for the infringement of patents, and no other recovery for damages or profits to be allowed. The resolutions were read and referred to the committee on patents. This is substantially the style of legislation that the Grangers tried to push through Congress some two or three years since, when a bill was introduced, by Mr. Sayler I believe, with provisions very similar to the above.

In the House, Mr. Vance, on the part of the committee on patents, reported adversely on the application of Mr. Horace Woodman for an extension of his patent on stripping cotton cards; and the same gentleman reported favorably on the application of E. A. Leland for an extension of his patent on paint cans.

In accordance with the request of the Smithsonian Institute, mentioned in my last, a bill has passed both houses of Congress appropriating $250,000 for the erection of a fireproof building, 300 feet square, on a plan designed by General Meigs, for a national museum, to be built on the Smithsonian grounds, for the exhibition of the various contributions to the Smithsonian Institute of the foreign commissioners at the Centennial. If General Meigs succeeds in putting up a fireproof building in this city of that size for the price stated, it will be the cheapest building ever erected, that Uncle Sam had to pay for.

The Agricultural Department has also had various donation from different commissioners, and $2,000 have been allowed it for erecting a gallery in its museum for their proper display. Thirty thousand dollars have been appropriated to the same department for seeds, to be distributed in that portion of our country that has been ravaged by grasshoppers.

A short time since, the President sent a memorial from some of your prominent citizens, asking for a site to be given on one of the islands in New York harbor for the erection of the Bartholdi statue of Liberty, and to-day Mr. Hewitt reported from the committee on foreign affairs a resolution authorizing the President to accept the statue when presented, and donating a site for its erection.

Mr. E. M. Marble, of Michigan, has been nominated by the President for the position of examiner-in-chief, who, it is reported, is to take the place of Mr. Woodward on the Board of Appeals.

Rear Admiral Goldsborough, commandant of the Navy Yard in this city, was buried to-day. This makes the sixth of his high rank who has died within a little more than a month. He was an officer of great experience, having joined the navy as a midshipman in 1812, and thus served his country for a period of over sixty-five years.

Some time since, Congress appropriated $200,000 to complete the Washington monument in this city; but before expending this amount it was determined to ascertain whether the ground was solid enough to bear the immense weight which would be placed upon it if the monument was erected in the style contemplated in the design, and about $2,500 have been expended in boring, etc., to test this important matter. The examination is said to have developed the fact that the completion of the structure in its present site is impracticable, and it is therefore suggested that the part of the monument now erected be taken down and erected in another portion of the city in a different and, it is to be hoped, a better style, one that will not be thought, like the present nondescript structure, to be a shot tower or glasshouse, and one that will be an honor to him whose virtues it is intended to commemorate. OCCASIONAL.

The Iron Plow.

To the Editor of the Scientific American:

I notice in the "Scientific American Handbook," an account, with portraits, of some distinguished inventors: among others Jethro Wood, whom you style the inventor of the modern cast iron plow, patented 1814; and you add: "Previously to this time, the plow was a stick of wood, plated with iron."

This is a mistake. Joseph Smith established a plow factory and made and sold plows at Smithtown, on the Delaware river, in Bucks county, Pa., in 1805. I have before me an account of the number made each year to 1814: In 1805, 20 plows; in 1806, 50; in 1807, 70; in 1808, 88; in 1809, 83; in 1810, 83; in 1811, 141; in 1812, 196; in 1813, 285; in 1814, 239.

These plows were made with cast iron moulds and land sides, and some had cast shares. They were made under a patent granted to Robert Smith, or to Robert Smith and Joseph Smith. The old deed is still in existence, but I have not seen it for a long while.

When Jethro Wood was advised by my grandfather, Joseph Smith, of what he had accomplished, Mr. Wood declared him to be a pirate. J. HESTON SMITH.

Lambertville, N. J.

The Balestrieri (?) Reflector.

To the Editor of the Scientific American :

It is but fair that this, like every other question, should be decided in accordance with the facts in the case. In 1857, I made that reflector, as complete as an invention as it is today. The form, number of rings, etc., were precisely as they appear in your engraving. This I am prepared to prove by a number of living witnesses.

In a communication to you, written, I think, in January, 1870, and published by you in February, 1870, I stated that, 12 or 15 years previously, I made this apparatus, and that it proved a powerful reflector. DAVID SHIVE.

Allentown, Pa.

The Commercial Value of Scientific Knowledge.

At the annual meeting of the Birmingham and Midland Institute, England, the chairman, Mr. J. Thackray Bunce, in the course of his address spoke at some length on what we may term the commercial value of scientific knowledge, or on the value of that kind of information to those engaged in manufactures and in industrial pursuits of all kinds.

"By a study of Science we do not mean study in its highest and best sense, a search after knowledge for its own sake, but that amount of study which is undertaken for the advantage it gives in competition with other manufacturers or professionals, and with other nations. As a nation we must be workers, producers; we cannot afford to wander about the by-ways of learning for the mere pleasure of gaining knowledge; we must, or the great majority of us must, tread the broad roads already graded and laid out by previous workers, picking up all the information we can, and storing it in orderly fashion in our mental wallets for use by and by. Others amongst us—a gradually increasing number—will strike out paths for themselves across untrodden fields, and seek for new treasures with more or less of success. We cannot all make researches and experiments, nor are we all fitted for the work; but we can all learn something of what is known already, and so prepare ourselves to take advantage of and utilize the discoveries of scientific investigators. Every artisan in the kingdom can, if he will, make himself acquainted with the principles on which the practices with which he is familiar are based, and there is no manufacture and no industry in the country which would not be benefited by such knowledge on the part of its workers. In a few years now a considerable portion of our workers will be men who are more or less well grounded in theory; they are receiving a technical education, and when they enter the ranks of the industrial army they must, in the natural order of things, occupy prominent places. Even now Whitworth scholars, at present a comparatively small number, make their way readily to the front, and in competition with mere rule-of-thumb men gain an easy victory. This patent fact will shortly make an impression on the artisan world, and in a few years we shall see that technical education will be regarded as a necessary part of the training of our mechanics and other workers.

"It will be readily understood how important is the possession of both theoretical and practical knowledge by the worker, for, while the scientific man is capable of pointing out improvements in processes, he is so placed in the majority of cases that he is unacquainted with the methods of working; on the other hand, the practical man, looking upon his processes as trade secrets, and being unacquainted with their defects, never seeks the aid which a knowledge of Science places at his disposal." Many instances of a persistence in wrong methods or in wasteful processes might be collected, but one alluded to by Mr. Bunce will sufficiently indicate the commercial value of a knowledge of Science. "Birmingham, as is well known, reckons amongst its most important industries the manufacture of jewelry, and in the processes of coloring and refining gold and silver considerable waste of the valuable metals was, and probably is still to some extent, incurred. In the process of coloring gold articles a minute portion of the valuable metal is washed off; but owing to a want of acquaintance with the chemical processes involved, only a percentage of the gold is recovered from the washing waters. Thus, in recovering silver from the liquor, the usual process is to throw it down as chloride by means of common salt, but the workmen and the employers, being unaware of the fact that an excess of salt redissolves a portion of the silver, have for years been throwing away a considerable quantity of silver. On the authority of Mr. Woodward, the Professor of Chemistry to the Institute, it is stated that one firm has effected a very material saving in this process entirely by the knowledge gained by one of its members while attending the classes of the Institute. Here we have a definite instance of the commercial value of a knowledge of Science; but, if the proposition were not obviously true and required to be demonstrated by evidence, many instances might be gathered together."

We have thus drawn attention to a subject, says the *English Mechanic*, which, in the course of the present year, will be much talked of in the principal seats of industry throughout the country. In speaking of the value of Science from a merely commercial point of view, we have endeavored to convince the masses of its importance to them as a matter of business, but we know that many of those who commence the study of Science for the less noble purpose will be induced to pursue knowledge for its own sake, while none can be utterly insensible to its refining and elevating influences.

Do Snakes Catch Fish?

A. W. Chase, of the United States Coast Survey, describes, in a note to the editor of the *Popular Science Monthly*, a contest which he and a brother officer witnessed in 1867 on the Purissima, a small trout stream about twenty-four miles south of San Francisco:

"We had been fishing on the stream, and came to a high bank which overlooked a transparent pool of water about ten feet in diameter and four feet in depth. This pool was fringed with willows, and had on one side a small gravel bank. The trout at first sight was lying in mid-water, heading up stream. It was, as afterward ascertained, fully nine inches in length—a very desirable prize for an angler. While studying how to cast our flies to secure him, a novel fisherman appeared, and so quick were his actions that we suspended our own to witness them. This new enemy of the trout was a large water-snake of the common variety, striped black and yellow. He swam up the pool on the surface until over the trout, when he made a dive, and by a dexterous movement seized the trout in such a fashion that the jaws of the snake closed its mouth. The fight then commenced. The trout had the use of its tail and fins, and could drag the snake from the surface; when near the bottom, however, the snake made use of its tail by winding it around every stone or root that it could reach. After securing this tail hold it could drag the trout toward the bank, but, on letting go, the trout would have a new advantage. This battle was continued for full twenty minutes, when the snake managed to get its tail out of the water and clasped around the root of one of the willows mentioned as overhanging the pool. The battle was then up, for the snake gradually put coil after coil around the root, with each one dragging the fish toward the land. When half its body was coiled it unloosened its first hold and stretched the end of its tail out in every direction, and finding another root, made fast, and now, using both, dragged the trout out on the gravel bank. It now had it under control, and uncoiling, the snake dragged the fish fully ten feet up on the bank, and I suppose would have gorged him. We killed the snake and replaced the trout in the water, as we thought that he deserved liberty. He was apparently unhurt, and in a few moments darted off. That the water-snake of our California brooks will prey upon the young of trout, and also smaller and less active fishes, I have noticed, but never have seen an attack on a fish so large or one more hotly contested."

Dried Potatoes.

A German journal thus describes the manufacture of "dried potatoes," as conducted at Carsten's works in Lubeck: The potatoes are peeled with the hand, and cut into disks by a machine. These are put into a basket, and this into a boiler, where the potatoes are nearly, but not quite, boiled. The disks are next put on wire frames in a dry oven, where they are dried quite hard. It is important to preserve the color of the potatoes, and to prevent their turning gray, as they would by the above process alone. The material, after slicing, is treated with cold water, to which has been added one per cent of sulphuric acid, or one to two per cent of muriatic acid. Then it is washed in pure water, and the drying proceeds. The preparation obtained, which has lost none of its starch, is of a slightly citron-yellow tint, and transparent like gum. Boiled with water and a little salt, it is said to resume the natural color and fibrous structure of potatoes, and is not distinguishable in taste from the newly boiled vegetable.

Adulterating Rubber.

The use of the salts of barium for adulterating goods sold by weight is on the increase. Some rubber goods have been found with these salts in the material, which on combustion left as much as 60 per cent of ash, pure rubber leaving only 2·5 or 3 per cent. The adulterated goods cracked and lost their elasticity.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—NO. XXII.

BENCH WORK.

Turning now for a space from examples requiring so much lathe work, we come to deal more particularly with the bench and the devices and operations connected with it.

A good bench is a great assistance to a pattern maker. It should be perfectly true on its upper surface, which is best made of hard wood and covered with a coat of varnish to prevent dust or drippings of glue from adhering to it, so that it is always cleanly in appearance. The vise, when screwed close to the bench, should come level with its top, and the butt or stop for work to press against should be so constructed that its height may be readily altered, as this will have to be done perhaps fifty times a day. In the absence of a well contrived mechanical stop, which always admits of re-adjustment without stooping, I should recommend a stop of wood made by placing two wedges together, as shown at A and B, Fig. 158. A pin is fixed tightly in the wedge, A, which slides in a groove in B for a short distance; this prevents the wedges from falling apart when loosened. A light tap on B loosens, and one on A tightens, the stop. The ordinary contrivances used at the bench, in addition to the workman's tools, are the shooting board (already described), the mitre box, and the bench hook. The mitre box is a contrivance to enable a workman to saw mouldings, pipe patterns, etc., to an angle of 45° ; it is simply a trough with saw cuts made at the required angle. The stuff to be cut is laid in the trough and pressed to one of its sides, the saw being guided by the saw cut. The bench hook is a piece of wood sawn to the shape shown in Fig. 159, and is used as a butt; for timber, in cross-cutting work, should not be sawn directly on the bench.

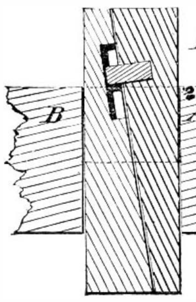


Fig. 158.

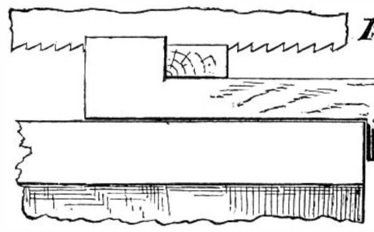


Fig. 159.

Figs. 160, 161, and 162 are illustrations of different methods of jointing pieces of wood together so as to form a square or any angle. Fig. 160 represents a tenon and mortise joint, made as follows: The two pieces, A and B, having been planed or otherwise made to size as required, are marked for the position and length of the mortise in one case, and for the length of the tenon in the other; both pieces are now gauged with a mortise gauge, both being marked alike; and then from the face side we mark a tenon or mortise of the size required, which is generally a third of the thickness of the stuff. Where the mortise approaches the end of the piece, a provision has to be made to insure strength by adding the extension denoted in Fig. 160 by the dotted lines. This practice, however, though often adopted in carpentry, is rarely admissable in pattern work; and in its stead, the tenon or the piece, B, is diminished in width, as shown in Fig. 163, the mortise being made to correspond. In order to avoid breakage during the cutting of the mortise, the piece, A, Fig. 160, is got out an inch or two longer, which excess is sawn off after the glue is dry; an excess of a $\frac{1}{4}$ to $\frac{1}{2}$ an inch should also be allowed on the tenon, as it is necessary to chamfer off the corners of the tenon so that in driving it may not damage the mortise. To prevent the tenon from, in time, working out, the mortise is slightly tapered; that is, made wider on the side remote from the piece carrying the tenon. Then the tenon is provided with two saw cuts, one on each side, near the edge; and after being driven home, wedges are driven into these cuts, thus locking the joint. A joint more commonly in use among pattern makers is the half lap shown in Fig. 161, which has been already described. When this joint occurs away from the end of the pieces, the mortise need not, and should not, extend through the piece. This joint, besides being glued, may be fastened with screws, or, if very thin, riveted with short pieces of lead wire.

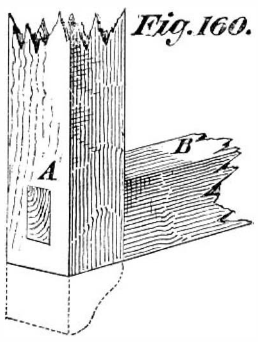


Fig. 160.

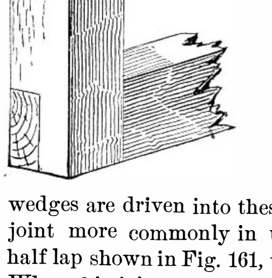


Fig. 161.

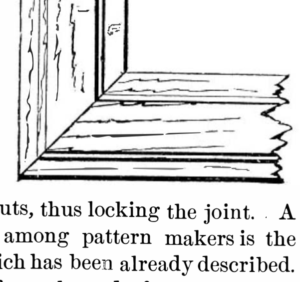


Fig. 162.

A very superior method of jointing is the dovetail, shown in Fig. 164, which is serviceable for connecting the ends and sides of a box, or any article in that form. The strength of the corner formed in this way is only limited by that of the material itself; therefore it should be preferred when available in making standard patterns, or for work too thin to admit nails or screws; the corner formed by this joint is not limited to 90° or a square, so called, but may form any angle. Nor is it imperative that the sides or ends of the box or other article be parallel. They may incline towards one another like a pyramid; a mill hopper is a familiar example of this. If it be required to dovetail a box together, get out four pieces for the sides and ends, to be of the full length and width of the box outside, respectively. They are to be planed all over, not omitting the ends. The gauge, that is already set to the thickness of the stuff, must now be run along the ends, marking a line on both sides of each piece. Then mark and cut out the pins as on the piece, A; the dovetail openings, in B, are traced from the pins in A. The pieces, having been tried and found to go together, are finally brought into contact and held in their places with glue.

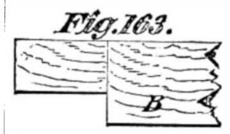


Fig. 163.

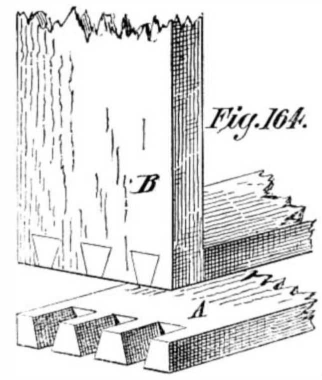


Fig. 164.

Fig. 162 is a mitre joint, the only one serviceable to mouldings, pipes, and other curved pieces. It is not a strong form of joint, and is only used where the preceding kinds are inapplicable. It is made with glue, the pieces having been previously sized; and as an additional precaution, if the work will admit, nails, brads, or screws are inserted at right angles to one another.

As an example, to make the pattern for a pillow block, as shown in Fig. 165. This pattern will be more easily moulded with the base up; that is to say, it will lie in the sand in the reverse position to what it is drawn in Fig. 165. Prints will be required for the bolt holes, square prints for the recesses in the block intended to be cored out to receive the heads of the cap bolts, and round prints on the tops of the cheeks and oval prints on the base. We first plane a piece for the base, B B, to the correct size, allowing $\frac{1}{10}$ inch to the foot for the contraction of the casting in cooling. We next draw center lines upon it on both sides. It must now be observed that a hollow or filleted corner appears where the cheeks of the block meet the base; and, further, that the recess in the block to receive the brasses is drawn to a depth coinciding with the height of the hollow or fillet. It will be advisable, therefore, to prepare a piece of the length from C to C, and to shape the ends to the outline of the cheeks, and, forming in this piece all the fillet, the cheeks may next be prepared of a thickness from the line, A to D. These must be strongly fastened, and are best mortised clear through the base, and glued fast. Two semicircular pieces must be turned for the portions outside the lines, A A, and three-cornered pieces must be fitted in the square recess to make it octagonal as required. Nothing now remains but to attach the core prints and make a suitable core box. A half box will suffice for the cap bolt holes, and a whole one for the holes in the base, as the cores for these latter will stand on end. To make the cap, we take a piece of timber large enough to make that portion of the cap that is above the line, C C; and we line or mark out the form of the cap on both sides (using a center line to make the marking on the two sides correspond), and pare away the surplus wood down to the lines. The pieces below the line, C C, are to be afterwards glued and nailed on. It is advisable to cut out a recess in the top of the cap, as shown in Fig. 166 at A B, to afford convenience to the machinist in using the wrench upon the nuts. Fig. 167 is a sectional view of a pattern for the brasses; and this pattern requires great care in its making, for the following reasons: Brasses of this kind, and of a size not larger than is required for a journal about ten inches in diameter, can be fitted in much quicker by chipping and filing than by any other method; and in any event, a great deal of labor and metal can be saved by constructing the pattern of the necessary shape. Since, however, to give the required shape without the reasons therefor would not convince the reader of the correctness of the method, I will fully explain the two. It has been stated in former remarks that brass castings are smaller than the patterns from which they are cast by an amount of $\frac{1}{8}$ inch per foot, which is due to the contraction of the metal in cooling. Now, in addition to this contraction, the casting of a brass also contracts across the bore. Suppose, for example, that, in Fig. 166, A A represents a locomotive axle box, and that B represents the brass for the same, the two being shown in section, while C represents the casting for the brass. Beginning, then, with the casting, C, we have the following considerations: The diameter of the brass across D will be less than it should be, because such castings always close in that direction more than is due to the contraction in cooling. As a consequence of this, the top of the bevels, as denoted by the dotted line, E, becomes less than it should be; and when the brass is fitted on the sides and let down in the box ready to fit on the crown and on the bevels, the bottom of the brass will bed and the bevels will not, as shown in the illustration. Now, supposing the angles to be at the top $\frac{1}{16}$ of an inch from the bevels of the box, then it will require about $\frac{1}{8}$ of an inch to be taken off the bottom of the brass to let the sides come to a fit, whereas if, when the bevels of the brass contact with the bevels of the box, the bottom of the brass were $\frac{1}{4}$ inch from the bottom of the box, $\frac{1}{16}$ inch taken off the bevels would let the bottom come home. It is then easy to see that the pattern maker should make the pattern so as to allow for the shrinkage across D, and at the same time insure that the bevels of the brass shall contact with the box before the bottom does. Then by the time that the machinist has taken sufficient off the bevels of the brass to fit them to the bevels of the box, the crown will come home, and the best way to insure this is to make the bevels of the brass of the same shape as those in the box, and then take a certain amount off the crown face of the brass (G in Fig. 166). What this amount should be depends upon the angle of the bevels; for bevels of 45° the proportions should be, for brasses of two and less inches bore, a full $\frac{1}{32}$ inch; for brasses having a bore of from two to four inches, $\frac{1}{16}$ inch will answer; while, if the bore is from four to seven inches diameter, $\frac{1}{8}$ inch will be a good proportion. If, however, the bevel is greater, these proportions may be increased. This is an important matter, and should never be overlooked or neglected, since it reduces the labor of fitting the brasses by at least one half.

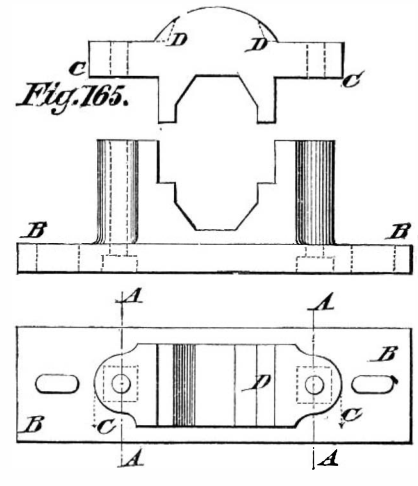


Fig. 165.

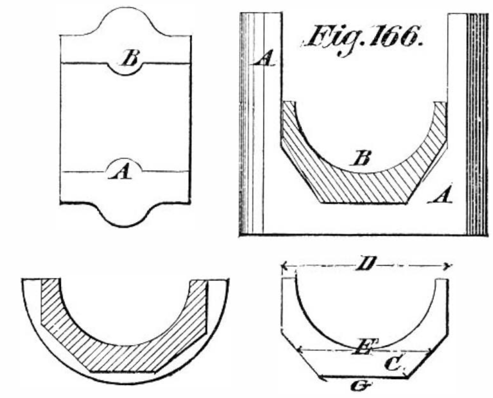


Fig. 166.

Roumanian Amber.

According to H. Biziste, of Bucharest, Roumanian amber differs totally from the German amber found on the shores of the Baltic Sea. Both are the fossil resins of antediluvian trees and agree in chemical composition, but differ in color. German amber is found only of light colors—yellow, white, and pink—while Roumanian amber is red, pink, brown, blue, green, and black. These colors are frequently found mixed in a single piece, and we also have lumps with silver-colored veins and gold specks. On account of this variety of colors, the Roumanian amber is highly esteemed, and the darker and more beautiful pieces are more costly than yellow amber, especially as they are more rare.

German amber is found in the sea or in alluvial earth; the Roumanian amber is only found in mountainous places and highlands, where it is sought and dug out by the peasants. The collection of amber languishes, or, more properly speaking, is never conducted in a rational manner. The peasants being ignorant, and lead only by instinct, dig here and there, wherever they guess that amber is to be found. Formerly, this amber was found in larger quantities, and also in much larger pieces than at present. Biziste is of the opinion that if the search for amber and its collection should be carried on in a scientific manner, by competent judges, it would prove remunerative. At the Vienna Exhibition, Biziste took a diploma for a beautiful collection of cigar holders, ornaments, etc., made of black amber.

SALICYLIC ACID AS A SYRUP PRESERVATIVE.—M. Lagoux, after a series of experiments to determine the minimum percentage of salicylic acid to be added to fruit syrups to prevent fermentation in hot weather, reports the proper quantity of acid to be equal to $\frac{1}{1000}$ the weight of the sugar contained in the syrup.

IMPROVED STEAM ENGINE CUT-OFF.

We illustrate herewith a new and simple cut-off, which is positive in its action, has few parts, has no springs or other appliances requiring constant attention and delicate adjustment, and is controlled by the governor so as to cut off steam, we are informed, at from one sixteenth to seven tenths of the stroke. Fig. 1 is a horizontal section through valve chest and cylinder, and Fig. 2 a view of the cut-off mechanism, all of which, it will be noticed, is easily accessible.

The cut-off valve, A, Fig. 1, works on the back of the main slide valve, so that, when either end of the cut-off is down, the steam is shut off from that end of the slide, which moves freely under the cover of the cut-off valve. The shaft of the cut-off valve, it will be observed, is squared in order to admit of the firm attachment of the valve. Where the shaft passes through the steam chest, it fits into a simple bushing, next to which and within the chest there is a collar. The pressure of steam on the chest then forces the shaft outward, making a steamtight joint between the collar and inside end of the bushing. The use of a stuffing box is thus avoided, and friction is greatly reduced.

Outside the valve chest and rigidly attached to the rock shaft is the rock lever, B. In this are guides (dotted lines) for rack bars, C, upon which bars are formed stops, as shown in Fig. 2. D is the governor rod which, by a short lever, is connected with a pinion which is loose upon the valve rock shaft, and which engages the rack bars, C. It will be evident that any motion communicated to the pinion from the governor will cause the rack bars to advance and recede, and in this way the stops will be moved either nearer together or further apart, in horizontal direction. E is a rod which connects with a bell crank, which is vibrated by an eccentric on the main shaft. This rod moves a sliding bar, F, upon which toes or stops are attached. Inspection of Fig. 2 will show that, as this bar reciprocates, the beveled sides of its stops will come in contact with the stops on the rock lever, B. And as one or the other pair of stops come in contact, the result will be, as the sliding bar continues its motion, that the rock lever will be pushed to the right or left; the valve shaft will thus be vibrated, and consequently the cut-off valve itself will be brought down upon one or the other end of the slide. Now it is clear that the time when this vibration of the cut-off shall occur depends upon the time, sooner or later, when the stops on the sliding bar come in contact with the stops on the rock lever; and if the horizontal distance between the latter is decreased, then this contact will occur sooner, and steam will be cut off earlier in the stroke; while, if it be increased, just the reverse will obtain.

But the distance between the stops on the rock bar depends upon the relative position of the rack bars, C. By slightly converging their guides toward the end of the rock bar, the contact of these stops with those on the sliding bar tends to give the same angular movement to the lever, whether the former are at the outer or inner end of their travel. Then the governor, as already explained, regulates the position of the rack bars, C, and thus controls the action of the device. The inventor points out that the lift of the cut-off valve is very small and need not be more than half the width of the induction port. The outside lap of the cut-off valve is so proportioned in relation to the steam ports in the main slide valve that, when one end of the cut-off valve is down on the back of the main slide, shutting steam off from that end of the cylinder, the pressure on the back of the cut-off valve is equal to the difference of the pressure of the steam in the steam chest and the expanding steam in the cylinder. When the piston has arrived at the end of its stroke, the main slide valve has moved back half its stroke, *plus* the lap and lead, to admit steam to that end of the cylinder; at the same time the main slide has closed the cylinder port at the other end of the cylinder; and its induction port has traveled past the end of the cut-off valve, admitting live steam to the under side of the plate, thus putting the cut-off valve in equilibrium. Consequently the sliding bar, which gives motion to the rock shaft lever, through the toes in the bar and the stops in the lever, has no other resistance to overcome than simply the inertia of the valve, when called upon to move it so as to cut off the steam. The device, we are informed, can be applied cheaply to engines that are now built, or running, and requires but slight alteration to existing patterns.

Patented January 16, 1877. For further particulars relative to sale of patent to shops, States, Territories, or on royalty, address the inventor, Mr. J. Fish, Summit, Union county, N.J.

Fig 1

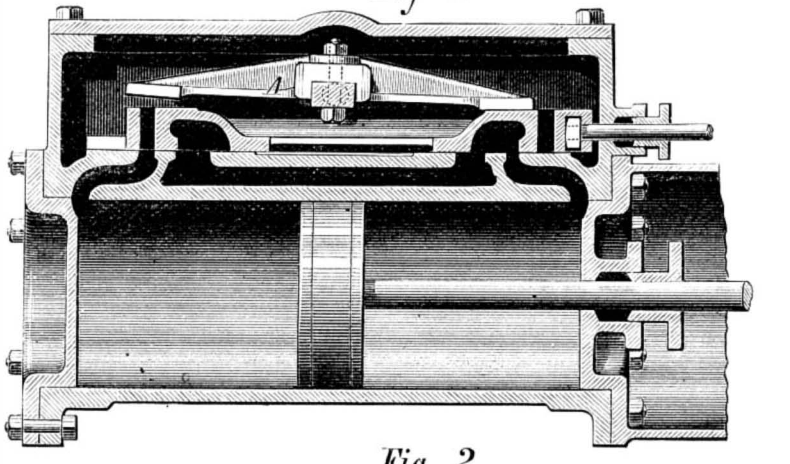
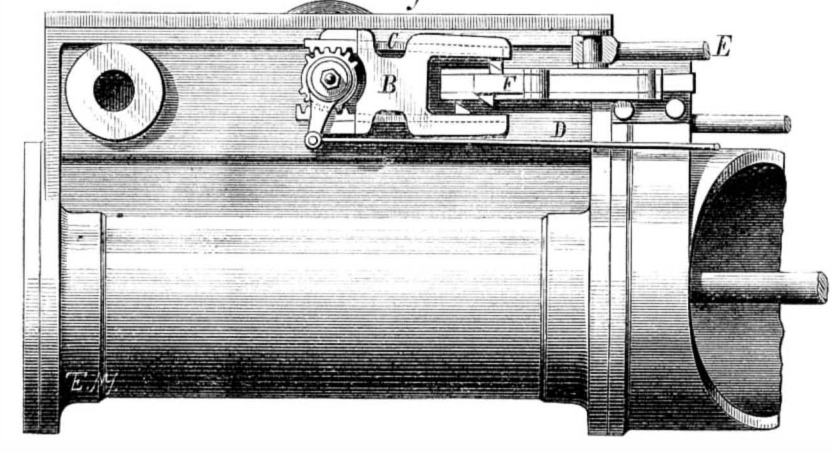


Fig. 2



FISH'S VARIABLE CUT-OFF.

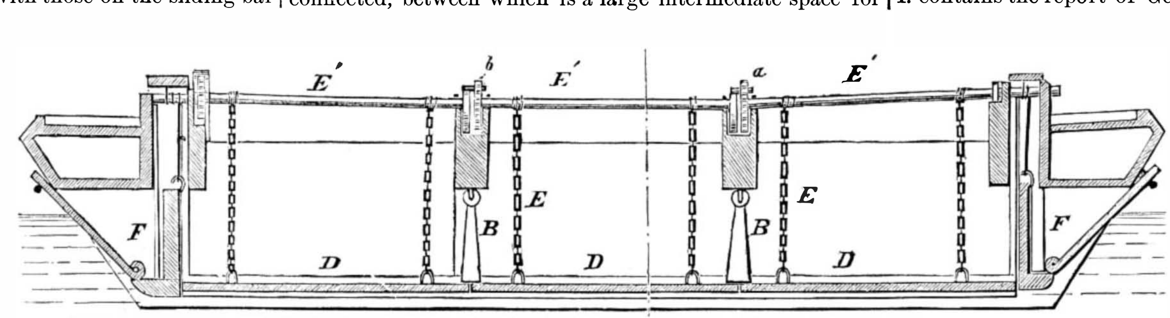
BLUE glass will cure a Spitz dog of hydrophobia. Pound it up fine, and mix it with his food.

Gas Iron.

The entire product of the Etna Iron Works, Allegheny City, Pa., is worked and heated in all departments with natural gas, brought to the works through pipes from the wells, which are nearly 1,500 feet deep, and situated in Butler county, Pa., 19 miles from the mills. Iron treated with this fuel—pure hydrogen and carbon compounds—becomes homogeneous, and has a uniform strength and finish not to be found in ordinary grades of iron. The superiority of natural gas iron is attributed to the amazing heating power of this new agent, as well as to an entire absence of sulphur and other impurities met with in all coals, and absorbed readily by iron when in a highly heated state.

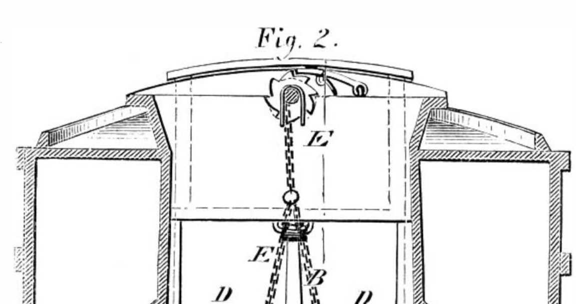
A NEW DUMPING SCOW.

We illustrate herewith a new dumping scow, which is so constructed as to admit of the rapid and convenient discharge of the load into the water by the automatic action of gates and the sweep of the water through the scow. The vessel is built in two separate boat-like structures, laterally connected, between which is a large intermediate space for material to be transported. This central space is divided into compartments that are closed at the bottom by hinged drop gates, D, which bear against the lower enlarged ends of pendent arms, B′, when they are closed. Each gate is raised or lowered by means of suspension chains, E, at the ends, that branch out from one common chain wound up on the ends of each top shaft, E′, for each pocket. The shafts, E′, turn in suitable bearings for winding up the chains by suitable crank or lever mechanisms, being retained by ratchets and pawls. The chains are alternately wound on the shafts in an opposite direction, so that, when the pawl of the first shaft is released, the weight of the contents on the gates drop them and turn the shafts, releasing, by the pawl and cam connections of the shafts, successively the remaining shaft sections, so as to drop automatically the gates and empty all the pockets. Simultaneously with the dropping of the bottom gates, vertically guided end gates, F, are raised when the water has full sweep through the scow, so as to produce the rapid submerging of the contents from the pockets. The entire load of the scow can thus be easily and rapidly discharged without requiring a large number of hands, and without loss of time. After the load is dropped into the water the bottom gates are raised, and simultaneously therewith the end gates and guard plates are closed.



ALLEN'S DUMPING SCOW.—Fig. 1.

Fig. 2.



Patented through the Scientific American Patent Agency, November 28, 1876, by Mr. Daniel Allen, of Rondout, N.Y.

Patent Rubber Worm—A New Fish Bait.

Those small boys who are in the habit of converting their mouths into bait boxes, when they go fishing, will be gratified to learn that, through the genius of a recent inventor, they may continue to use that convenient receptacle for a new bait which is free from the disadvantages peculiar to the angle worm. Any boy who has meditated over the shortcomings of that slimy invertebrate knows that it squirms disagreeably, especially when accidentally bitten, that it has an affinity for dirt, which is annoying when swallowed; that, even when on the hook, it has a way of dissolving off in the most unaccountable and exasperating manner; and that it perversely permits itself to be carried off piecemeal by suckers and minnows, in total disregard of its legitimate purpose. There can be no doubt that the day of the angle worm has passed, and that against the improved flexible rubber worm of Mr. W.H. Gregg (patented January 2, 1877) he can no longer hope to compete. Serving as bait, and at the same time as chewing gum, it must be evident to the least thoughtful that the rubber worm has an incontestable advantage.

Report of the Chief of Engineers, U.S.A.

There are 107 officers in the engineer corps of the United States Army. Sundry economical critics, while urging great reductions in the numerical force of our military service, have dwelt upon the fact that the said officers are virtually in possession of sinecures, and that a smaller number could perform all the necessary work. As it requires three large volumes of nearly 800 pages each to contain the reports of these gentlemen for a single year, and as not only was every individual of them on active service during the entire period, but additional civilian professional aid was largely needed, we strongly doubt whether their offices are likely to be sought after by those in quest of small work and large pay.

The report before us is carried up to June 30, 1876. Part I. contains the report of General Humphreys, Chief of Engineers, which is a summary of the material spread at length throughout the remainder of the work. From this it appears that 156 operations, looking to the improvement of rivers, harbors, etc., were carried on, and that during the year over six million dollars were expended therefor. The full details of the various undertakings, illustrated by a large number of maps and diagrams, occupy the remainder of Part I. and all of Part II. In Part III. there is a valuable series of notes on European surveys compiled by Major C. B. Comstock. These also are copiously illustrated, mainly with reproductions of the charts of different nations. There is a full report of Lieutenant Wheeler's surveys west of the 100th meridian and of the Yellowstone surveys. The work as a whole is an exceedingly instructive and valuable production, and may be recommended to the careful study of engineers.

Centennial Medals.

An editorial in the New York *Tribune* recently censured the managers of the Centennial Exhibition for the delay in delivering the medals of awards. Mr. Goshorn replies to the *Tribune's* strictures, through the Philadelphia *Evening Bulletin*, that such a thing as the delivery of medals three or four months after the close of an exhibition was never heard of, and that the medals for the Vienna Exposition of 1873 are still being distributed. The Centennial medals are now being manufactured at the United States Mint, Philadelphia, and Mr. Goshorn does not think that more than 500 have as yet been struck off. The medals will be given out as soon as they are ready, and all in good time.

This answer will be satisfactory to several of our correspondents who have inquired as to when the medals would be delivered.

THE BAD LANDS OF WHITE RIVER.

To the southeast of the Black Hills in Dakota Territory, and stretching nearly to the great sand hills of Nebraska, lies a sterile region, the soil of which is broken up by projecting rocks, which give the whole district a remarkably uninviting appearance. So unsuited is it for habitation that the Indians, ages ago, gave it the name of the Bad Lands, which has belonged to it ever since. It is a work of immense difficulty to travel through this region, the ravines and valleys into which the rocks are worn being defiant obstacles in themselves and rendering it easy to lose one's way.

It is to Dr. F. V. Hayden, now United States Geologist, whose researches in the Upper Missouri country extended from 1853 to 1866, that we are indebted for our most definite scientific knowledge of this region.

The surrounding country is prairie, and the Bad Lands occupy a valley about 100 miles long by 30 broad, which seems to have sunk away from the surface of the earth. We publish herewith an engraving, for which we are indebted to the *Christian Weekly*, which well represents the general aspect of this valley, and the remarkable formations which characterize it. The rocks are fragments of what were once continuous strata, but which are now broken into tower-like columns; and it needs, as Dr. A. C. Peale remarks, but little exercise of the imagination to fancy oneself in the streets of an ancient city, whose inhabitants left behind them spires, buttresses, and shafts as monuments of their labor and genius.

M. De Girardin, a French traveler, gives the following account of a visit to the Bad Lands: "Accompanying one of the geologists, I ascended a hill and enjoyed one of the most wonderful of sights. At the extremity of an immense plain, rose-tinted by the reflection of the setting sun, there appeared to us an immense city in ruins—a city surrounded by walls and bastions, filled with palaces, gigantic domes, and monuments of most striking and fantastic architecture. At intervals, upon a soil white as snow, rose crumbling castles of a brick-red color, and pyramids with sharp summits, capped with shapeless masses, which seem to tremble in the wind. In the center of this chaos stood a gigantic spectre-like column. Descending into the valley, and passing between two columns of antediluvian architecture, we discover a vast amphitheatre, surrounded by crumbling and indented hills of a rich yellow color, and a confused mass of miniature mountains, of red and yellow clay, thrown without order on a soil so hard that the horses' feet make no impression upon it."

This desert, says Dr. Peale, is destitute of vegetation, and the scanty supply of water is strongly alkaline, coating the rocks with a white crust, where it evaporates. There are no signs of life, not a bird, nor even an insect. The geologist pursues his investigations surrounded by bleak and barren desolation. If he is there in midsummer, the scorching sun, pouring down in the hundred defiles that thread this pathless waste, is reflected back to him from the white or colored walls, unmitigated by a breath of air, or the shelter of a solitary shrub.

This extraordinary region is a vast city of the dead; and its spires and towers are the monuments of most remarkable extinct races of animals, whose remains are strewn through the *débris* in the greatest confusion. Thick layers of rock are composed of petrified bones, sometimes perfectly preserved, and again reduced to powder. Vast numbers of turtles are found.

Some of the animals combined the peculiarities of the bear, hog, and cat. Others, 18 feet in length, had points of resemblance to the tapir, rhinoceros, hog, and horse, and still others represented a race that lived on both flesh and vegetables, and yet chewed the cud like our cloven-footed grazers. These curious animals became extinct before the mammoth and mastodon lived. When they roamed over the country, Europe and Asia were represented by islands, scattered over a wide expanse of ocean, and our Atlantic seacoast extended back to the mountains, and far up the Mississippi valley. The region between the Rocky Mountains and the Mississippi was covered with great lakes, whose waters were at first salt, but gradually became fresh. Between these lakes were areas of land covered with a vegetation tropical in its luxuriance and profusion. Through its forests roamed herds of singular animals. In the bitter struggle of life, many species and genera were blotted out, and their remains washed into the lakes, to be imbedded in the then forming rocks. One of our most eminent geologists thus beautifully gives the picture of tertiary times:

"Most of the continent exhibited an undulating surface, rounded hills, and broad valleys, covered with forests grander than any of the present day, or wide expanses of rich savannah, over which roamed countless herds of animals, many of gigantic size, of which our present fauna retain but a few dwarfed representatives. Noble rivers flowed through plains and valleys, and sealike lakes, broader and more numerous than those the continent now bears, diversified the scenery.

"Through unnumbered ages the seasons ran their ceaseless course, the sun rose and set, moons waxed and waned over this fair land, but no human eye was there to mark its beauty, nor human intellect to control and use its exuberant fertility. Flowers opened their many-colored petals on meadow and hillside, and filled the air with perfumes, but only for the delectation of the wandering bee. Fruits ripened in the sun, but there was no hand there to pluck, nor any speaking tongue to taste. Birds sang in the trees, but for no ears but their own. The surface of lake or river was whitened by no sail, nor furrowed by any prow but the breast of the water-fowl; and the far-reaching shores echoed no sound but the dash of the waves, and the lowing of the herds that slaked their thirst in the crystal waters."

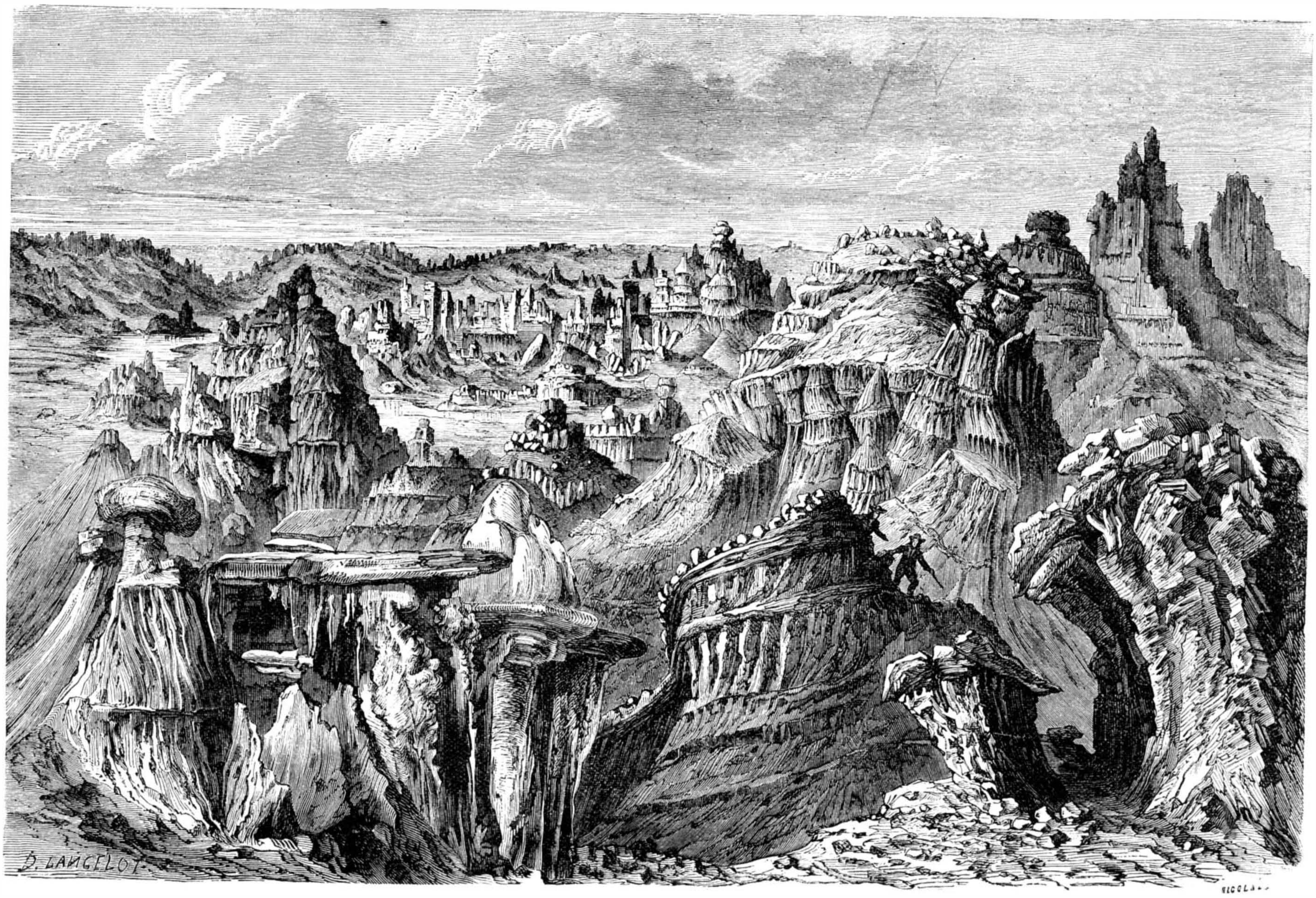
Gradually the lakes became filled with sediment, and the barriers over which their outlets flowed were slowly broken down and they were drained. Great climatic changes ensued. Subsequently the country was elevated, and the process of erosion began. Rain channels cut deeper and deeper into the soft rocks, forming gorges which communicate in every direction, leaving monuments between giving the characteristic peculiarities of the Bad Lands.

Yielding to the forces of nature, and crowded to the southward, during the glacial period, by the mantle of ice that covered the country, the inhabitants of this region disappeared, until now the only living representative of them is the rhinoceros. Such changes are almost incomprehensible; but we should remember that the time in which they were effected is, to us, simply infinite.

Changes are going on at present, which will eventually result in the draining of our great lakes, as were those of the Bad Lands. "The cities that stand upon their banks will, ere that time, have grown colossal in size, then gray with age, then have fallen into decadence, and their sites be long forgotten; but in the sediments that are now accumulating in these lake basins will lie many a wreck and skeleton, tree trunk, and floated leaf. Near the city sites and old river mouths, these sediments will be full of relics that will illustrate and explain the mingled comedy and tragedy of human life. These relics, the geologist of the future will doubtless gather, and study and moralize over, as we do the records of the tertiary age. Doubtless he will be taught the same lesson we are, that human life is infinitely short, and human achievements utterly insignificant."

The Steam Engine of the Future.

A lecture was lately delivered in Greenock in celebration of the anniversary of James Watt and the centenary of the completion of the first practical steam engine. Mr. J. Scott Russell was the lecturer, and the theme of his lecture took the form of queries as to whether we had discharged our duty as trustees of that valuable gift to mankind, whether we have during one century got out of the steam engine all the good to humanity which it was capable of producing, and, finally, what was the work which James Watt had left us to do in the coming century. Mr. Russell, in answering these questions, was of opinion that, as trustees of the steam engine, we had worthily discharged our duty; and that the duty left by Watt was, in point of fact, the invention of a new steam engine which should occupy less space, consume less fuel, and perform the work of the world at one half the cost, and render all the elements of modern life cheap and abundant, instead of dear and scarce. But is such an engine possible? It is not impossible; and Mr. Russell's contribution to the solution of the subject gives hope, says the *Mining Journal*, that "the steam engine of the future" may become a great fact before the end of the present century.



VIEW IN THE BAD LANDS, WHITE RIVER, DAKOTA TERRITORY.

THE OLEO-MARGARIN INDUSTRY.

The manufacture of artificial butter, if it has not already reached the status of an important industry, certainly bids fair to take that rank before long. It has already attained a forward stage of development, which is shown by the fact of its having become specialized. The production of oleo-margarin is distinct from the butter manufacture; and in the future, while the former will be carried on by large establisments where great quantities of fat can by special machinery be treated cheaply and with uniform results, the churning of the oil with the milk, and the subsequent processes necessary for its conversion into butter, will be the work of probably numerous small factories.

The details of the butter making are all embodied in an elaborate article by Dr. Henry A. Mott, of this city, which were published, with illustrations, in the SCIENTIFIC AMERICAN SUPPLEMENT some time ago, and they therefore need not be recapitulated here. Our object in the present article is to direct attention to the wholesale production of oleo-margarin, as carried on in this city, its growing commercial importance, and the secret of its successful manufacture, as recently demonstrated by the original investigations of Professors Chandler and Adams and Dr. Mott.

We were afforded an opportunity of examining into the details of the industry at the factory of the Commercial Manufacturing Company, where some eighty thousand lbs. of fat are daily converted into oil, about all of which at present is exported to Europe. Fat of all kinds is utilized, provided that it is perfectly sweet and clean; and to insure this, the material on its reception is thrown into huge tanks and there thoroughly washed and minutely examined. Doubtful portions are at once rejected, and taken elsewhere in the factory, to be rendered into tallow. The clean washed fat, cut in suitable pieces, is then carried to an upper story and fed into chopping machines, whence, in a finely hashed, pulpy state, it runs at once into huge kettles of a capacity of 2,300 lbs. each. Upon the temperature at which it is melted in these receptacles depends the whole success of the process; and to this end the heat is never allowed to rise above 120° Fah. Upon the experiments, and other considerations touching this point, we shall dwell in some detail further on. About two hours are consumed in the melting, during which process salt is added; and then the liquid, which meanwhile is constantly stirred by mechanical means, is conducted to settling kettles, where membrane and other impurities are deposited. From these vessels, while still hot, the "stock," as it is termed, is drawn off in cans and carried to the "seeding" room. Here the material is allowed to cool, when it becomes of about the consistence of tallow; but it possesses a very apparent grain, being in this respect totally different from tallow, the prominent characteristic of which is the entire absence of anything akin to granulation. In this state, the fat goes to four workmen who stand beside a four-armed revolving table. Workman No. 1 adjusts a cloth to line a shallow box on the extremity of one of the arms; workman No. 2 fills the cloth with stock; workman No. 3 folds the fabric over, and workman No. 4 removes the package ready for the press. In the establishment we visited, there were eight huge hydraulic presses, each capable of holding several dozen filled bags at once, and of applying a pressure, if necessary, of 500 tons to the ram. The usual working pressure is about 300 tons, under which the pure clear oil, or oleo-margarin, is freely squeezed out, and runs directly from presses to the lower floor, where it is drawn off into tierces.

There are various minor points in the process which we have here outlined, notably the straining of the oil or stock before it enters the cans for the seeding room; the necessity of keeping that department at a constant temperature of from 80° to 85°, etc., which we shall not stop to consider. One important advantage, however, is that in the manufacture there is no waste. The refuse fat, or any stock which becomes, even in the least appreciable degree, tainted is at once rendered into tallow, for which there is always a good market. The contents of the bags, after the stock is pressed, are a fine quality of pure stearine, readily purchased by candle and soap makers; and finally the scrap, after the tallow rendering, is valuable as a fertilizer, and is sold at about half a cent a pound for that purpose. Even the edges of the stearine cakes, which yet contain a little unexpressed oil, are sent back to the melting tanks, in order that that fraction may be saved; and the cloths in which the stock is packed during pressing yield, while being cleansed after each use, several hundred gallons of oil a day, which goes, however, on account of its being charged with impurities, to the tallow and not to the melting kettles.

The oil, as it enters the tierces, is perfectly pure, limpid, and sweet, and possesses a slight buttery odor. On becoming cold, it congeals into a hard, yellowish-white mass. Butter was exhibited to us, prepared from fresh oil, which was not distinguishable from the genuine article, and which was undoubtedly superior in quality to the average butter sold in the markets at this time of year.

Dr. Mott, in the article which we published recently, presented a careful *resumé* of all the various patented processes bearing on this subject of artificial butter making; and he pointed out very clearly that the only successful means which has been discovered is that invented and patented by Hippolyte Mège. Mège, it appears, discovered first that, to produce from the fat the necessary granulated material, a low temperature of melting is necessary, while a high one is destructive; and secondly, he devised the method of converting oil into butter by churning it with milk. The corroborating investigations of Drs. Chandler, Adams, and Mott leave little question but that Mège's discoveries bear as important a relation to artificial butter making as do the eye-pointed needle and feed motion to the sewing machine; and that, like the latter, it is hardly possible to produce the one any more than successfully to construct the other without the employment of these fundamental creations. Consequently, herein lies the cause of the failure of the various compounds which from time to time have been offered to the public, but which were not produced according to Mège's process. The record of Dr. Chandler's experiments shows a very extended investigation both into the past literature of the subject and into actual conditions in order to discover whether, by any other mode similar to that described by Mège, a like product could be obtained. The gist of Mège's idea is in these words: "My observation is that 125° Fah. is about as high as the heat can be raised safely in the melting kettles. Professor Chandler heated a sample to 150° Fah.; and although the resulting product was carefully subjected to the regular processes, it possessed a disagreeable and offensive odor, which could not be eradicated. Fat heated to 143° and 130° yielded similar results. A trial was made wherein the heat was raised to 230°, and this product was worse than any. In fact, Dr. Chandler concludes that the higher the temperature, the inferior the product; and so narrow is the dividing line that, while melting at 123° yields good results, melting at 130° produces altogether bad ones: while nowhere does it appear that Mège's process has been anticipated. Dr. Chandler also states that he finds oleo-margarin butter "to be a good and wholesome article of food, and equally as free from injurious effects as the butter made from cream." Professor Adams' experiments were made simultaneously with those of Professor Chandler, and his results and conclusions are substantially the same. In order to verify the conclusions of both of the above eminent chemists, and at the same time to reach some further details as to the conditions of investigations, etc., Dr. H. A. Mott has recently conducted a series of separate researches embodying four sets of experiments, in each of which from 400 lbs. to 500 lbs. of fat, prepared by washing, etc., were used. The results of his experiments are as follow.

The object of experiment No. 1 was to note the effect of heating the fat to 160° Fah. This temperature was reached in 1 hour and 47 minutes; and the fat was allowed to remain thereat for 9 minutes. It was then allowed to rest in order to get a separation of the membrane. The refined fat, on being drawn off, was allowed to cool in a room at 85° Fah., and then packed in bags and subjected to the usual pressure. Its disagreeable odor and taste were strongly marked; and when converted into butter, the latter was manifestly unfit for food. The sample exhibited to us by Dr. Mott plainly shows this, as it is evidently nothing but colored tallow.

In experiment No. 2, a temperature of 150° was reached in 1 hour and 38 minutes, and the fat held thereat for 10 minutes. Subsequent treatment was the same as the foregoing, and the results were apparently identical. In experiment No. 3, the fat was heated to 140° in 1 hour and 34 minutes, and kept thereat for 16 minutes: with similar results. Finally in experiment No. 4, where but 130° was reached, in 1 hour and 27 minutes, and maintained for 11 minutes, no improvement on the foregoing was found. In every case the fresh oil had an unmistakable tallowy odor, which, after a few days, became exceedingly offensive. On the other hand, as we were shown by the samples, butter prepared from fat treated at the same time, at a temperature below 120°, was sweet and fresh. Of course the *rationale* of the discovery is simply that, at a certain point, the stearine is acted upon by the temperature in such a way that, when the liquid congeals, the stearine no longer crystallizes; and instead of the grainy feeling, very palpable on drawing the finger through the partially congealed material, there is merely the unctuous smoothness of common tallow.

There is nothing about the process of making the oil which need excite the prejudice of a fastidious taste. Perfect cleanliness is necessary to the proper production of the material, and therefore must be maintained. As regards the butter made from the oil, it is chemically butter, and not tallow. This is clearly shown by the following analyses—selected out of a large number of equally favorable ones—made separately by Drs. Brown and Mott:

CONSTITUENTS.	Artificial butter (Brown).	Artificial butter: average of 2 analyses (Mott).	Cream butter (Mott).	Same as last calculated to 5·225 per cent of salt.
Water	11·25	12·005	12·29	11·827
Butter solids	88·75	87·995	87·71	88·173
	100·00	100·000	100·00	100·000
Fats { Olein, Palmitin, Stearin, Butyrin, etc. }	87·15	82·025	86·01	82·765
Casein	0·57	0·745	0·19	0·183
Salt	1·03	5·225	1·51	5·225
Coloring matter	trace	trace	....	.....
	88·75	87·995	87·71	88·173

Besides the use of oleo-margarin for the manufacture of artificial butter, it finds another extensive channel in the manufacture of cheese. The skimmed milk is placed in the usual cheese vat, and heated to 92° Fah., when the oleo margarin, in a fluid condition, is added and stirred for from three to five minutes, or until an emulsion is formed, when rennet is added, sufficient to cause coagulation in from 8 to 10 minutes, and thus the oil added is made to enter into the composition of the curd. The curd is then cut and worked in the usual manner. The Hon. X. A. Willard, Professor Caldwell, and others have stated that the cheese produced is very palatable, and makes a good, healthful article of food.

Factories similar to the one we visited are now established in Cincinnati, Chicago, St. Louis, Providence, Philadelphia, Bethlehem, Pa., Baltimore, and various other localities. All work under the Mège patent, which is owned by the United States Dairy Company, an association of wealthy capitalists of this city. No great quantity of the butter made from oleo-margarin reaches our markets, as, as already stated, the principal consumption of the oil is in Europe. From across the Atlantic, we are informed that the demand is constant; and although the establishment in this city has been in operation but a few months, the extent of its production is now only limited by the difficulty of obtaining the one million lbs. of pure and suitable fat necessary weekly to utilize the full capacity of the works. One hundred and twenty men are employed in the factory, which has been running day and night since June last.

Preparing Cod Fish for Market.

A correspondent of the *Montreal Gazette* gives the history of a cod fish from the moment when, on the hook of the fisherman, it is dragged from its native element till it disappears down the human throat on the banks of the Amazon, the Parana, the Tagus, or the Po: "After a few expiring wriggles—and it is a comfort to be informed by naturalists that fish are almost insensible to pain—the cod is flung from the fisherman's boat upon the rough stage, where it is received by the 'cut-throat,' who, with a sharp knife, lays open the fish across the throat and down the belly, and passes it to the header. This operator proceeds to extract the liver, which is dropped into a vessel by his side, to be converted into codliver oil. He then extracts the entrails and wrenches off the head, and throws these into another receptacle, to be preserved for the farmer, to mix with bog and earth, thus forming a most fertilizing compost for his fields. The tongues, however, are taken out, and also the sounds, and these, fresh or pickled, are an excellent article of food. The fish is then passed to the splitter, who, by a dexterous movement, cuts out the backbone nearly to the tail, and thus lays the fish entirely open, and capable of being laid flat on its back. This is the nicest part of the operation, and the splitter always commands higher wages than the rest of the operators. The salter next takes the fish and washes it well from all particles of blood, salts it, and places it in piles to drain. After laying the proper length of time it is washed, and spread to dry on the 'flake,' which is formed of spruce boughs, supported by a framework resting on upright poles. Here the cod are spread out individually to bleach by exposure to sun and air, and during this process require constant attention. At night, or on the approach of rain, they are made up into little round heaps, with the skin outward, in which state they look very much like small haycocks. When the 'bloom,' or whitish appearance, which for a time they assume, comes out on the dried fish, the process is finished, and then they are quite ready for storing. On being conveyed to the premises of the exporting merchant, they are first 'culled,' or assorted, into four different kinds, known as 'Merchantable,' 'Madeira,' 'West India,' and 'Dun,' or broken fish. The first is the best quality, the second a grade lower, the third is intended for the stomachs of negroes, and the fourth, which is incapable of keeping, is used at home. The cod sent to hot countries are packed by screw power into small casks called 'drums;' those which go the Mediterranean are usually exported in bulk. Large quantities of dried cod fish are shipped to Brazil, and there is hardly an inhabited corner of that vast empire where the Newfoundland cod is not to be found, being carried on the backs of mules from the seacoast into the most distant provinces of the interior. The negroes of the West Indies welcome it as a grateful addition to their vegetable diet. To all parts of the Mediterranean it finds its way, Italians, Greeks, and Sicilians equally relishing the produce of the sea harvest. The Spaniards and Portuguese are our best customers, and all over the sunny peninsula the 'bucalo' is a standing dish. In the warmer regions of the earth the people seem to have a special liking for the dried and salted cod, and to them it is an almost indispensable article of food."

A Wonderful Species of the Cotton Plant.

A cable despatch from London to one of our daily papers says: A remarkable discovery has been made in Egypt by Signor Giacomo Rossi, Austrian Consular Agent at Alexandria. He has found a new cotton plant, which is so wonderfully prolific that it may prove a dangerous enemy, the report says, to the American cotton raising interests. Signor Rossi, in his report of the discovery, says that about two years ago he accidentally came across the new plant on the property of a captain in the Menulia District, who collected the seed and sold it to his neighbors at twelvefold the price obtained for the ordinary kind. The plant has a long stem, and being without branches much space is saved. It bears on an average fifty pods on each bush, while the usual yield of the plant is about thirty. A smaller quantity of seed is needed, but the great drawback in Egypt is that it requires much more water, which necessitates the alternating of the crops with grain and vegetables. In the sea islands of the Atlantic coast, or along the lower Mississippi, it would prove wonderfully prolific.

The Analogy of Sound and Light.

The Saturday evening free lecture in connection with the Loan Collection of Scientific Apparatus at South Kensington was lately given by Professor Barrett, of the Royal College of Science, Dublin, on "Some Experiments Illustrating the Analogy of Light and Sound."

The Professor commenced by referring to some of the well known facts about light and sound, such as that sound waves travel through air, while light waves travel through luminiferous ether, etc. Among many illustrations of the rate at which each travels, he gave this as a very intelligible one: If a cannon were fired in London the sound would take about eight minutes to travel to Birmingham, a little over one hundred miles, while in the same time the light from the flash would have traveled to the sun, a distance of over ninety millions of miles. But, though they so differ in the rate of progress, both light and sound show many phenomena in common.

In the experiments made during the evening the sensitive flame was used as a detector of sound. This delicate acoustic reagent, familiar to London audiences through Professor Tyndall's lectures, was first, we believe, discovered in 1866 by Professor Barrett, though he modestly did not allude to the fact. Indeed, most of the experiments shown during the evening formed the subject of a paper read by him before the Royal Dublin Society in January, 1868, and the discovery of the ratios referred to at the end of the lecture was announced in the *Quarterly Journal of Science* for 1870. The performance of the experiments, however, was entirely new to a London audience.

The analysis of the phenomena of light and sound were illustrated in the following order: 1. Both light and sound get feebler as they leave their source of origin. In the case of sound this was shown with a loud ticking watch and a sensitive flame. 2. In reflection the angle of incidence is the same as the angle of reflection. In the case of sound, this was shown with the sound of a whistle sent along a tube, and reflecting along another placed at an angle to it from a reflector placed at the end where they approached. The distance to which a feeble sound might be reflected perceptibly from a concave mirror was shown with mirrors over thirty feet apart. 3. With refraction, in the case of light, familiar convex lenses were used; and in the case of sound, analogous but less familiar lenses of gas of a different density from air were used. A collodion balloon, filled with carbonic acid gas, served as a double convex lens, and its action was manifested by the concentration of sound from the ticking watch on to the sensitive flame. 4. Both light and sound suffer absorption in passing through non-homogeneous media. Professor Tyndall's apparatus, showing the "echoing back" of sound in passing through successive alternating layers of gas of different densities, is now well known, and every one is familiar with the fact that, though light may traverse a vessel of clear water, it can no longer travel when it is filled with bubbles of transparent air. 5. There is an analogy between the sympathy among the same notes of a gamut and the sympathy among individual colors in the spectrum. An incandescent body that produces a particular bright band in the rear of the spectrum will, when in a gaseous state, absorb light, and cause a dark band in exactly the same part of the scale. Tuning forks, wires, or columns of air in jars are responsive to vibrations produced by others exactly in unison, but only to those. This was shown in various ways in a very clear manner. 6. An analogy, which Professor Barrett called a more fanciful one, was spoken of. All the complex music of an orchestra is the result of a few simple notes variously combined. So all the tints of a picture are the results of a few simple colors variously combined. The musical scale sorts the complex notes in one case, the spectrum sorts the complex colors in the other. Professor Barrett, taking Professor Listing's determination of wave lengths, has made a most interesting comparison. The wave lengths of the notes of the gamut he expresses not in absolute but in relative measurement. Thus C is taken as 100, and all the other notes have their wave lengths expressed in percentages. Similarly, red is taken at 100, and the wave lengths of other colors are expressed in percentages. This interesting result comes out in comparing the two columns. D and orange are each 89; E and yellow, 80; F and green, 75; G and the average of the blues, 67; A and violet, 60; B and ultra violet, 53; C and the obscure rays (black), 54. Further, the comparison of harmonies comes out in an interesting manner. Low C and upper C sound well together, so red and black go well together. Red and green, or C and F, harmonize well; but red and orange no lady would wear, and C and D make a combination by no means pleasant. Red and blue, or C and G, also go well together. 7. The concluding part of the lecture was devoted to an illustration of the figures described by vibrating bodies. Several apparatus for this purpose were briefly referred to, but especial attention was given to an apparatus of great ingenuity devised by Mr. S. F. Pichler. Professor Barrett showed it with an electric light and a reflection on to a screen. The principle of it may be thus described: Two metallic vibrators, each with a small speculum, are fixed at right angles to each other, and sounds are produced by a current of air acting on one or both of them at pleasure. The perpendicular vibrator is tuned to a given note; the horizontal vibrator is fitted with a mechanical arrangement whereby its pitch can be graduated to any degree of nicety within the compass of two octaves. An apparatus is also provided whereby a pencil of light is concentrated upon the speculum of the perpendicular vibrator, whence it is reflected to the speculum of the horizontal vibrator. For lecture purposes artificial light is used, which is further reflected and magnified upon a screen. When musical sounds are produced by the vibrators, various luminous geometrical figures are formed on the horizontal speculum and reflected on the screen by the single or joint action of the vibrators described by the pencil of light; and the form and motion of such figures demonstrate the exact relations to each other of the musical notes produced. Sounds which harmonize to the ear produce regular figures to the eye, as, for example, segments of the circle, ellipses, ovals, circles, or straight lines; and if the amplitude of each vibrator be equal, these luminous figures will hover on the speculum or screen with an apparent steadiness like that of the heavenly bodies hovering in the sky. If the sounds do not harmonize, the figures are confused, unsteady, and complicated, presenting an appearance as if the wave lines were contending with each other. The mathematical relations of musical notes are also demonstrated, regular simple forms being produced by combination of those notes which result from vibrations bearing a definite numerical ratio to each other, while irregular and unsteady figures are caused by notes which have no such ratios. The pattern made on the screen by a discord is very bewildering to the eye.

Professor Barrett, in concluding, said: After seeing how musical notes may be translated into moving lines of light, the words put by our poet into the mouth of Lorenzo have additional interest:

> "There's not the smallest orb which thou behold'st
> But in his motion like an angel sings."

Major Festing conveyed the thanks of the audience to Professor Barrett.—*London Times*.

A Japanese Cotton Mill.

In an interesting report on the trade of Kagoshima, Assistant Consul Hodges gives the following description of a native cotton mill: The cotton weaving factory and spinning mill at Kagoshima is situated at Iso, and contains 100 looms of English make. It employs 250 workmen, who receive their wages in rice, men being paid from eight "go" to three "sho" six "go" per day; women from eight "go" to one "sho" five "go;" and children from eight "go" to one "sho," according to their skill. Both married and unmarried women are employed, and they are partial to the occupation. When the mill was first worked it was on account of the Prince of Satsuma, and an attempt was made to weave gray shirtings of similar weight and texture to those imported from Manchester. A few pieces were made; but on account of the China and Japan cotton being of a very short fibre, the work was so expensive and tedious that the attempt was abandoned, and the manufacture of heavy cottons commenced. The first cost of the machinery was about $80,000, and the erection about $50,000 more. It has now passed into the hands of a company, and the principal articles of manufacture are cotton cloth and cotton thread. Small quantities of a broad silk fabric, and of mixed cotton and silk fabrics, have also been turned out. The cotton used in the manufacture is imported from Osaka, the annual amount being about 2,600 bales, at an average of $16.10 per bale of 56 lbs. During one visit they were only manufacturing "momen," a coarse white cotton cloth, and cotton thread. With only 30 looms at work, they were turning out daily 10 pieces of cloth 252 feet long and 3 feet 5 inches broad; and of the woof, or cross thread, 350 catties. This cloth is worth about $4.60 per piece, and it, with the thread, is principally exported to Osaka. A striped cloth is also manufactured, but this is nearly all consumed in Kagoshima. The hours of work in the factory are seven daily, commencing in winter at 8.30 A.M., and ceasing at 4.30 P.M., with an interval of about one hour for dinner, at noon.

Snake Charmers Humbugs.

One by one, Science is annihilating every notion which ascribes to any person or class of persons phenomenal powers. Dr. Fayrer, in his splendid and valuable work "The Thanatophidia of India," says that the famous East Indian snake charmers are impostors, and that he has repeatedly detected them attempting, by subtle impositions and clever acting, to delude lookers-on into the belief that they were dealing with veritable wild snakes, when all the time the dancing cobras that made their appearance at the sound of the pipe were some of their own tame snakes, placed in certain spots beforehand.

These professional snake-catchers are many of them, in addition to their regular vocation, most expert jugglers, and exceedingly adroit at all kinds of sleight-of-hand tricks. It is their constant practice to "turn down" a few tame snakes in a garden hedge or somewhere close in the vicinity of a house they intend paying a visit to, ere they present themselves before the sahib, the owner of the premises; and then, with every appearance of good faith, the rascals request permission to be allowed to clear the compound of snakes; at the same time stipulating for a reward, perhaps one rupee a head for every snake they succeed in catching. If the gentleman of the house should happen to be a griffin, or new-comer, likely enough he will be induced to lend an ear to so plausible a request, and at length promise these crafty rogues so much for each snake they succeed in catching. Soon, to his horror and amazement, hideous serpents of various dimensions are produced, one from the straw in an empty stall in the stables, another from the garden hedge, and so on; till at last, perhaps, the fraud is carried too far and discovered.

Dr. Fayrer states that certain descriptions of serpents—chiefly of the genus *naja*—most undoubtedly are susceptible to, and in a measure become fascinated on hearing, musical sounds. "I have constantly seen," he says, "tame snakes in the possession of snake-catchers, on hearing the sound of the pipe, erect themselves and sway their heads from side to side, and beyond a doubt show pleasure at the strain; but I have never once seen a wild snake go through the same performance; and I believe that only tame reptiles carried about in baskets and 'broken in' for such an exhibition so conduct themselves. I have repeatedly offered snake charmers five rupees to bring out from its sanctuary, by means of music, a cobra known by me to be 'at home,' but invariably all their efforts have been in vain."

There are many who actually believe in the efficacy of stones which, when applied to a snake bite, are supposed to withdraw the poison; but if such a very simple remedy were really effectual, and a genuine specific, the snake stone cure would speedily be brought into universal use. "It would appear, however, that these people really prize these so-called stones, for I have been present when money has been offered to them to part with one, but declined."

Perhaps the strongest argument against this snake stone cure is that these very men often themselves fall victims to the bite of the cobra, though at the time in possession of a stone which they assert to be capable of working a cure. Moreover, when these professional snake catchers have to deal with an undoubtedly wild cobra in full vigor—although as a rule they display extraordinary pluck, skill, and resolution in capturing it, and on the first favorable opportunity will with wonderful quickness seize hold of and secure it—an attentive beholder cannot fail to remark the extreme caution and watchful management they display on first clutching hold of the animal, their whole demeanor and action differing unmistakably from the off-hand, careless manner which they assume when grasping one of their own harmless specimens; and it is an undoubted fact that these men really dread the consequences of a chance bite from a wild cobra quite as much as other mortals do, and are well aware that nothing can withdraw the deadly venom from a wound, or save life, when once the poison has mingled with the blood. But even with all the remedies as yet known, including copious doses of brandy and ammonia, and the immediate efforts of skilled surgeons, it is sad to be told by men such as Dr. Fayrer, and others who have devoted time and energy to the subject, that there is almost no hope of saving life if the bite has been inflicted by one of the most venomous snakes in full health and vigor.

East Indian Jewelry.

In our recent article on Signor Castellani's collection of antiquities, we referred to the fact of the lost art of making Etruscan jewelry. It is believed that valuable hints of how the ancient goldworkers operated may be gathered from the itinerant goldsmiths of the East Indies. These craftsmen carry their tools with them in their wanderings, and, where employment can be found, transform coins and bits of metal into filagree ornaments resembling the antique whilst still following their natural style. The *English Mechanic* has the following regarding the tools, and manner of working of these artists: A low earthen pot full of chaff or sawdust, on which he makes a little charcoal fire, a small bamboo blowpipe about 6 inches long, with which he excites the fire, a short earthen tube, or nozzle, the extremity of which is placed at the bottom of the fire, and through which the artist directs the blast of the blowpipe; two or three small crucibles, made of the fine clay of ant-hills, a pair of tongs, an anvil, two or three small hammers, a file, and, to conclude the list, a few small bars of iron and brass, about 2 inches long, differently pointed, for different kinds of work. It is astonishing what an intense little fire, more than sufficiently strong to melt silver and gold, can be kindled in a few minutes in the way just described. Such a simple portable forge deserves to be better known. It is, perhaps, even deserving the attention of the scientific experimenter, and may be useful to him when he wishes to excite a small fire, larger than can be produced by a common blowpipe, and where he has not a forge at command. The success of this little forge, it may be necessary to state, depends a good deal on the bed of the fire being composed of combustible materials, and a very bad conductor of heat. The smiths at Ceylon use a composition as a hone for sharpening knives and cutting instruments that is worth noticing. It is made of the capitia resin and of corundum. The corundum, in a state of impalpable powder, is mixed with the resin rendered liquid by heat, and well incorporated. The mixture is poured into a wooden mould, and its surface levelled and smoothed while it is hot, for when cold it is extremely hard. It is much valued by the natives, and preferred by them to the best of our hones.

A New Mode of Shipping Guns.

According to a contemporary, a smart firm of American engineers in London, who do not believe in peace, have hit upon a novel mode of sending small cannon to any place where they may be required, and where, perhaps, the powers in command might object to their introduction. The plan in question consists of taking two small guns and placing a round bar of strong wood down the bore of each, so as to hold them together, the muzzles joining. They then bind the whole with straw rope, and cover that with a coat of fire-clay. This forms a perfect core, and round it is cast an iron column, like those used in building purposes. When complete they would not excite the suspicions of the most cautious custom officers.—*British Trade Journal*.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SPLIT WHEEL.

Benjamin T. Mills, Fall River, Mass.—This consists in slotting or notching a wheel from the center to the circumference to admit of placing it upon the shaft, and in cutting a dovetailed groove in each side of the notch thus formed. A section of the wheel is made to fit the said notch and the grooves. The object is to furnish a wheel that may be applied to or removed from shafts where it would be inconvenient or impossible to place a wheel of ordinary construction.

IMPROVED WATER TUBE AND CIRCULATING STEAM BOILER.

William Ord, Brooklyn, O.—This consists of the combination of a tubular or other boiler and its mud drum, having side extensions toward the fire-front, with tubes that extend from the side extensions backward and enter the boiler at the rear end, just below the water line. The tubes are connected at the rear end with drop tubes and a receptacle for collecting the scale or sediment.

IMPROVED ATTACHMENT FOR RAISING AND LOWERING RUDDERS.

William J. Bushall and Thomas E. Parkin, Beaufort, N. C.—Thick plates of metal are bolted on to the stern post. The space between the plates forms a dovetail, into which is fitted, on guides, a movable part of the stern post, to which the rudder stock is attached in the ordinary way. A suitable pin prevents the plates from spreading, and also holds the rudder down. It is designed to have the spare rudder which the vessel will carry provided with a duplicate of the movable part of the stern post, and also with the appropriate steering gear, so that in case of emergency no time need be lost in applying these parts.

IMPROVED WATER-PUMPING APPARATUS.

John B. Comstock and William Niemann, New Orleans, La.—This is an improved apparatus for pumping water, to drain and to irrigate land, so constructed that the pumped water may assist in working the pump. When the weight has been wound up and released, its downward pressure will work the pumps, which discharge their water into the tank. When the tank is full, a stopcock in the discharge pipe is opened, and the water is discharged upon the buckets of the wheel, so that the pumps may be worked by the water raised by said pumps, the weight assisting and regulating the motion.

IMPROVED TURBINE WATER WHEELS.

James Andrews and William Brown, Thomaston, Ga.—This wheel, having spiral buckets and diagonal apertures in the top of the casing, will, it is claimed, yield a greater percentage of power than other turbines.

IMPROVED TIRE-HEATING DEVICE.

Charles O. Gause, Hesper, Kan.—As heretofore constructed, the fronts or doors of tire heaters of the class to which this belongs have been hinged at the side, and thus adapted to swing horizontally, and the wheel, or other device, for supporting the tire while being heated has been attached to the back of the furnace or heater. The present inventor improves on this by hinging the front or door of the heater at its lower edge, and also pivoting the tire-holding wheel to said front, so that the latter may be turned down, together with the tire wheel, and allowed to rest, in a nearly horizontal position, on the forge or furnace. The tire or tires may be easily applied to or removed from the wheel while in this position.

IMPROVED SCREW PROPELLER.

William S. Hull, Jackson, Miss.—This invention relates to a novel construction of propeller designed to secure a greater driving capacity with a smaller expenditure of power, and adapted to operate either upon the air or water as a fulcrum. The invention consists in a set of right angled triangular vanes, blades, or fans, one side of each of which blades is attached to the propeller shaft at right angles thereto, while the rear and less acute apices are deflected away from the said shaft, the laterally projecting tapering blades, thus constructed and arranged, serving to distribute the work in ratio corresponding to the leverage throughout the length of the blades, and thus securing a greater motive effect from a smaller expenditure of power.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ARTIFICIAL FEATHER.

Julius Brown, New York city, assignor to himself and Moritz Leipziger.—Pieces of downy fur are attached to sheets of india rubber, which are cut in proper shape to resemble feathers, and provided with wires or whalebones to imitate the quills.

IMPROVED FLOWER FRAME.

Charles S. Archer, Hanover, Ind.—This consists of an outer perforated section in connection with an interior section or core of corresponding shape secured thereto, the whole being closed by a bottom part to retain moistened sand placed between the outer and inner sections.

IMPROVED HINGED SPLINT.

George S. Adams, Philadelphia, Pa.—By means of an ingenious arrangement of screws this splint may be easily and gradually extended and contracted, as may be required, and may be adjusted to the right or left, as the angle of the limbs may require.

IMPROVED LABEL HOLDER.

Samuel A. Hughes, Brooklyn, N. Y.—This consists of a metal frame with raised guide moulding, open at one side for the card, which is retained by a spring-acted bottom plate, and locked by a suitable spring catch or device.

IMPROVED DEVICE FOR MUSICAL INSTRUCTION.

Russell S. Hill, Industry, Ill.—This consists of a board frame with a strip of woven wire, or other equivalent substance of dark color, nailed on a little in advance of light lines, representing the lines of the staff, together with movable notes and other characters to be used in teaching the principles of vocal music. It contains all the advantages of the blackboard, while it is more easily handled.

IMPROVED RECORDER.

Nicholas Van Rees, Philadelphia, Pa.—This is a device to be used by a bartender to register his sales as they are made, so that the proprietor can know by examining the register how much money there should be in the drawer.

IMPROVED LINE FASTENER.

David H. Levy, New York city, assignor to himself and George W. Gumpert, of same place.—This consists in making the sheave bolt of a block revolve with the sheave, and attaching a crank handle to one of its ends.

IMPROVED HYPODERMIC SYRINGE.

Joseph McMorries, Newberry, S. C.—This is an improved construction of hypodermic syringes, by which subcutaneous injections may be made in a very convenient and painless manner, as the injection is made simultaneously with the entrance of the needle. The invention consists of a syringe with hollow plunger rod for guiding the needle rod, both rods being connected to spring-acted plunger rods of tubular side casings, and retained by spring-acted triggers. They are simultaneously released for jointly entering the skin and injecting the liquid.

IMPROVED MOUSING HOOK.

Amon W. Chilcott, Cassville, Pa.—This is a lever hook fastener, for attaching traces to hames, connecting reins with bridle-bits, uniting railroad signal cords, also for attaching watch chains to watches, and for similar purposes. It consists of two fulcrumed lever hooks that are applied by perforations of the overlapping plates at one end to the trace, chain, or strap, and at the other end by overlapping hooks to the ring or eye. The hook ends and upper plates are being recessed to one half the thickness of their shanks at the fulcrum to form a mousing hook when closed, and are readily spread open on being detached.

IMPROVED LINE FASTENER.

Jasper T. Cronk, Hoboken, N. J.—This consists of a clothes-line-supporting arm or brace, that is secured adjustably to brackets of the window casing, and slid to the outside when the clothes are applied to or taken off the clothes-line. The slack of the line is taken up by attaching the lower part of the line to a hook below the sockets.

IMPROVED HARNESS SADDLE.

Samuel E. Tompkins, Sing Sing, N. Y.—This saddle is so constructed that the jockey-flap and pad parts may be made and attached to the bearing plates, and the saddle-tree afterward attached to said bearing plates. With this arrangement the saddle-tree need not be soiled or marred by handling in making the saddle, as is usually the case.

IMPROVED WATERING TROUGHS.

Frank A. Coffman, Tipton, Iowa.—This is a trough for watering stock, which is so constructed that the water can be readily poured out of it in winter to prevent it from becoming filled with ice. It is tilted or tipped over to discharge its contents, and again raised into position, when required, by operating a suitable lever.

IMPROVED TOY PICTURE.

Joseph Kayser, New York city.—This relates to improvements in the construction of the surprise picture applied to paper boxes and other articles, for which letters patent have been granted to same inventor under date of April 18, 1876, and No. 176,228, so that more than two pictures may be instantly and successively changed thereon in a very neat and amusing manner.

IMPROVED POCKETBOOK LOCK.

Franz F. Weiss, Jersey City Heights, N. J.—This device may be readily opened and closed by simple pressure on the lock with one hand only, so as to be conveniently used by ladies. It consists of a slide plate that moves along inclined guides of a top plate, and withdraws a spring plate with a projecting bolt from the socket fastening of the flap.

IMPROVED ANILINE DYE.

Lewis Leigh, Pittsfield, Mass.—This is a solid block or cake, consisting of soap, gelatine, and an aniline dye, the whole soluble in water, and capable of imparting a fixed color to fabrics.

IMPROVED AUTOMATIC TOY.

William Maguire, Jersey City, N. J., and Julius Gallot, New York city.—This is an improved automatic toy, that represents two boxers, or other figures, in the act of boxing or fighting; and it consists of two figures, with movable bodies and arms, operated by connecting rods, the bodies being made to oscillate more or less on the fixed legs by spring-acted main rods, that are actuated by a clock train, with irregularly spurred cam wheels.

IMPROVED HARNESS BUCKLE.

Manuel Huerta, The Dalles, assignor of two thirds his right to N. W. Chapman, of same place, and Victor Trevett, Portland, Oregon.—This is an improved fastener or buckle for fastening together the straps of the various parts of a harness, to avoid sewing and the use of ordinary buckles. It enables a harness to be made cheaper, to be easily repaired, and to be readily taken up and let out.

IMPROVED FOUNTAIN PEN.

Philip Goehring, Richwood, O.—A tube or feeder passes longitudinally through the holder. Through it the ink passes to the pen. The holder is inserted in the lower end of a hollow piston, which enters the ink reservoir. A small air hole in the ink reservoir admits air to regulate the flow of the ink.

IMPROVED SHOVEL.

Patrick C. Kierns, New York city.—This consists in providing a tang or extension on the upper end of the shovel blade, that is received by a split handle, which extends a short distance over the sides of the upper portion of the shovel blade, and which is covered and reinforced by triangular plates riveted to said blade. The tang being covered with wood is thus rendered more agreeable for use in cold weather; and as the outside strap is dispensed with, the handle is smooth throughout its entire length.

IMPROVED MARKING BRUSH.

James M. Patterson, Euchee, Tenn.—By pressing upon a spring with the finger or thumb, a lever raises a valve and allows the ink to flow to the hair of the brush.

NEW AGRICULTURAL INVENTIONS.

IMPROVED HORSE HAY RAKE.

John L. Wager, Deposit, N. Y.—This is a wire-toothed horse hay rake, which is so constructed that the teeth are firmly held in place, and at the same time are secured in such a way as to give them the necessary play, and allow them to be easily and quickly detached when desired.

IMPROVED SULKY PLOW.

Mercer Brown, St. Joseph, Ill.—This machine is so constructed that the plow may be easily and conveniently raised out of the ground, and may be turned upon the share or upon the bar without being swung to or from the land. The wheels may also run over corn ridges or other uneven ground without raising the plow when the wheels rise, or forcing it down when they descend.

IMPROVED HARVESTER.

William Gangwer, Mulberry, Ind.—This harvester is so constructed as to enable the cut grain, as it falls upon the platform, to be conveniently removed and deposited in gavels in a receiver, and compressed, ready for binding. Suitable devices enable the bound bundles to be readily thrown from the machine.

IMPROVED BEEHIVE.

Hiram Hatfield, Ossian, Ind.—This beehive is so constructed as to prevent the moth from entering, and is thoroughly ventilated. The honey boxes or drawers may be arranged, exchanged, and removed, without danger to the bees or to the operator.

IMPROVED PLOW.

William T. Cheatham, Rienzi, Miss.—In this improvement the plows may be set at any desired distance apart, or be reversed. The device may be used with one, two, or three plows, as may be desired.

IMPROVED RECIPROCATING CHURN.

Peyton W. Gum, and William H. Seawell, Strasburg, Mo.—This churn has a long shallow body provided with a detachable perforated board in its center, pivoted to a frame, and connected at one end by a rod with a treadle. By operating the treadle the churn body is rocked upon its pivots, forcing the milk from one end of the said churn body to the other through the holes in the plate, and bringing the butter in a short time.

IMPROVED CORN PLANTER.

Alpheus Fox, Rock Falls, Ill.—The passages formed in the forked conductors are continued separately nearly to the bottom of the boot or leg of the planter, where they are stopped by an inclined bottom piece, and provided with a slide valve, which, moved up and down, will drop corn alternately from one and the other of the passages in the boot. This valve is connected to a crank pin projecting from a segmental pinion placed on a short shaft, which also supports the disk inside of the seed box. A bar is provided that gives motion simultaneously to the segmental pinions. A new mode of constructing the frame is also embodied.

IMPROVED FENCE POST.

Harrison Fitts, Rollin, Mich.—This consists in forming a hollow iron post flat on one side and cylindrical on the other, and providing it with a foot having the shape of a cross. The semi-cylindrical form of the post secures maximum strength with minimum weight, and avoids any considerable projection of one side of the post beyond the side of the fence.

IMPROVED GATE.

Jonathan Sowerby and Henry Deck, Rockford, Mich.—As the gate is pushed back or open, the wheels upon it roll up an inclined bar, and at the same time keep the gate in horizontal position. As the gate is released, its weight causes the wheels to roll down the inclined bar, and the gate closes itself.

NEW HOUSEHOLD INVENTIONS.

IMPROVED PIANO STOOLS.

George A. Ramseyer, New York city.—Of the two inventions, the first has a hollow post strengthened by an interior metallic tube that is attached by a screw nut to a socket of the base. The center screw post of the seat is threaded at the lower part, and of cylindrical shape at the upper part, to be simultaneously screwed into a nut of the tube, and guided by the same. The parts may be conveniently separated and packed into compact space for shipment. The second invention provides an improved piano stool supported on two posts or pillars, that is adjusted into higher or lower position by side buttons and simple mechanism placed entirely out of sight.

IMPROVED BIRDCAGE SCREEN.

Gilbert W. Chapin, Brooklyn, N. Y.—The frame is made in two parts of V-shaped wires hinged together. Upon the wires strips of gauze or tarletan are attached. The device fits around the bottom of a birdcage and prevents the scattering of seed upon the floor beneath.

IMPROVED COVER FOR SPRING BED BOTTOMS.

Kortum K. Peck, Faribault, Minn.—This is an improved cover for spring bed bottoms, made in two parts, hinged to each other. Each half is formed of two side pieces, two end pieces, and intermediate cross slats. The cover is placed upon the springs of the bed bottom, and is stiff enough to be kept from sagging between said springs, and at the same time is elastic enough to accommodate itself to the yield of the springs.

IMPROVED BURGLAR ALARM.

Daniel Mersereau, Newark, N. J.—In using the device a slide is pushed forward, and a spring wound up. The teeth are inserted in the floor in such a position that the case may stand in an inclined position, with its upper end resting against the door to be protected. If, now, an attempt be made to open the door, the case will be pressed downward upon the slide which withdraws a stud from an escapement, and allows the alarm mechanism to operate the hammer to sound an alarm, while at the same time the device prevents the door from being opened. In the case of a window the device is connected with the upper and lower sashes in such a way that the movement of either sash may move the case and slide upon each other and sound the alarm.

IMPROVED PETROLEUM STOVE.

Fredrick Hildebrandt, New York city.—This relates to improvements in the burner of lamp for petroleum cooking stoves, by which the oil vapors are conducted from the interior of the oil reservoir to the flame for complete combustion, and in which the spur wheels for operating the wicks are arranged at the interior of the reservoir, so as to present a smooth top surface, which may be kept clean with greater ease.

IMPROVED LAMP WICK.

Walter F. Hopkins, Cincinnati, O.—This extension lamp wick is so constructed as to afford a good light when the wick is short and the oil low. A set of loose wicks are connected with the wick to be burned, and serve to keep the burning wick supplied with oil until all the oil in the lamp shall be consumed, however short the said wick may be.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED EXCURSION WAGON.

Elisha Mills, Lexington, Mich.—This consists of a wagon body for excursions, constructed of an outer main frame, supported and attached to lateral pieces, which rest on longitudinal spring boards. The spring boards rest on bolsters of the truck, which keep the main frame, by uprights passing into recesses of the same, in steady position thereon. The seat supports are applied to central longitudinal spring boards, attached to the top of the lateral pieces carrying the seat spring boards and the back rest boards, which is secured to the driver's seat and a rear head piece.

IMPROVED WHEEL FELLY.

Edward P. Hood, New Boston, Mass.—The ring plates are made open, and with a splice or lap, to enable the shrinkage of the tire to bring them down firmly upon the spokes.

IMPROVED GUIDE FOR SAWING MACHINES.

Cornelius R. Blauvelt, Newark, and Peter V. V. Sage, East Orange, N. J.—This is an improved device for holding work while being mitered or beveled, which may be quickly and firmly secured to the table, readily adjusted for any thickness of wood, and to any style of table, which will allow the table to remain horizontal, so that there will be no extra strain upon the saw, which may be readily adjusted to bevel the wood at any desired angle.

IMPROVED BLIND SLAT ADJUSTER.

Hermann H. Cammann, New York city.—This consists of two arms jointed together, and provided with a notched segment and a spring bolt or detent, and jointed to a plate attached to the lower rail of the blind, and to the rod that operates the slats. By this device the slats may be placed and retained in any desired position.

IMPROVED MACHINE FOR SAWING AND BORING WOODEN BLOCKS.

Fred T. Stevens and James O. Stevens, Coos, N. H.—This is a combination of a clamping device for holding the wood while being sawed and bored, and grooved rollers, acting intermittingly, for feeding the bar of wood to the machine. There is also a swinging saw for cutting off the blocks, and a sliding boring mandrel that is moved up at the proper instant for boring the block. The various parts are operated by cams and levers.

IMPROVED SASH CORD FASTENER.

Charles Hintzman, New York city.—This consists of a detachable socket, secured to the sash by a single screw near one end, and at the other by two lips, that project under a lock plate.

IMPROVED COMPOSITION FOR VENEERS.

Charles H. Land, Detroit, Mich—This composition is capable of vulcanization in the finishing process. It consists of whiting, linseed oil, rubber, turpentine, and sulphur.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

A. B. S. will find directions for making an æolian harp on p. 330, vol. 26.—A. F. B. can copper iron wire by following the directions on p. 90, vol. 31. To silver it, use the preparation described on p. 299, vol. 31. —C. D. is informed that we do not know of the offer of a premium for a method of crystallizing maple syrup.—H. B. B. and many others should read our article on the horse power of an engine on p. 33, vol. 33.—E. T. will find directions for building a hen house on p. 139, vol. 36.—T. C. will find something on the formation of butter in the process of churning on p. 119, vol. 30.—T. F. M. will find a good recipe for ice cream on p. 251, vol. 28. —J. W. B. will find on p. 253, vol 30, a recipe for paste for fastening paper to tin.—C. W. D. will find on p. 123, vol. 31, directions for bluing steel.—W. W. does not give the length of his crank arm nor the speed at which the car is to run.—T. H. C. will find something on the use of zinc in boilers on p. 36, vol. 32. —E. E. P. will find directions for building a refrigerator on p. 251, vol. 31.—C. E. C. is informed that steel has been used for making boilers. As to flow of water through pipes, see p. 48, vol, 29.—H. L. C. will find directions for polishing shirt bosoms on p. 203, vol. 31. To clean kid gloves, see p. 283, vol. 30.—W. D. can use aquarium cement on his wardian case. See p. 202, vol. 28.—A. B. will find a recipe for Babbitt metal on p. 122, vol. 28.—T. A. B. is right as to the size of the drill asked for by W. H. R. The $\frac{15}{64}$ drill would be about $\frac{1}{177}$ smaller than the $\frac{6}{25}$ hole.—H. & W. will find a good recipe for a depilatory on p. 229, vol. 28.—W. S. F. will find directions for nickel plating on p. 174, vol. 30.—I. A. H. is informed that the lava gas tip is made by a patent process. —B. F. F. will find something about the Australian colonies of Great Britain on p. 161, vol. 36.—H. L. C. is informed that we do not recognize his coin from the impression he sends.—D. F. H. will find an answer to his query as to large and small wagon wheels on p. 91, vol. 36.—H. Y. D. will find directions for making hydrogen on p. 341, vol. 27.—B. H. W. can mount photographs by following the directions on p. 91, vol. 31.—J. W. B. will find a recipe for an aquarium cement on p. 202, vol. 28.—McC. will find a recipe for mucilage on p. 202, vol. 31.—J. S. R. will find an article on American graphite on p. 55, vol. 25.—L. J. D. will find a recipe for a bright bronze on p. 51, vol, 33.—C. L. T. should read our articles, now in course of publication, on straightening metal plates. —O. S. is informed that we have no means of verifying the sea serpent story.—A. J. P. and R. W. C. will find a recipe for baking powder on p. 123, vol. 31.—E. J. will find a recipe for black enamel on iron on p. 208, vol. 26. —J. D., Jr., will find an answer to his query as an alloy that will expand on cooling on p. 138, vol. 36.—T. S. V. will find a recipe for cement for patching leather boots on p. 119, vol. 28.—J. H. W. will find a description of an incubator on p. 273, vol. 33.—C. R. will find a recipe for artificial marble on p. 57, vol. 28.—H. J. D. will find directions for French polishing furniture on p. 11, vol. 32. —J. M. T. will find a formula for safety valves on p. 363, vol. 29, and for horse power of engine on p. 33, vol. 33.—G. W. W. will find a recipe for a depilatory on p. 107, vol. 30.—C. B. W. will find directions for re-tinning tinware on p. 139, vol. 36.—J. McF.'s device is not a perpetual motion, as it depends on heat for its power. As to the flight of birds, he forgets that the atmosphere rotates as well as the earth.—W. B. will find something on the retina of the eye on p. 20, vol. 32.—C. H. S. will find directions for making artificial meerschaum from potatoes. etc., on p. 307, vol. 34.—F. L. will find directions for coloring gold chains on p. 43, vol. 30.—H. J. D., S, H., J. F. L., T. M. F., J. H. N., W. B., B. L., E. E., R, S., P. W., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) G. O. E. asks: 1. What would be the effect of the explosion of 40 gallons each of pure oxygen and hydrogen, contained in gas bags like those used with the oxyhydrogen stereopticon? A. A mixture of oxygen and hydrogen in the proper proportion is as powerful an explosive, in proportion to its specific gravity, as nitro-glycerin. The explosion of such a quantity of the mixture as you mention, in an ordinary apartment, would endanger the building. If the gases are not mixed, there is no danger, as neither of them alone is explosive. 2. Is there no way of preventing the possibility of such an explosion? A. With suitable safety bottles between the gas reservoirs and jet, and with equable pressure in each reservoir, there is little or no danger under skillful manipulation.

(2) J. M. A. says: I find an apparent contradiction between two standard authors as to the definition of "living force." Bartlett's "Analytical Mechanics," page 45, says: "The living force of a body is double the quantity of work expended by its inertia while it is acquiring its velocity." This author represents the living force by $M v^2$. In Peck's "Mechanics," it is stated, on page 187, that "the expression $\frac{1}{2} M v^2$ is called the living force of a body. . . The living force of a body is the measure of the quantity of work expended in producing the velocity." Thus one author places the measure of the living force at twice the amount of the other. Why this discrepancy? A. Professor Bartlett's definition is probably the most generally accepted; but there is good modern authority for the other. It is a case of definition, about which authorities are apt to differ. Al. agree that the energy is $\frac{1}{2} M v^2$, while some consider that double the energy is an imaginary "living force," and others do not.

(3) C. asks: What kind of dye is used in coloring rattan for fancy chair seats? A. For blue, sulphate of indigo, partly saturated with an alkali. For scarlet, lac dye used with tin salt as a mordant. For red, dye with madder, using tannin and alum as mordants. For black, impregnate with acetate of iron and boil with a decoction of madder and logwood. For green, boil with an alum mordant and then with sulphate of indigo, and a little fustic or quercitron. For yellow, use an alum mordant and dye with fustic. The coal tar colors may also be employed for this purpose.

(4) J. C. P. says: 1. I wish to build a tug boat for the purpose of towing barges laden with oyster shells. The barges are 30 feet long by 10 feet wide, and 3½ feet deep, and will hold 7 or 10 tons of shells. What size should the steam tug be to tow such barges at the rate of 3 or 5 miles per hour? A. If you only mean to tow one barge at a time, an ordinary row boat, 18 to 20 feet long, fitted with engine and propeller will answer very well. 2. What are the constituents of oyster shell lime? A. An analysis of oyster shells by Schossberger shows that they consist of three layers, as follows: 1. Inner layer, the so-called mother-of-pearl. 2. Brown hard scales, forming the outer edges of the successive laminæ of the outer shell. 3. A chalky layer, interposed between the laminæ of the shell. The first of these contains: Carbonate of calcium 94·7, organic matter 2·2, other salts and loss 3·1. The second contains 89·1, 6·3, and 4·6, and the third 88·6, 4·1, 6·7 of these ingredients respectively. You should consult our advertising columns for addresses of dealers and manufacturers.

(5) A. J. K. says: In the glass sand business we have during winter to dry all our sand. I dry it now on a floor, drying 15 tons in 10 hours. Is there an apparatus that we could use that would keep the sand in one place and save the work of shovelling it off the floor? A. For similar purposes the material to be dried is caused to pass, by means of continuous bell buckets, through the extended flue of a small brick furnace. This method has succeeded very well, and is employed extensively for the drying and roasting of certain ores, etc.

(6) J. J. asks: How can I unite a set of vulcanite teeth that are broken, that they may stand the saliva and heat of the mouth? If I knew how to make the vulcanite that the teeth are set on, I think I could have mended them with it. A. Mix dry caoutchouc with half its weight of flowers of sulphur, and thoroughly knead the mixture on a plate of warm metal. Heat the teeth to a temperature of about 212° Fah., join the fractured edges with a little of the caoutchouc dough, moistened with a drop or two of bisulphide of carbon, and expose the whole to a temperature of about 200° Fah. for 2 hours. At the expiration of this time, raise the temperature to 300°, and maintain it constantly at this for 4 hours more. When cool, the joint will be found firm, and may be trimmed with a sharp knife.

(7) W. R. T. says, in answer to C. S. D., who asks as to what is the best wood for a guitar: My experience shows basswood to be best. Either use the wood in pieces, or get a strip of a sufficient length, and steam it so that it will not break.

(8) J. A. M. says: I have a 26 inch under runner burr, and the spindle heats when the stand is full of oil, so that I have to stop. There is no grit in it. How can I remedy it? A. Make your spindle cone-shaped at the end, like a lathe center.

(9) J. N. P. asks: 1. What is draw-filing? A. Draw-filing is filing with the length of the file at a right angle to the motion of the file, the latter being held in both hands and made to cut on both strokes, by which process the file cuts more smoothly.

What is a shaping machine, or what is the difference between a shaping machine and a planer? A. A shaping machine is a machine for planing iron. In a shaping machine the slide carrying the tool travels, the table holding the work being stationary. In a planing machine the head and slide are stationary, while the table carrying the work travels back and forth.

A friend of mine has been working for years on a machine to be inclosed in a caisson, and let down in a cistern, claiming that the water of the cistern will run the machine and pump a continuous stream out of it at the top as long as there is any water in the cistern. I have tried to convince him that he is trying to make a perpetual motion, but he says he is not. A. Such an apparatus would be a perpetual motion.

(10) C. R. S. asks: 1. Which is the most powerful and economical for a road locomotive, a double engine of 8 horse power in each cylinder, connecting on the same driving shaft, or one single engine of 16 horse power? A. The double cylinder would be the best. 2. How large should the boiler be? A. Consult a manufacturer.

(11) J. C. M. asks: How can the amount of friction of a valve on its face be ascertained, if we have the pressure of steam per inch and the area of the surface occasioning the friction? The answer should designate the number of lbs. applied to the valve rod necessary to move the valve. A. The precise pressure cannot be calculated because it depends upon the fit of the valve to its seat.

(12) E. H. M. asks: What kind of curve is best to use in bent arm gears? A. Variously shaped curves are used, all serving equally well.

Of what size should master taps be? A friend says that they should be of the same size as working taps, while I hold that they should be $\frac{1}{32}$ of an inch larger. A. Master taps for tapping dies should be from once to twice the depth of the thread larger than the bolt the die is intended to cut.

(13) L. M. C. asks: If a locomotive is running on a down grade (the drivers, of course, having a forward motion) without working steam in the cylinders, the throttle being entirely closed: if the engineer throws back the reverse lever so that the backing eccentrics work the valves, what would be the result? I read some time ago that air would be pumped through the steam pipes into the boiler and thus increase the pressure. But how is any air going to enter the boiler, the throttle being closed? A. The piston would draw air from the exhaust, and pump it partly back through the exhaust and partly into the steam chest.

(14) J. J. asks: Will a well constructed condensing engine of 5 inches bore and 12 inches stroke, cutting off at ¼ stroke, with a steam pressure of 100 lbs. (which would be 25 lbs. at end of stroke, and an average of about 57 lbs.), give as much power as a compound engine taking the same amount of steam? A. No. The compound engine would give most power.

(15) G. E. C. says: I read that to reverse a stationary engine the eccentric should be turned halfway round on the shaft from where it stood. I claim that it will not do to turn it exactly halfway round, and other engineers dispute this. Please let me know. A. If the valve has no lead, the eccentric may be turned halfway round on the shaft to make the engine run the other way. But if the valve has lead, the eccentric turned halfway round would set the valve wrong to twice the amount of the lead.

(16) O. J. says: You are doing the community a good service in pointing out the poisonous character of the fumes of the colored fires ordinarily employed, and the dangers that may arise to delicate constitutions by their use. With a view of introducing some mixtures that seem to be free from injurious ingredients (sulphur and antimony and arsenic compounds being eliminated) and producing fumes not even so annoying as tobacco smoke, I append the following formulæ, and send you samples of two different red fires: Red No. 1: Chlorate of potash 16 parts, nitrate of strontium 30 parts, lycopodium 3 parts, sugar of milk 2 parts. Red No. 2: Chlorate of potash 1 part, nitrate of strontium 8 parts, shellac 2 parts. Green No. 1: Chlorate of potash 9 parts, nitrate of barium 30 parts, lycopodium 3 parts, sugar of milk 2 parts. Green No. 2: Chlorate of potash 1 part, nitrate of barium 8 parts, shellac 2 parts.

(17) J. F. asks: Please tell me how I detect tellurium in ores, and in what minerals it is chiefly found? A. Metallic tellurium is a tin-white, brittle substance, with a metallic luster, and a specific gravity of 6·25. It is never found free in Nature, but usually in combination with either bismuth or gold and silver. With bismuth, it constitutes the mineral known as tetradymite, which has a steel-gray color and a high metallic luster. Tetradymite occurs in tubular crystals or foliated masses, which mark paper like black lead. Tellurium, in combination with gold and silver, forms the mineral sylvanite, of metallic luster and steel-gray color. When fused on charcoal it yields a light yellow, malleable globule, which contains 1 part telluride of silver and 2 parts telluride of gold. Metallic tellurium has, at present, no place in the arts, and finds a market only in the preparation of mineral and other scientific cabinets. Its price is quoted by dealers in rare metals at about $8 per ounce or $90 per pound.

(18) E. C. H. asks: 1. Is cast cast-steel suitable for laps and dies for steam pipes, and for other kinds of screw-cutting? A. Yes. 2. What is the shrinkage of cast cast-steel, and of malleable iron? A. It is very irregular, differing according to the size of the casting. 3. How much larger should the tap be for cutting open dies than the bolt that the dies are to be used on? A. About 1½ times the depth of the thread larger.

(19) J. D. E. asks: Why could we not make a telescope on the principle on which the Huyghenian eyepiece is made? A. Because the chromatic and spherical aberration cannot be corrected by such a combination of lenses.

(20) W. W. H. says: I wish to stain some windows for a church. Please give me a recipe for making a good imitation of colored glass. A. You cannot stain the glass without removing it from the window, but you can imitate the stained glass by means of transparent colors applied as paints. For this purpose, use such colors as Prussian blue, gamboge, and carmine. These will give you the three primary colors, and by their mixture the other tints may be produced. Apply with a brush, and use any transparent varnish, such as dammar, as the vehicle.

(21) E. R. asks: Is there any liquid cement, that is less expensive than shellac, with which I can cement together fine white sand or pulverized pumice-stone? A. Common rosin dissolved in naphtha, with the addition of a little gutta percha to render the resulting cement more binding and less brittle, is a preparation at once strong, cheap, and waterproof. It may be concentrated to any consistence by evaporation of the solvent.

(22) J. F. S. asks: How can I recover sulphuric acid from waste, after the washing of nitro-glycerin? A. There is no method sufficiently economical to be of any practical value for this purpose. The concentration of the acid by the evaporation of the diluent would be tedious and expensive. If the solution is not too dilute, the greater part of the sulphuric acid may be removed as sulphate of lead by agitating it with the proper quantity of dry lead carbonate, allowing to settle, and subjecting the dried precipitate to dry distillation in stoneware retorts heated to bright redness.

Please tell me of a simple and cheap method of making glue? A. Gelatin or glue exists in many animal tissues, as the skin, cellular membranes, tendons, and ligaments, and forms the framework of bones, horns, hoofs, etc. It may be separated and dissolved out from these by protracted boiling with water. The aqueous solution, when cooled, gelatinizes; and when this jelly is dried, it constitutes ordinary glue.

(23) S. J. T. asks: What form of coupling is the most durable and best adapted to run the line shaft of a threshing machine cylinder, 700 or 800 revolutions per minute on an angle, say, of about 20°? A. Use an ordinary universal coupling.

(24) W. W. asks: 1. Please give me the philosophy of the expansion of steam in the cylinder of a steam engine. Why does a cylinder 7 feet long and 3½ feet in diameter, other things being equal, give a power twice as great as a cylinder of half that length, although the surface of the pistons is the same? A. The power of an engine is the resultant of three data, pressure, distance, and time. If a piston has 1,000 lbs. pressure on it and moves 3½ feet in 1 second, it has half the power of one that has 1,000 lbs. pressure and moves 7 feet in 1 second. 2. Is the pressure on the piston, after it has passed 6 feet from the starting end of the 7 feet cylinder, any greater than it was when it had reached a point 1 foot from that of starting? A. Yes, unless the steam is cut off before the end of the stroke. If the steam follows the piston full stroke, the power will increase in proportion to the length of the cylinder. If the steam supply is cut off before the piston reaches the end of the stroke, the steam will expand and lose pressure in proportion to the increased space it occupies.

(25) M. S. D. says: For the information of the correspondent who asked as to twisting augers, allow me to say that the blade or twist of the common carpenter's auger is made by drawing the iron or steel out nearly flat, something like the blade of a table knife in shape, but thicker through the center than at the edges, as wide as you want the cutting size of the auger to be, and a little longer than the twist is to be when done. This is then heated; the cutting end or head is clasped in a vise; and the workman, holding the other or shank end with tongs, twists it over from right to left by hand. It is afterwards made true by means of crimp dies rapidly opened and shut upon it. The head is struck out in a die afterwards.

(26) C. W. H. asks: What paste or glue will fasten paper firmly to iron and stone? A. Melt together equal parts of asphalt and gutta percha. Use hot. The surfaces to be joined should be perfectly clean and dry.

(27) G. S. W. says: About 4 feet square of our flooring, with about 15 inches thick of sawdust between

it and the ceiling below, has been saturated with neats-foot oil. What can we do to prevent spontaneous combustion? A. It is better to remove the danger by substituting a new floor; but if this is not practicable, saturate the floor as thoroughly as possible with a strong solution of washing soda in lime water.

(28) C. R. asks: Is there any preparation that will hinder the decomposition of gelatin when used for moulds and often remelted? A. Try the addition of a little lime.

(29) F. P. W. says: I have spilt some black ink on my carpet. Please tell me how I can get it out without injury to carpet? A. If the ink is of the same kind as that used in your letter, it cannot be removed without destroying the coloring matters of the carpet.

(30) W. H. asks: What are the causes of the formation of lead ore, to the best of your knowledge? A. You do not state which ore of lead. Galena was probably formed by the fusion of oxide of lead in contact with sulphur, from which it crystallized.

(31) S. W. asks: What are the names of the elementary bodies discovered since 1869? A. The element gallium, discovered by Lecoq in 1875, is the only one.

(32) L. F. B. says: In answer to J. J. S., and others, you say that water boils at 184° on the St. Bernard. This mountain is 8,400 feet high. Are you right? A. The Swiss St. Bernard is 11,080 feet in height.

(33) W. C. L. asks: Does galvanized iron attract more cold than copper or other metals? A. If we understand you, the metal that is the better heat conductor will condense most moisture upon its surface; in this respect copper far surpasses galvanized iron. If copper be taken as 100, galvanized iron equals about 16 in the scale of conductivity.

(34) J. asks: Is there any substance which, if dissolved in alcohol and applied in solution to surfaces of raw, light-colored woods, such as ash and maple, will give them a luster and make the grain more apparent without changing the color? A. A filtered solution of pure, bleached shellac in alcohol will do this, or a very thin varnish of mastic. Such woods darken by age; this cannot be avoided.

(35) B. H. L. asks: What liquid could I use, that would be cheap enough, to kill weeds without injuring wood, so as to sprinkle 2 or 3 miles of plank road without hastening the decay of the wood? A. A sprinkling of crude carbolic acid would, in great part, accomplish this, without injury to the planking.

(36) E. A. W. asks: How can I remove the clinkers which accumulate on the brick linings of cooking stoves? A. These are due to the presence of alkalies or lime and sand with the coal, which become fused together, forming a glass which constitutes the adhering clinker. It can only be removed by mechanical means, but may be avoided by using only fuel free from these impurities.

(37) G. H. A. asks: 1. Is there any extract of lime that will answer the purpose of fresh slacked lime for a preservative, and not make anything that is immersed in it look limy? A. There is no extract of this kind. 2. How can I, after leaching the lime and getting the strength out of it, make it so that anything immersed in it would not show the lime after taking out and drying? A. The excess of adhering lime may be removed by immersing the substance, after digesting in the lime water, in pyroligneous acid; or the lime water may be acidified with the wood vinegar.

(38) W. L. I. says: I want to lift water to a height of 46 feet, then convey it to a tank distant from the well 45 yards. I have plenty of power with which to run any kind of pump. Can I get one to lift water to that height? A. There are pumps made especially for such situations, that can be driven by belts, gearing, or lever connections, as may be most convenient. It is not our custom to recommend special manufactures in these columns; but if you will make your wants known under the "Business and Personal" heading, you will open communication with the proper parties.

(39) H. D. D. asks: How can I calculate the dimensions of a boat to carry a given weight? A. Find how many cubic feet of water the boat displaces at different assumed draughts, and the product, in any instance, of the displacement multiplied by 62, gives the number of lbs. the boat can carry at that draught, including its own weight.

(40) F. R. R. S. asks: From what depth will a steam siphon draw water perpendicularly, and to what height above the siphon can the water be forced? A. It can draw about as far as a good suction does, and as ordinarily arranged does not force the water, but could easily be made to do so to a height depending on the pressure of steam.

(41) T. R. R. asks: Could you give a short table showing the rate at which atmospheric air is increased in temperature by sudden compression, as well as the increased pressure per inch, starting at about 60° Fah.? A. The following figures are taken from a table published by Professor Thurston in the *Journal of the Franklin Institute:*

No. of atmospheres.	Degrees of temperature Fah.	Lbs. pressure per inch.
1	60	00
2	180	About 15
3	260	30
4	322	45
6	420	75
8	497	105
10	561	135

(42) A. B. asks: What would be the power of a 100 lbs. fly wheel attached to one end of a horizontal shaft, worked by hand? A. The actual energy of such a wheel depends upon its dimensions and velocity, the general rule being:

$$\text{Energy} = \frac{\text{Moment of inertia} \times (\text{angular velocity})^2}{64 \cdot 4}$$

(43) H. H. asks: 1. Is steam visible in a boiler? A. No. 2. Does water boil in a boiler when there is a pressure of steam? A. There is no violent ebullition unless the pressure is practically removed. 3. How large a boiler is required for a 40 horse engine? A. One capable of evaporating from 10 to 60 cubic feet of water per hour. 4. What size of steam pipe is required for a 20 horse engine? A. Make it about ¼ the diameter of cylinder.

What size of balance wheel would a person want for a 22 inch circular saw? A. None will be required in general, except the pulley on the saw mandrel.

(44) J. J. T. says: What is the cause of the knocking in a water pipe? I am running a 20 horse engine, and the pump is attached to the crosshead; the feed to it is ¾ inch lead pipe with an air chamber on it; the discharge pipe to the boiler is 1 inch, with an air chamber. When pumping, the feed pipes make a fearful noise, as though some one were hammering it. A. The area of the suction pipe or suction valve is probably too small, causing the valve to have too much lift; and its violent closure causes the noise.

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

G. M. S.—No. 1 is pyrolusite, a gray ore of manganese. No. 2 is chalcophyllite or copper in combination with arsenic acid. No. 3 is quartz. No. 4 contains calcite and apophyllite—carbonate of lime and silicate of lime and potash.—E. M. P.—Your powder consists principally of some organic body; but the quantity was so small that we could not determine its nature.—D. A.—It contains mica and sesquioxide of iron.—J. R. B.—It is an impure clay—silicate of alumina. You did not pay the postage on your specimen.—A. D. G.—No. 1 is mica schist. No. 2 appears to be cassiterite (oxide of tin). Send a larger specimen.—F. W. M.—It is iron pyrites. See p. 7, vol. 36.—E. T.—Your mineral seems to be a piece of scoria from some furnace. It contains iron, sulphur, lime, and a large quantity of carbon.—B. H. L.—Your specimens are basalt and granitiferous rock.

COMMUNICATIONS RECEIVED.

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

On a Geographical Question. By P. G.
On the Distances of the Stars. By W. W.
On Shipping Nitro-Glycerin. By C. L. K.
On a New Car Coupling. By the O'K. McK.
On Civilization. By T. R. V.
On the World's Age. By A. F.

Also inquiries and answers from the following:

J. C.—W. A. M.—Y. S.—J. M. P.—N. S.—J. B. H.—O. O. O.—F. Z.—J. H. G.—A. B.—T. W. P.—H. A. H.—H. C. H.—A. G.—R. T. G.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells sewing machines? Who sells blue glass chimneys? Who makes artificial limbs of hard rubber? Who makes artificial eyes? Why do not makers of artificial stone advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

February 6, 1877,

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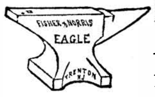

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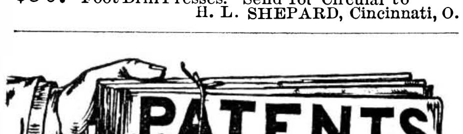

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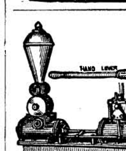

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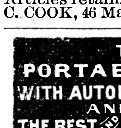

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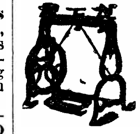

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