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BESSEMER STEEL.

The Bessemer process of making steel stands prominent among modern inventions as a great success, both practically and financially. From a scientific standpoint it commands our attention, as being a remarkably simple and yet very effective process. Just now the Bessemer works of this country are very active, and it seems likely that the existing works will prove insufficient to supply the increasing demand for Bessemer steel.

The facts given in this connection were furnished us by the Albany and Rensselaer Iron and Steel Company, of Troy, N. Y., portions of whose works are shown in the engraving on this page. Two converters are used in the Bessemer steel department of this establishment, having a capacity of seven tons each. They are about 9 feet external diameter and 16 feet high. They are made of a refractory material, the walls being about 1 foot thick. The exterior iron shell is made of ½ to ¾ inch wrought iron plates, and is mounted on trunnions, so that it may be inverted by a hydraulic cylinder by means of a rack and pinion.

Fig. 2.

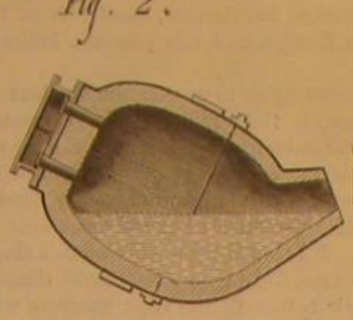
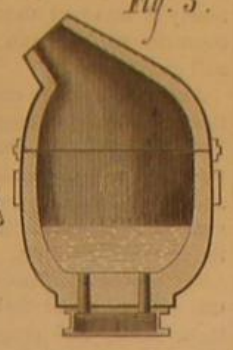


Fig. 3.

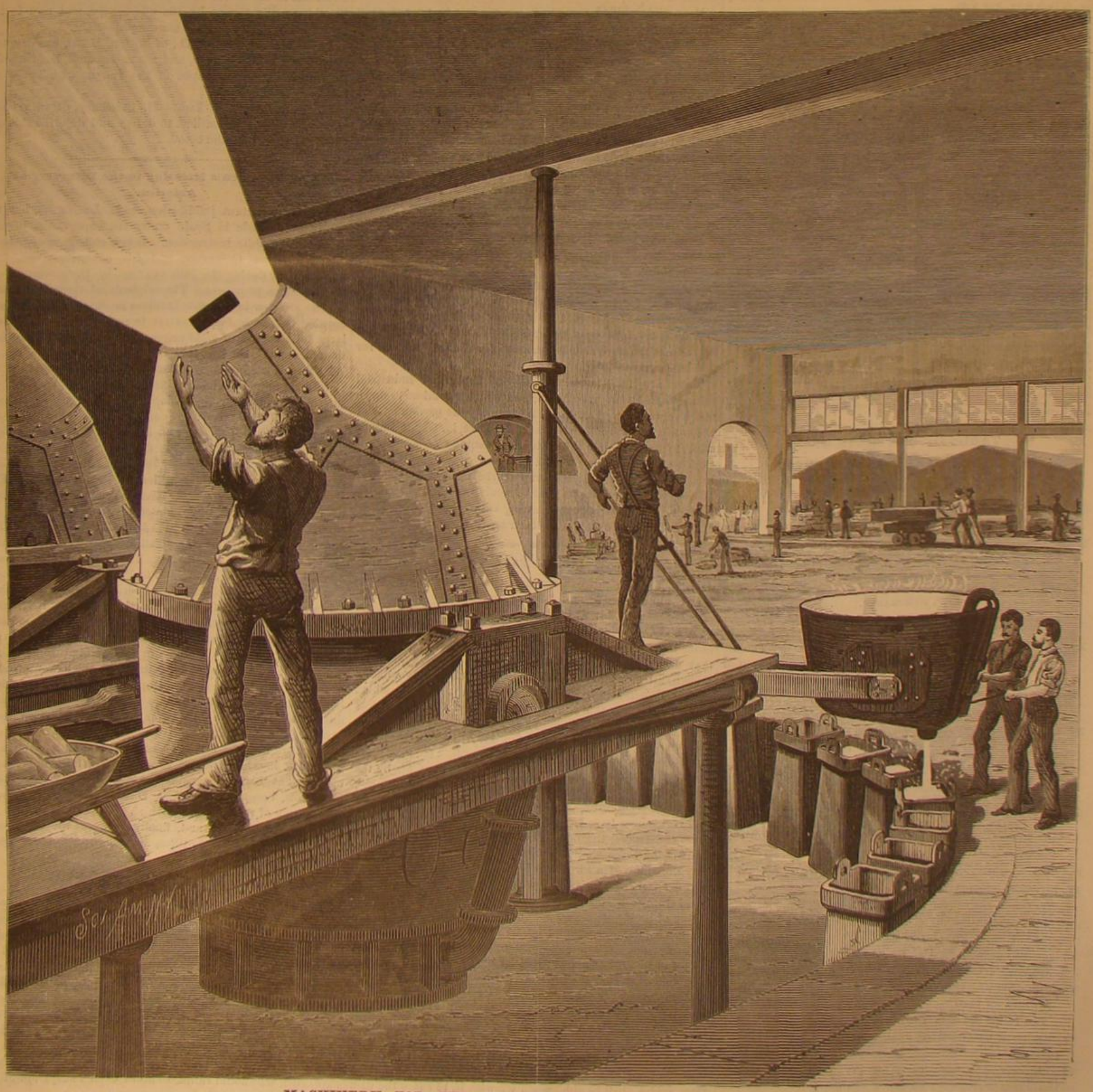


The construction of the converter is shown in the sectional views, Figs. 2 and 3. At one end it has a nose 18 inches in diameter, and at the other a tuyere box, communicating with the blowing engine through one of the trunnions.

Each bottom has 12 tuyeres, 6 inches in diameter and 24 inches long, made of fire clay, fire sand, and ganister, a stone belonging to the quartzite group. The tuyeres are each pierced by twelve ⅜ inch air holes through which the blast enters the converter. The converter is turned down, as shown in Fig. 2, to receive its charge of iron; it is of sufficient size to contain the entire charge below the nose and tuyeres.

The process of decarburizing iron requires about twenty

[*Continued on page* 137.]



MACHINERY FOR THE MANUFACTURE OF BESSEMER STEEL.

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NEW YORK, SATURDAY, AUGUST 30, 1879.

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BALANCE OF TRADE IN MEN.

It is a grand thing for any country to be able to show a balance of trade in material products on the home side of the sheet. To be able to sell, year by year, two or three hundred million dollars' worth of stuff in excess of what we have to buy abroad, as the United States can do, is substantial evidence of our progress in solid wealth.

The nation is justified in rejoicing over so favorable a showing. But there is another phase of our relations with the rest of the world, which tells still more remarkably in our favor, and which promises to aid in the near future, even more than it has done in the past, in building up for us a grand and abiding prosperity. There is nothing that contributes so much to the wealth of a nation as hopeful, energetic, thrifty men and women; and the Old World is daily sending us these by the ship load. At this port alone, during the year ending with May last, there were landed nearly a hundred thousand immigrants, mostly from the countries of Northern Europe, and this year the influx is still greater.

And what is more encouraging to us than the numbers of these incoming citizens, is their high average character. The social, military, and industrial conditions in Europe are such that a better class are emigrating now than formerly, and the indications are that still larger numbers of intelligent farmers and skilled workmen will seek our shores in the immediate future. It is but a little while since a single party of German-Russians, 350 in number, passed through this city to make their homes in the West, carrying with them money and property to the value of $400,000. The influx of well-to-do English and Scandinavian farmers, during recent years, has been unparalleled, and it promises to increase.

Meanwhile skilled mechanics are coming to us, not only singly, but in large companies. More than 150 French and English families recently took up their residence in New Albany, Ind., to engage in the plate glass industry established there. The day before this writing (August 6), 22 families and 20 single men, in all over 100 skilled workmen, arrived here on their way to Bridgeport, Conn., to which place they had emigrated from Sheffield, England, at the instigation of the Frary Cutlery Company, of Bridgeport. The men were, for the most part, between 20 and 35 years of age, picked workmen, intelligent, and well dressed. They were preceded by a smaller party a few weeks ago; and it is said that in the fall about 500 more skilled cutlers will be brought over by the same company from England and Germany.

These men come to America not because they cannot live at home, but because they and their children can live to better advantage here. And they come provided with certain employment, for the capital of the establishment which they had worked for in Sheffield comes with them. Thus, with the migrating workmen, a new center of industry, if not a new industry, is brought to our shores; and to a corresponding extent the necessity is removed for sending abroad for fine cutlery.

These are but scattering drops of the grand industrial rain, which has done so much, and which promises to do so much more, toward making this country the garden spot of the world for the industrial arts to thrive in. It is impossible to overestimate the national advantage of such additions to the productive wealth of a new country. With the best of wishes for the prosperity of the nations of the Old World, we cannot but be glad to receive from them contributions of such intrinsic and lasting value. May the balance of trade in men be the last to turn against us.

A LITTLE PARADOX.

M. Piateau, Member of the Academy of Sciences of Brussels, communicates the following note to *La Nature:* If, says he, perpetual motion were simply defined as the motion of a body, which, after receiving an impulse, continues to move indefinitely by virtue of its inertia alone, I should say, that under these conditions, it was realizable. As well known, all movements that we produce ultimately come to an end, because they inevitably meet with resistances which destroy them; so that to keep up a motion for a long time the intervention of a foreign force is necessary in order to continually restore to the moving body that portion of the motion which resistances have taken from it. It is thus that the oscillations of a clock's pendulum are kept up by the small impulses of the escapement. But if the foreign force, instead of communicating to the moving body the motion that resistances have caused it to lose, is employed to annul these resistances, the body will continue to move as long as the foreign force shall neutralize the resistances. Now we may make use of a force that is ever present, such as a current derived from a river; and in this case the moving body freed from resistances will continue to move indefinitely by virtue of its inertia alone.

Let us take an example; let us conceive of a horizontal disk movable around a vertical axis which is fixed to the center of its lower surface; and let there be hollowed out a hemispherical cavity of a few millimeters diameter in the center of its upper surface. Now let us suppose the apparatus located by the side of a river, where it is put in communication with the latter by means of a tube leading from a reservoir placed at a level lower than that of the lowest tide, the reservoir being constructed so as to furnish, by means of an orifice at the bottom, a uniform and strong flow, which shall be able, when we wish it, to cause the disk to revolve very swiftly.

This being done, before we allow our water course to act, let us spin a top very rapidly, place its point in the small hemispherical cavity, immediately cover the top with a bell glass whose axis coincides with that of the apparatus, and keep this glass firmly in position by some means or other. Finally, by the aid of one current of water, let us set the disk, along with the bell glass, in motion in the same direction as the top. As may be conceived, after a certain length of time, the movements of the disk, the top, and the air confined beneath the bell glass, will become equalized. Then the top will meet no further resistance at its point, since the support on which it rests is revolving with exactly the same speed and in the same direction; it will no longer experience any resistance from the surrounding air, since the latter will also possess the same angular velocity, and we will thus have the curious spectacle of a top remaining indefinitely in equilibrium on its point; and it will continue to revolve, not because any lost motion is restored to it, but because it does not lose any. This will be a perpetual motion according to the definition given at the beginning of this note.

FUNGI IN MAN.

The human ear is sometimes attacked by a disease which shows itself in the form of a running sore; in many cases the tympanum is destroyed and hearing lost before the nature of the malady is discovered. The disease is due to the growth of a microscopic plant or fungus of the *Aspergillus* family. It especially thrives when, from any cause, the secretion of wax in the ear is stopped or hindered. The microscope is a valuable assistant in the discovery of this fungus.

Consumption, the most disastrous malady that afflicts humanity, is now said to be caused by a yeast plant that flourishes in the blood. The presence of this fungus in the blood is readily shown by the microscope, and now forms the subject of careful study among physicians.

Dr. Ephraim Cutter, M.D., of Boston, Mass., has devoted much labor to this subject, and, we understand, has recently produced micro-photographs of the fungus with Tolles' remarkable $\frac{1}{25}$ objective.

We believe that Dr James H. Salisbury, of Cleveland, Ohio, was among the earliest to detect and describe this curious yeast plant of the blood.

New Documents Relating to the Discovery of America.

A very important publication, says *La Nature*, has recently been made in Spain under the supervision of the Minister of Public Instruction. It is a collection of letters of Christopher Columbus and his contemporaries, and reports made during the 16th century by the governors of the American provinces. The originals of these letters and reports are now in the state archives at Seville. The work, entitled *Cartas de India* (Letters from the Indies), forms a large folio volume of 1,754 pages, and contains the following documents of great interest:

1 Two autographs of Columbus addressed in 1502 to Ferdinand and Isabella, the first urging the necessity of suitable measures for increasing the population of the isle of *Española* (St. Domingo), the second containing a dissertation on the art of navigation. 2. A letter from Amerigo Vespucci to Cardinal Ximenes di Cuneros, Archbishop of Toledo, dated at Seville, 1508, regarding some merchandise to be sent to the Antilles. 3. Two letters from Fra Bartholomeo de Las Casas, Archbishop of Nicaragua, to the Infante Don Filippo, dated at Gracias á Dios, in Guatemala. 4. Two letters from Bernaldo Diaz del Castillo, one of the warriors of the small army of Cortez and the author of a history of Mexico. These two letters are addressed to Charles V, 1552, and to Philip II., 1558. 5. Letters from the bachelors, Don Pedro de Gasca and Don Christopher Vaca, of Casca, dated at Quito, 1541, and Cusco, 1542, announcing to Charles V. the death of the Marquis Don Pizaro, and the insurrection of Don Diego de Almagro. All these letters are very interesting, being written by eyewitnesses of the occurrences which they narrate. 6. A very curious letter from Dona Isabella Quivara, relating to the remarkable courage exhibited by the women during the expedition of Cortez, while all the men were prostrated by sickness.

The work contains 652 pages of text, and an appendix of 225 pages, in which we find 29 autograph letters and reports of different historic persons; 28 autograph pages from Columbus, Vespucci, Las Casas, Diaz del Castillo, Ximenes, etc., a map of the fortress in which the precious stones of the Incas were found; and, finally, maps of the Amazons, the Archipelago of the Antilles, and the Straits of Magellan, executed in the 16th century.

The Worcester Free Institute.

In an article on the advantages of a mechanical education, in a recent issue of this paper, mention was made of several of our leading institutions of technology, wherein the education commended could be had. It was not intended to give a full list of such institutions, much less to intimate that any not named were inferior to those named. Had such been the intention, it would have been a serious mistake, as well as an injustice, to omit the Worcester Free Institute, a school which ranks with the best technological institutions in the land. Our high opinion of the value of the work done there has been too frequently and too plainly expressed, we should think, to allow even a suspicion of an intentional slight of that nature on our part.

FAILURE OF TEA ROSES.

HABITS OF FULLER'S ROSE BEETLE.—(*Aramigus Fulleri*, Horn.)

BY PROF. C. V. RILEY.

Within the last five or six years frequent complaints have been made of the failure of tea roses, the cultivation of which has become a very important and lucrative branch of flower culture. This failure has recently been ascertained to be due to the larva of a little gray snout beetle, belonging to the family *Otiorhynchida*, and shown in its different stages in the accompanying figure.

Mr Peter Henderson, of Jersey City Heights, N. J., has himself suffered very much from the work of this insect, and I have had considerable correspondence with him during the winter upon the subject. The following quotation is from one of my letters replying to his inquiries:

"The first knowledge which I obtained of this insect was through our mutual friend, Mr A. S. Fuller, who sent me specimens in 1875, the species being then undescribed. In 1876 it was described under the name of *Aramigus Fulleri*, by Dr G H. Horn, in the proceedings of the American Philosophical Society, vol. xv., page 94. Mr. Fuller had found it in greenhouses, and somewhat injurious to camellias. It seems to be quite widespread, occurring from the Atlantic at least as far west as Montana, and its habit of injuriously affecting roses and other greenhouse plants must be looked upon as a comparatively recent acquirement. Such instances of newly formed habits are constantly presenting themselves to me in my studies of insects. The beetle seems to be purely American, and the genus *Aramigus* was, in fact, erected for it and another species (*Aramigus tessellatus*) of about the same size, but of a silvery white color, with faint green hue, which I have found in Kansas upon the well known 'resin weed.' The beetle belongs to the same family and is pretty closely allied to a well known European beetle (*Otiorhynchus sulcatus*, Fabr.), which is larger and darker in color, and is also very injurious to greenhouse plants, as well as to some grown out of doors. This species also occurs in this country, as I have specimens that were taken in Massachusetts. It is the habit of all these beetles, so far as their habits are known, to work in the roots of plants while in the larva state, just as your aramigus does. The eggs are doubtless laid upon the roots by the female beetle, which burrows into the ground for this purpose. Upon inquiry I find that what is evidently this same beetle has been more or less injurious to roses in and about Washington, and that Mr A. Jardin was obliged to give up the growth of tea roses here, a number of years ago, on account of its injuries."

In Bennet's excellent essay on "Rose Growing in Winter," he fails to mention this insect among the "causes of failure." Mr Henderson does not hesitate, in a recent number of the *Gardener's Monthly*, after a thorough investigation of the subject, and a correspondence with some of the best rose growers in six different States of the Union, to express his belief that in a large majority of cases failure is due to this insect alone.

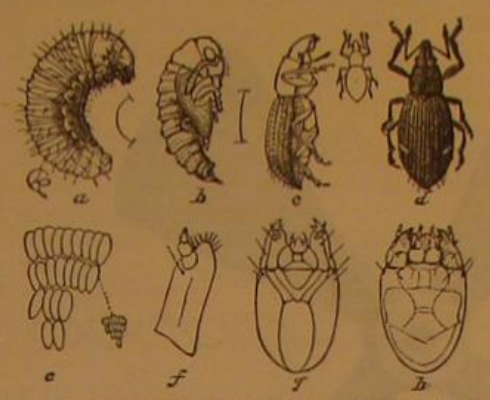
The only remedy that has been employed hitherto is to persistently catch and destroy the perfect insects, and the experience of Mr. John May, who has for five years been fighting it in this way at Madison, N. J., is to the effect that no substance will destroy the insect in its larva state without at the same time injuring the plant.

A study of the habits of this insect, which I have been able to make through the courtesy of Mr. Henderson, who sent me abundant material, enables me to add to his excellent account some facts that are both interesting and of a practical value. The most serious injury is done by the larvæ, which feed principally upon the more tender rootlets, and thus attack the plant in its most essential parts. This work being underground, is so insidious as to easily account for the fact that it has been generally overlooked.

I have had a quite healthy rose bush totally destroyed in three weeks' time by about three dozen of the larvæ, which were placed in the pot containing it. The symptoms that are manifest above ground when the grub is at work are partial stagnation of growth, weak pale shoots, and generally barren flower buds; and when these symptoms manifest themselves strongly a number of the grubs will be found if the plant be dug up and shaken. The parent beetles, like most other snout beetles, live for a considerable time, as I have kept them in confinement for nearly three months. They are nocturnal in habit, being quite active and feeding only after dusk. They shun the light during the daytime, and hide under the leaves or cling tightly to the branches or in some fork near the base of the plant, always in such position as not easily to be observed. Upon disturbance they drop to the ground, draw up their legs, and "play 'possum," remaining motionless for some time, and looking very much like a small lump of dry earth, the color adding greatly to the resemblance.

This habit of simulating death upon disturbance is common to many other insects of this family. They feed upon the leaves, but do more injury by severing them than by the amount of foliage consumed. The eggs are laid in flattened batches, consisting of several contiguous rows, and each batch containing from 10 to 60. The individual egg is smooth, yellow, ovoid, and about 1 mm. in length. The female shows a confirmed habit of secreting her eggs, which are thrust between the loose bark and the stem, especially at the base just above the ground. In the twenty odd batches which I have examined they have invariably been thrust either between the loose bark and as above described, or into any other crevice that could be found; as, for instance, that formed by some paper around the edge of the bell glass in which some of my experiments were made. More rarely they are laid between the earth and the main stem just at the surface of the ground. The eggs are so firmly glued together and to the place of deposit that they are not easily seen, and are with extreme difficulty detached. It is for this reason that they have escaped the notice of rose culturists.

These eggs require about a month to hatch, and the new born larva, which is of a pale yellowish color, with light brown mouth parts, is quite active, and immediately burrows into the ground, and acquires, very soon after, a bluish hue. Just how long this larva requires to attain full growth I have not been able to ascertain, but, in all probability, it remains at least one month, and probably several more, in the ground, where the pupa state is finally assumed.



Aramigus Fulleri.—*a*, larva; *b*, pupa; *c*, beetle, side view; *d*, same, dorsal view, the outline between showing natural size; *e*, eggs, enlarged and natural size *f*, left maxilla of larva, with palpus; *g*, underside of head; *h*, upper side of same, enlarged (after Riley.)

As the injury of this insect has been mostly to roses under glass, there will be found no great regularity in the periods of its transformation under such circumstances. In point of fact it is found in all stages during the winter and early spring months. Yet that, in a more general way, there are cycles of development, is proved by the fact that during a visit to Mr. Henderson, which I made last May, neither beetles nor eggs were to be found, though egg shells under the loose bark at base of the plants were common.

While the destruction of the parent beetles, when persistently followed up, is an excellent preventive of the injuries of the larva, and strongly to be recommended, yet when roses are extensively grown, some beetles are sure to escape detection. It is evident from the facts here set forth in relation to the eggs, that we have still another and more effectual preventive measure within our reach, namely, the destruction of the eggs before they hatch. For this purpose I would recommend the tying of a few thicknesses of tape or of narrow pieces of rag, or even stiff paper, around the butt of the plant, the bandages to be examined every three weeks, and detached and burned, if eggs are found in them. Where the number of plants is large, this destruction of the eggs might be expedited by the employment of traps, consisting of small stakes, around which such layers of cloth or paper are tied. These should be thrust into the ground near the main stem of the plant, and can be collected once every three weeks, thrown into a tub of hot water, subsequently dried, and used again without untying the bandages. Or, again, the materials always at hand in a florist's establishment may be employed, for I doubt not but that a few folds of oil paper placed in a slit made in an ordinary wooden label, and this stuck into the ground at the base of each plant, would form an excellent lure to the female in ovipositing. I am indebted to W. G. Le Duc, Commissioner of Agriculture, for the electrotype of the figure here used, and which was prepared for my report to the Department.

The Australian Exhibitions.

Mr. O. M. Spencer, United States Consul General at Melbourne, Australia, transmits to the Department of State a very full report of the proposed Exhibitions at Sydney and Melbourne. The first opens on the 1st of September, 1879, and will close on the 31st of March, 1880. That at Melbourne opens on the 1st of October, 1880, and closes on the 31st of March, 1881. This Exhibition will be held in the Carlton Gardens, comprising an area of 65 acres. Nearly all of the leading European governments have signified their intention of being present by royal commissioners. All of the Australasian colonies have entered heartily into the enterprise. The English government has taken a warm and decided interest in it. The Prince of Wales and others of the royal family will visit the Exhibition. The Duke of Genoa will come out in an Italian man-of-war, and France and Germany will be represented in a similar manner. The relation which exists between the Sydney and Melbourne exhibitors is one of generous rivalry and cordial co-operation. The two cities will soon be connected by railway. There are several lines of steamships now plying regularly between the two places, with low rates for freight. The expense of transferring goods from Sydney to Melbourne will be moderate, including storage. Goods will be received at the latter Exhibition building on the 1st of June, 1880.

All the usual facilities accorded at previous international fairs in other countries will be liberally afforded at Melbourne. The protection of inventions capable of being patented is fully secured. Should the United States decide not to send out a man-of-war, it is advisable to ship all heavy goods in sailing vessels, *via* the Cape, not later than February, 1880. Goods from the Pacific slope and parcels of great value and small bulk may be shipped *via* San Francisco by the Pacific Mail Steamship Company, which runs a monthly line of steamers from San Francisco to Sydney. Show cases, shelving, belting, etc., may be procured in Melbourne at low rates, at the cost of the exhibitors.

On The Fallacy of Refrigerating Ships for the Destruction of Yellow Fever Germs.

There are reasons to believe that it is well nigh impossible to eradicate by refrigeration the spores of yellow fever from the holds of thoroughly infected ships; although, with the frosts of autumn, yellow fever generally disappears from districts where it has been epidemic. We can philosophically reason to this conclusion by comparison of the conditions with those of other more familiar phenomena of heat and cold.

The window pane of a heated room on a cold day, supplies more nearly than any other familiar example, the peculiar conditions under which the refrigeration of ships has been, and save exceptional cases, must be attempted, and a lesson or two from the pane cannot fail to be of service. The temperature of the window pane, when the frost upon it melts, must be the temperature of melting ice, and an exact compromise between the external and the internal temperature —the one much below the freezing point, the other much above. Similar conditions apply to the hull of the ship, aggravated greatly by its irregular inner surface.

In the case of a ship, floating in a medium, the temperature of which is far above freezing, or as may be the case in the Gulf of Mexico, at from 60° to 75° Fah. (U. S. Coast Survey, 1857, 102), although the general temperature of the air in the interior of the ship may be considerably below freezing, even enough so for the deposition of frost upon objects contained therein, it is no evidence that the cracks and crannies which are nearest or next the skin of the ship will be thoroughly refrigerated, but on the contrary, they will constantly have their temperature restored to them by convection of heat from the water lying against the wall of the ship, and were it possible for frost to collect upon the sides of the ship, it could completely overlap such crannies without reducing the inclosed air or substance to the freezing point.

It may, then, be asserted that it is practically impossible to so thoroughly absorb the heat from these interstices as to make the destruction of the spores a matter of certainty. The thermal condition of the hold of a ship under process of refrigeration, even supposing that a thorough circulation of cold currents could by any possibility be established, is no evidence that it is not possible for yellow fever germs still to exist there. It is reasonable, then, to suppose that the cause of the recent failure to disinfect by refrigeration a government ship, which was obliged to return to port on account of the fever again breaking out after the vessel had been thoroughly treated by the freezing process, may be referred to the circumstances above given.

Owing to essential differences in construction, iron ships are more especially subject to these conditions than wooden ones; but there exists, even in the case of wooden ships, but little encouragement for perseverance in this method.—*Science Observer.*

A Rapid Voyage.

The fastest long distance run on record is that of the English mail steamer Durban, Union Steam Company, Capt. A. S. Warleigh, with telegrams from the seat of war at the Cape. The Durban left Table Bay a little before 8 P.M., April 1, and averaged 298 miles a day to Madeira, where a stop of 4½ hours was made on the 14th day. Plymouth, England, was reached at 6 P.M., April 20. The entire distance, about 6,000 miles, was made in 18 days 16 hours, actual steaming, or an average of 13.1 knots the whole voyage. Much better time has been made across the Atlantic, but this is the best on record for so long a distance.

DR. LANDERER, a Hungarian naturalist, writes from Athens that a dead African eagle, *Gypactes barbatus*, was lately found at Maina, on the southern Greek coast. On examining the bird an iron headed arrow over a foot long was found transfixed under one of the wings. Evidently the eagle had been fired at and struck in Africa by some native, and had borne the arrow in its body in its flight over the Mediterranean until it fell dead from exhaustion on touching land at Maina.

Nuts.

It is estimated that there are in the United States over 400,000 railway cars of all kinds, also 16,000 engines. These engines and cars in traveling over the roads lose annually between four and five million of nuts. These will weigh over 1,500,000 lb., and their cost is between $30,000 and $40,000, and this loss is continued from year to year, saying nothing of the nuts thrown into the scrap heap, with their bolts worthless from the use of the jam nut, also the liability to accident from loose nuts.

A LARGE shoe manufacturer of New York State recently advertised in Boston and New York for 25 shoe fitters to work in his factory. He was ready to pay full current rates and furnish steady work, but had only one application. Apparently there are no large body of shoemakers out of employment.

NEW PROPELLER SCREW.

The accompanying engraving represents Mr. H. G. Deane's improved propeller screw, Fig. 1 being a side elevation and Fig. 2 an enlarged longitudinal section of one of the blades.

The improvement consists in perforating the propeller with holes, the diameters of which increase as they approach the center of the wheel. These holes are countersunk on the driving face of the blade. It is stated that this wheel has a number of advantages, among which are great facility in backing; decreased liability to breakage and corrosion; increased buoyancy at the stern of the boat; entire absence of vibrations and trembling; and last and most important, an increase of speed is secured. The explanation of all this is that the vacuum behind the blade being destroyed, the full effect of the power applied to the wheel is realized.

The number of blades which has been found to give the most satisfaction is four, but the inventor claims that perforations improve any and every kind.

Fig. 1.

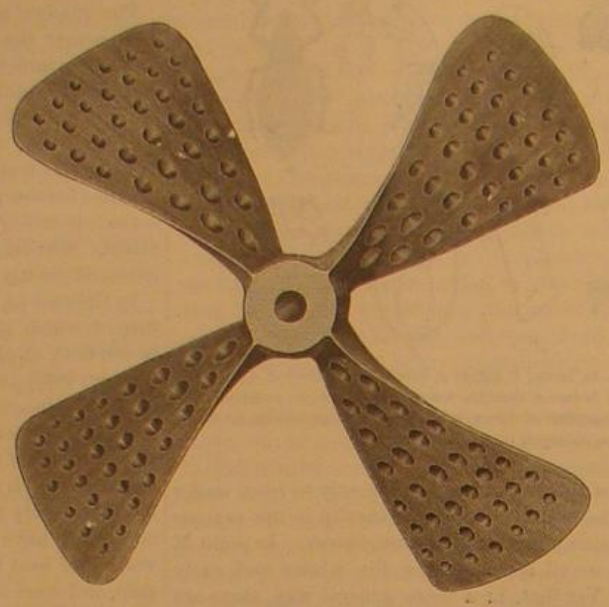
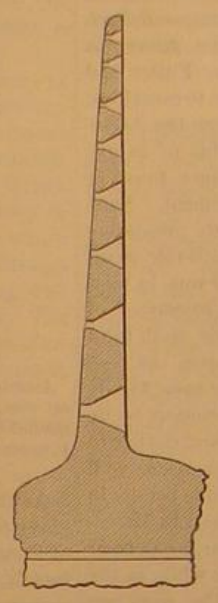


Fig. 2.



DEANE'S PROPELLER.

To Preserve Autumn Leaves.—Spread the fresh leaves and press them in a suitable dish, with alternate layers of fine sand, which is thoroughly dry and as hot as the hand can bear. When the sand has cooled they may be removed, smoothed under a hot iron, dipped for a moment in clear French spirit varnish, and allowed to dry in the air.

A Big Jam of Logs Broken.

The big jam of 10,000,000 logs, on Carratunk Falls, was broken last week, 6,000,000 logs going out at once, which was said to have been a grand sight. It took 65 men 13 days to break the jam and get the rear over Carratunk Falls. A portion of the ledge was removed by blasting. Omar Clark, Esq., has had a crew of 50 men in charge from the time the first log started on Moose river, then on the main river until this time, and not an accident of any kind has happened to a man, not even the jamming of a toe. Tuesday the rear of the drive was at Patterson's Bridge, and by this time it is probably at Norridgewock. This will make 85,000,000 logs that have passed down river this season.—*Augusta (Me.) Journal.*

THE THUNDERER'S GUN.

It may probably be difficult for most of us to believe that the 38-ton gun illustrated by the engraving was actually fired with the long column of projectiles and charges, shown in the foreground, in its bore. This, says the *Engineer*, was the unanimous opinion of the committee—an opinion, however, which has been much questioned by many, and flatly contradicted by Sir W. Palliser. The gun is in the Arsenal, open to investigation, lying in the condition exhibited by the engraving. The gun has been built up and held together by hoops as depicted. The fragments of the steel tube, and the stud and *débris* that are considered significant in their condition, have been collected for careful inspection and kept in a glass case, and the figures of the projectiles and charges supposed to have been inside the gun have been chalked on the exterior, while actual specimens of such stores have been placed in their proper order on the ground, as shown by A B C D E F.

We will endeavor to put the leading points of the question briefly before our readers. That a gun may be fired with double ammunition in it is, we think, apparent from the fact that guns have been so loaded, and the mistake only discovered just in time to prevent the gun being fired. However monstrous such a state of things may appear, it may be easily seen that with a telescopic mechanical rammer it is possible to make a mistake when the tell-tale is not working. Indeed, it will be seen that if the thicker tube of the telescope is the one farthest from the rammer head, and of such a length as to enter the bore of the gun, the inside tube next the rammer head being in fact shorter than the bore, there is no means of knowing how short a way or how far the inside tube may have moved.

This being a very possible contingency, the three points urged by the committee are: (1) That portions of the steel tube showed that they had been scored by a shell after they had been dislodged from their proper position. (2) That a stud had been picked up which had been evidently torn out of a Palliser shell, which showed that a Palliser shell was in the bore, that is, the projectile of the round previous to that last entered. (3) That the gun has yielded in the place where it could be most likely to do so, if a charge were fired in about the position indicated under these extraordinary conditions.

Sir W. Palliser considers that the shell was wedged, and tripped up, as it were, by a portion of the wad lying some distance in front of the projectile, and that its base would, under such conditions, rise, and it should strike the bottom of the bore, scoring the steel tube, he thinks, in much the same way in which it is now seen to be scored. In fact Sir W Palliser considers, from experiments which he has made on a small scale, that the scoring of the pieces of steel tube is exactly what he would have expected. He feels, apparently, like the committee, that some demands are being made on our credulity in asking us to believe that this great result arose from a single shot jamming against a hard *papier maché* disk, but he assumes he has obtained very similar results in this way on a small scale, and that the great resistance of the millboard is due to the very great rapidity with which it must be crushed to let the shot pass. Sir W. Palliser, however, says with regard to the stud found by the committee in the turret, that if absolutely proved to be a Palliser stud it would be "conclusive" evidence in "favor of the committee's report." He thinks, however, that no certainty can be obtained in this matter; nevertheless the Royal Laboratory, who manufactured the studs and to whom this one has been submitted for opinion, pronounce unhesitatingly that it is actually a Palliser stud. This, it appears to us, ought to settle the matter.

The fact is that the accident was an extraordinary one, and we must not therefore be surprised to find that there was something extraordinary in the condition of matters to account for it, and we should accept the explanation that seems irresistibly supported by the evidence of the Palliser stud, to say nothing of the scored steel fragments and position of fracture. We are informed that definite instructions have been given to the War Office Committee, ordered shortly to assemble to investigate the whole question of heavy guns, to test the twin 38-ton gun of the Thunderer to destruction. General S. Enderby Gordon, C.B., has been appointed president of this committee. Admiral Boys, C.B., late Director of Naval Ordnance, and Major Ellis, R.A., are among the members, who are exclusively naval and military officers.

Relief of Color Blindness.

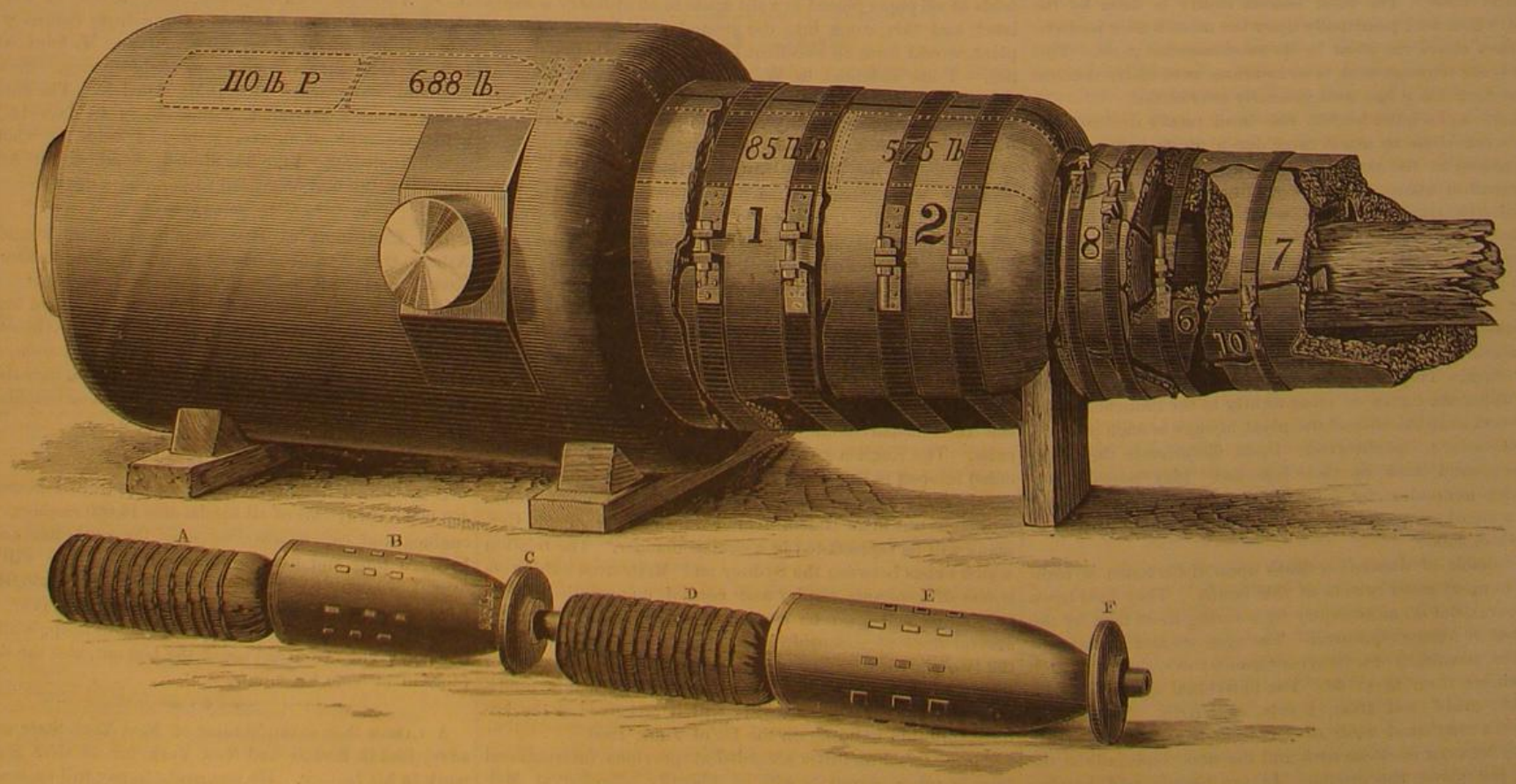
M. Delbœuf has found that if a person afflicted with Daltonism looks through a layer of fuchsine in solution his infirmity disappears. A practical application of this discovery has been made by M. Javal, by interposing between two glasses a thin layer of gelatine, previously tinted with fuchsine. By regarding objects through such a medium, all the difficulties of color blindness are said to be corrected. Experiments in Philadelphia, says the *Medical and Surgical Reporter*, by Dr. P. D. Keyser, affirm the success of this method.

American Institute Exhibition.

Our manufacturers are now fully awake in the matter of exhibitions, and, so far as their limited space is concerned, we are assured the coming Exhibition of the American Institute, of this city, will be of more than usual value and novelty. For information address the General Superintendent, New York city.

The Old Telegraph Mine.

In our issue of July 26, a correspondent, in describing the Old Telegraph Mine in Utah, gave a report of analyses of 1,000 tons of ore by Othon Wuth, of Pittsburg, in which a most important item was omitted. The report should have stated that the ore, in addition to the other matter enumerated, yielded from 15 to over 100 oz. of silver, and $2 to $4 gold per ton.



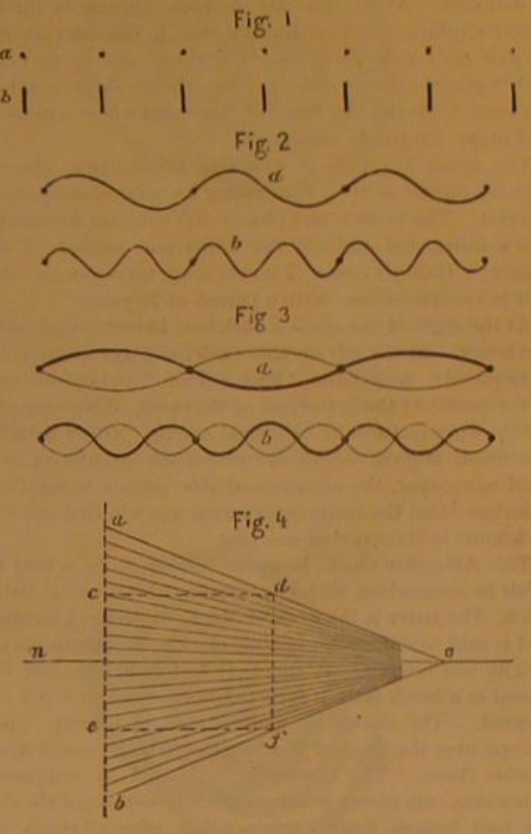
THE THUNDERER'S GUN AT WOOLWICH.

THE CYCLOSCOPE.

The very remarkable apparatus which we are about to describe was invented by Professors McLeod and Clarke, of the Royal Indian Engineering College. It is designed for measuring the velocity of revolution of any kind of machine whatever, and allows the *absolute* speed of the mechanism in motion to be determined at the very moment of observation, and that too with an accuracy that has been hitherto unknown. In order to make the description of the apparatus easier understood, we will state, in a few words, some of the phenomena upon which it is based. Every one knows, or has observed, that if any series of objects whatever are revolving or moving with a certain velocity the eye loses the faculty of distinguishing their outlines; and this is owing to the persistence of impressions upon the retina. Upon this physiological phenomenon are based the "phenakisticope" and other similar toys. Now, then, let us suppose that a certain number of points (Fig. 1, *a*) are examined in a mirror fastened to one of the prongs of a tuning fork. When the latter is set in vibration, these points, by reason of the phenomenon above mentioned, will appear to us like so many lines (Fig. 1, *b*). Now let us place these points (which we will suppose to be equidistant) on the diameter of a cylinder, and let us cause the latter to revolve with a uniform motion. If we arrange our tuning fork so that the vibrations will occur in a direction parallel to the cylinder's axis of revolution, the points will then appear to us in the form of a sinuous line (Fig. 2, *a*) or wave, and the height of this wave will naturally depend upon the amplitude of the vibrations, while its length will vary with the velocity with which the cylinder revolves. It will be readily understood that if a certain relation exists between the period of the tuning fork and the speed of the cylinder, the wave will appear stationary. Nothing is easier than to determine the conditions which are necessary for the formation of a stationary wave. In fact, if, for example, the velocity of the points is such that the time taken by each of them in traversing a space equal to the distance which separates them, is equivalent to the duration of *one* complete vibration of the tuning fork, a stationary line will appear (Fig. 2, *a*). If, on the other hand, the time employed by each point to pass over a space equal to *two* intervals is again equivalent to the duration of one complete vibration, the wave traced by the image of each point will meet the adjacent point; and, as each point will trace a wave of its own in space, these waves will be superposed and form a double one (Fig. 3, *a*). Each of these waves may, through a change of length, vary as to its form In fact, if we apply to the tuning fork the same reasoning that we have applied to the points, that is to say, if we suppose the duration of the vibrations is changed in some manner, waves like those represented in Fig. 2, *b*, and Fig. 3, *b*, might appear. Theoretically we might obtain for each wave an infinite number of waves of like order.

Now let us see how this phenomenon can benefit us in estimating, for example, the speed of a revolving cylinder. For this, let us suppose that our points are 100 in number, and that they are placed at equal intervals. Let us take a tuning fork making 60 complete vibrations per second; then let us examine our points, and let us, moreover, suppose that a *stationary* wave (similar to that represented at Fig. 2) appears to us; then it is very evident that 60 *points per second* (or 3,600 per minute) will pass before the mirror. But for *one* turn of the cylinder 100 points will have to pass before the mirror, so the velocity of the cylinder is then equal to $\frac{3600}{100}$=36 revolutions per minute. The least change in the speed of the cylinder will give an apparent translatory motion to the wave; and, if the velocity is too great, the wave will move in the same direction as the points, but if too little it will move in the opposite direction. This very simple experiment is the fundamental base of the "Cycloscope," which it now remains for us to describe.

If upon the cylinder we had but one series of points, a single rate of speed might produce the wave that we should have chosen to determine its velocity; but if we place a series of dotted rings side by side, the number of points varying in each, it is very evident that in order to obtain the same wave on examining the points of one of these rings, it would be necessary to give the cylinder different rates of speed. Nevertheless, it would be practically next to impossible to place such a series of dotted rings upon a cylinder. Fig. 4 shows the ingenious means employed by the inventors to overcome this difficulty. Upon a sheet of paper are traced a series of lines all converging to a point, *o*, and passing through equidistant points marked off on the line, *a b* (these lines are usually white on a blue ground); this done, a parallelogram, *c d e f*, is cut out equal to the superficial area of the cylinder and glued upon the latter. The distance from the point, *o*, to the line, *a b*, as well as the number of points between *c* and *e*, are determined by a very simple calculation. If we now examine these lines, not as before in a mirror, but through a slit cut in a thin sheet of metal or cardboard, all the abovementioned phenomena will exhibit themselves exactly in the same manner; and, moreover, from a single inspection of Fig. 4 it will be readily seen that these lines act the part of an infinite series of equidistant points, and that consequently we shall be able to determine all the velocities that are possible between the extreme ones determined by *e e* and *d f*. These lines possess another important property: if we trace lines parallel to *e e* they will cut the oblique ones at a great number of points proportional to their distance from the line, *e e*. If, for example, the side, *e c*, is equivalent to 60 revolutions of the cylinder, and the



THE CYCLOSCOPE.

side, *d f*, to 20, the line which divides *e f* and *c d* into two equal parts will mark the position that must be occupied by the slit through which it will be necessary to examine the lines in order to obtain the stationary wave when the cylinder is revolving at a velocity of 40 revolutions per second. The wave generally adopted is the one of the second order (Fig. 3, *a*), as being the easiest to recognize.

Fig. 5 represents the cycloscope as it is now constructed. At B we see the cylinder with its paper covering. The wheel, R, serves to put it in communication with the machine whose rotary speed is to be measured. The movable box contains a reed or vibrating lance, which performs the functions of a tuning fork, and to which is fastened a small plate of zinc, in which there is a slit about equal in width to the breadth of the lines traced upon the cylinder. The lance vibrates 60 times per second. The small toothed wheel, E, and the wheel, D, being situated upon the same axis with the box, A, the latter can, by simply turning the wheel, D, to the right or left, be moved to any position in front of the cylinder. At S is an opening through which the lines are examined; it contains a lens for the purpose of magnifying the images. When the apparatus is to be operated the plate is caused to vibrate by means of a small bellows, the tube of which is seen at C C'. The box, A, carries an index by means of which the speed is read upon a graduated scale. Supposing that the cylinder is revolving and that we wish to learn its speed, we place the eye at S, and with the right hand turn the wheel, D, until we meet with the stationary wave which has served to determine the divisions; the index, O, will then point to the figure that indicates the speed. The graduated scale has also been arranged by Professor McLeod so that the speed can be read off without removing the eye from S.

By means of the cycloscope we can ascertain the minutest variations in velocity, and learn thereby that the most perfect machines, no matter how well regulated they may be, are constantly subject to variations. The services that such an apparatus may render are numberless, and, as Sir William Thomson has well said, Professor McLeod has here given us a more sensitive and more perfect measurer of time than that which we possess in the best made chronometer.—*La Nature.*

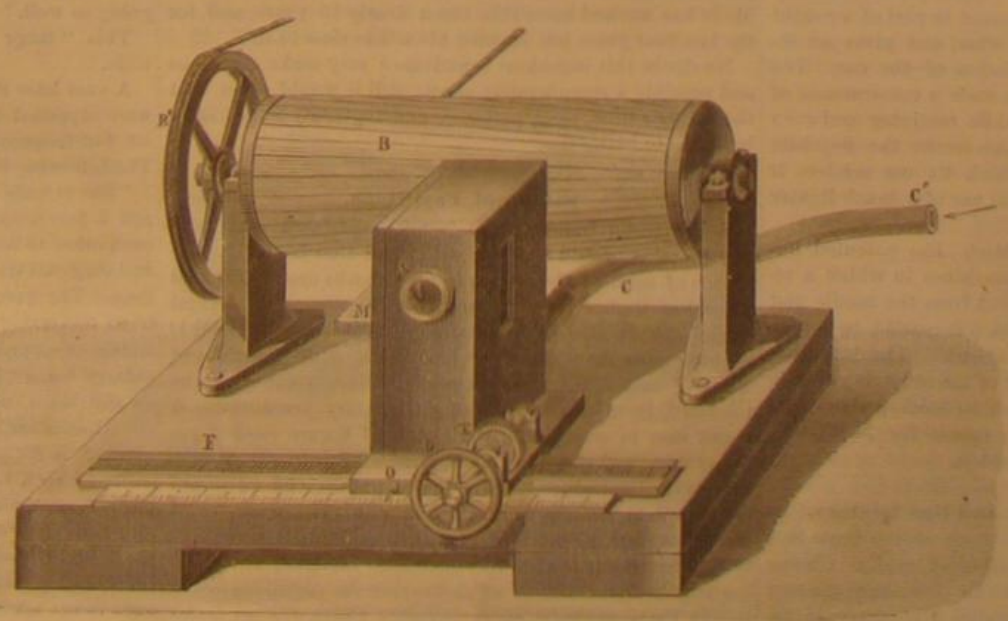


Fig. 5.—THE CYCLOSCOPE.

ARSENIC IN WATER COLORS.

According to the *Chemiker-Zeitung*, M. Fleck, in searching into the causes of the death of a young engineer, found in the corpse remarkable quantities of arsenic, the origin of which he attributed to the water colors which the deceased had been in the habit of using; for, on an analysis, he found that a specimen of sepia contained 2·08 per cent of arsenious acid; one of terra di Sienna, 3·14 per cent, and one of red brown, 3·15 per cent. The deceased engineer having been in the habit of drawing his brush, charged with the color, through his lips, it is not impossible that the arsenical colors were absorbed by degrees in the saliva. M. Fleck was then led to make a profounder study of the subject, and with the following result:

The dark colors of French make usually have an iron base; when they are dissolved in water they give a colorless liquid most generally containing no arsenic, while the residue left on the filter contains the organic matter combined with iron and mixed with arsenious acid. Some of the darker colors, marked "chenal," and "Paris et Richard," gave the following quantities of arsenic: Colored sepia, 1·10 per cent; natural sepia, 0·98 per cent; burnt sienna, 1·76 and 2·23 per cent; Van Dyke brown, 0·81 per cent; brown ocher, 0·52 per cent; sap green, 0·82 per cent; bister, 0·67 per cent; Indian red, terre de Cassel, burnt umber, raw umber, each 0·5 per cent.

Among the water colors known under the name of "Hornemann's technical colors," which were submitted to analysis, brown ocher and sepia contained only traces of arsenic, while terra di Sienna showed 1·19 per cent. It might be perhaps inferred that because oxide of iron has been successfully employed as an antidote to arsenic, and because arsenite of iron is not poisonous of itself, the arsenic contained in water colors in the form of arsenite of iron could exert no injurious influence on the health. But this would not be so unless the arsenite of iron were accompanied by ferric hydrate and magnesia in a free state (as happens when iron is exhibited as an antidote), since these substances neutralize the acid juice of the substance and thus prevent the decomposition of the arsenite of iron formed. When the latter comes in contact with the gastric juice without being protected by a base, the hydrochloric acid of the juice destroys the arsenite of iron introduced with the color and sets the arsenious acid free.

Negatives on Paper.

The success which has followed the practice of the gelatino-bromide process and the easy character of its manipulation have revived the desire for a substitute for glass as a support for the sensitive film. The Rev. H. J. Palmer has already shown good work on a gelatine film, and several operators have been more or less successful with various substances; but we want something simpler and less troublesome before glass can be dispensed with. One of our successful northern amateurs is at present getting pretty good results on simple paper. The kind he at present prefers is known as letter-book paper—a variety extremely thin but tough, and with a perfectly smooth surface. A roll of this, slightly damped, is laid on a perfectly level board a little narrower than itself, and the edges folded over and fastened with gum to keep it flat. The emulsion is poured on and spread with a glass rod in the ordinary manner. When dry it is cut into suitable sizes and exposed between plates of glass, as was the case with waxed paper. So far the results are promising, and I have little doubt that some such arrangement will ultimately be found in every way satisfactory for all outdoor work. It is probable that a previous coating of rubber in benzole, as suggested by me a number of years ago, might be an advantage by keeping the emulsion on the surface. Should simple paper be found to answer, as I have little doubt it will, some of our enterprising manufacturers will soon be sending it into the market in rolls similar to carbon tissue, as it may be made by the same apparatus and in exactly the same way by simply substituting the sensitive emulsion for the pigmented gelatine. In addition to the advantages of lightness and non-liability to break, there will be the further and, to many, greater advantage of reduction

in cost. The price of glass is altogether saved and the labor reduced to a minimum, a band of several yards being coated in the most perfect manner in a few minutes. I hope to return to the subject again as the experiments of my friend proceed, and trust that, meanwhile, other workers will turn their attention in this direction, as the greater the number who put their hands and heads to the work the sooner will the desirable end be accomplished.—*John Nicol, Ph. D., in the British Journal of Photography.*

MECHANICAL INVENTIONS.

An improvement in the class of cotton presses whose followers are operated by a screw or screws, and are provided with an automatic mechanism for shifting the driving belt, and thus arresting the follower either in its ascent or descent, has been patented by Mr. George Cooper, of Augusta, Ga. Its construction cannot be readily described without an engraving.

An improved form of axle box and journal for vehicles has been patented by Mr. James A. Manning, of Danville, Ind. It prevents rattling, and it may be adjusted to compensate for wear; the journal will retain the oil or grease, and the box is prevented from wedging upon the journal.

An improvement in side-bar wagons has been patented by Messrs. William and Cyrus R. Fenstermacher, of Shippensburg, Pa. The invention consists in combining with the king bolt and fifth wheel a stay or brace having rear branches secured to side bars passing up on the inside of fifth wheel, and having the front branches fastened to the bolster.

A machine for manufacturing barbed fence wire of that kind in which the barbs are formed by wrapping a strip of sheet metal having inclined slits formed in its edge or edges around a wire spirally, has been patented by Alanson Cary, of New York city.

An improvement in the class of sash locks, in which an eccentric and sliding bolt are so connected that the action of the eccentric operates the bolt, has been patented by Mr. Hermann T. Raeke, of Baltimore, Md.

An improved monkey wrench has been patented by Mr. Baziel W. Lloyd, of Jackson, La. It consists in the combination of a box having arm and screw cutter sections held in the box, and a wrench having parallel jaws, the movable one being provided with a socket for holding the dies.

Mr. Moses R. McGregor, of Pine Bluff, Ark., has invented a lap ring or link of novel construction, adapted for use with plows and chains, and wherever available. It consists of the two flat links of similar size and shape, each having an opening at one side, and connected together. Upon one link is fixed a flat-sided pin or lug, which passes through a slot that is formed in the other link. This pin is headed or upset upon the link so as to retain the links together.

Mr. Daniel Kunkel, Sr., of Oregon, Mo., has patented an improved washing machine, which may be applied to an ordinary wash tub. It is simple, convenient, and effective. It is an improvement upon the washing machine for which letters patent No. 155,873 were granted to the same inventor, October 13, 1874.

An improved clay press has been patented by Mr. Simeon G. Phillips, of Perth Amboy, N. J. The object of this invention is to construct a press or adapt the ordinary presses for pressing clay in thin sheets one half the usual thickness, more or less, and sufficiently dry for the potter's use, without increasing the bulk of the press or using more cocks to produce the usual amount obtained at one pressing.

An improved attachment for clocks, to be connected with a self-lighting and self-extinguishing attachment for gas burners, which shall be so constructed that the gas will be lighted and extinguished automatically at fixed times, so long as the clock continues to run, so that the only attention required will be to wind up the clock at the proper time, has been patented by Mr. Simon Goldsmith, of Boston, Mass.

Mr. John F. Curtice, of Fort Wayne, Ind., has invented an improvement upon the car brake shoe, patented March 21, 1876, by I. H. Congdon, in which detached pieces of wrought iron are embedded in a body portion of cast iron, by casting the said body portion around the wrought pieces, whereby the wearing face of the shoe is composed in part of wrought iron, and is enabled to better resist wear, and gives an increased friction for stopping the motion of the car. The object of this invention is to provide such a construction of this composite brake shoe as will, while retaining and even increasing the wearing qualities, also secure the requisite strength to resist the breakage to which its use renders it liable, and at the same time allow the use of a much lighter and less expensive shoe.

Mr. James Tripp, of Coldwater, Mich., has patented improvements in that class of sewing machines in which a revolving shuttle takes the upper thread from the needle and loops it around the lower thread, which is carried by a bobbin contained within said revolving shuttle. The invention consists in the peculiar arrangement of the revolving shuttle with respect to its driving mechanism, its holding plates, and other co-operating parts, and in the means for facilitating the removal of the shuttle and its bobbin.

Relative Economy in Steam and Gas Engines.

According to Mr. J. T. Sprague some of the improved gas engines now in use, of small capacity, realize 1 horse power on the gas derived from 1 3-5 lb. coal; and the best steam engines, of large capacity realize 1 horse power on 2½ lb. coal. Gas engines are thus shown to be much more economical as motors than steam engines.

A Couple of Clocks.

Dr. J. L. Blair, of Abingdon, Illinois, has recently completed a clock which is locally regarded as one of the most wonderful pieces of mechanism ever made. This clock is 8 feet 2 inches high, 3 feet 4 inches wide, and 10 inches deep —lower half. The upper half is 6 inches deep and has a circle top. The largest wheel is 13 inches in diameter. The longest shafting is 3 feet. Weight of clock, 118 pounds; of weights—two in number—8 and 22 pounds. The case and works are made mostly of walnut wood. In addition to its time-keeping capacity, this clock minutely illustrates (it is claimed) the composition and movements of the solar system. Time is indicated at the center of the sun, a ball 15 inches in diameter. Around the sun the planets circle in their respective orbits. The earth is 3 inches in diameter, turns on its axis once a day, and goes round the sun in an orbit 9 feet in circumference once a year. In its daily revolution the earth indicates the time of day everywhere, shows day and night, longitude, and so on.

The moon, 1¼ inch in diameter, accompanies the earth with its proper motion, illustrating its phases, eclipses, and the rest. The motion and phases of Venus are illustrated in like manner, and similarly the orbits and motions of other planets. Halley's comet, 7 inches long, traverses an orbit 14 feet in circumference, with a period of 76 years.

At the right of the clock a skeleton, 10 inches high, strikes the hours. At the left another skeleton plays a tune as often as required. A skeleton "Father Time" swings his scythe at the center of the lower half of the clock. Above are places for showing pictures of historical events. Other details are described, at great length and with much enthusiasm, in the local newspaper, the most remarkable feature being the circumstance that the entire contrivance was whittled out with a jack-knife in the space of one year.

This Abingdon clock, however, appears to be a very rude affair in comparison with one now on exhibition in Detroit, Mich. The latter is the work of Mr. Felix Meier, a mechanic, and is said to eclipse the famous clock at Strasbourg in complexity and interest. It stands 18 feet in height, and is inclosed in a black walnut frame elaborately carved and ornamented. The crowning figure is that of Liberty, upon a canopy over the head of Washington, who is seated upon a marble dome. The canopy is supported by columns on either side. On niches below, at the four corners of the clock, are four human figures representing infancy, youth, manhood, and age. Each of these figures has a bell in one hand and a hammer in the other. The niches are supported by angels with flaring torches, and over the center is the figure of Father Time. At the quarter hour the figure of the infant strikes its tiny bell; at the half hour the figure of the youth strikes his bell of louder tone; at the third quarter the man strikes his bell, and at the full hour the graybeard. Then the figure of Time steps out and tolls the hour, as two small figures throw open doors in the columns on either side of Washington, and a procession of the Presidents of the United States follows. As the procession moves, Washington rises and salutes each figure as it passes, and it in turn salutes him. They move through the door on the other side, and it is then closed behind them. This procession moves to the accompaniment of music played by the clock itself. The music machinery is capable of playing several airs.

The mechanism also gives the correct movement of the planets around the sun, comprising Mercury, which makes the revolution once in 88 days; Venus, once in 224 days; Mars, once in 686 days; Vesta, once in 1,327 days; Juno, once in 1,593 days; Ceres, once in 1,681 days; Jupiter, once in 4,332 days; Saturn, once in 29 years; Uranus, once in 84 years. As these movements are altogether too slow to be popularly enjoyed, the inventor has added a device by which he can hasten the machinery to show its workings to the public.

There are dials which show the hour, minute, and second in Detroit, Washington, New York, San Francisco, London, Paris, Berlin, Vienna, St. Petersburg, Constantinople, Cairo, Pekin, and Melbourne. The clock also shows the day of the week and month in Detroit, the month and season of the year, the changes of the moon, etc. It is said that Mr. Meier has worked upon this clock nearly 10 years, and for the last four years has devoted his whole time to it.

No doubt this ingenious contrivance may make a curious and possibly a remunerative show; still it would seem that the maker's time, skill, patience, and ingenuity might have been put to better use.

Fireproof Partitions.

A provincial builder, who is not acquainted with London practice, would be surprised to find that the inside partitions of most of the houses in the suburbs are constructed wholly of timber framing, and that the rooms of several stories are divided in this manner. The house, in fact, is nothing more than a shell of brickwork with partitions of wooden studs. How such a mode of construction can be tolerated, in utter contempt of all sanitary precautions, it is not easy to conjecture, but leasehold tenure encourages the system, and surveyors themselves wink at it. Of course this method expedites the erection of houses, and we would not complain if they were filled in with brick-work, or if the joists over the heads of one partition and its lower portion were filled up with incombustible material, so that a fire may have less chance of destroying the partitions above it. In Paris, as every one is probably aware, timber framing is largely resorted to, but the spaces between the uprights or quarters are built up with rubble laid loosely, and then plastered on both sides to fill up all interstices, so that, practically, a fire-resisting partition is the result. Our system of brick-nogging is a somewhat analogous operation, and answers tolerably well if properly done. In France the usual operation is as follows: The framed partition is inclosed on both sides by strong oak batten laths about three inches wide, nailed horizontally about six inches apart; within this the spaces are loosely packed with rough stone, and a strong mortar or plaster of Paris is laid on from both sides at the same time, and pressed through the interstices, so that the rubble becomes embedded in the mortar, consolidating both it and the timber. The surfaces are also covered so that the laths are hidden entirely. In this way a thoroughly concrete partition is formed, more effective and self-supporting than the brick wall; certainly superior and more durable than the English brick-nog partition, and throwing all ordinary plastered partitions into the shade. The brick-nog partition often fails; when the timber decays the bricks are not held together by a strong and independent thickness of plaster. The common hollow plastered partition becomes a nest for mice and a receptacle for vermin and dirt, and when a fire occurs it forms the means of communication, between the floors, and affords a channel for the supply of air. It is strange that although these facts are patent to every practical builder, architects and builders still adhere in an obstinate fashion to the plastered partition and the hollow wooden floor. We have constantly advocated floors, staircases, and landings, particularly, of concreted and incombustible materials, and though the idea is recognized and carried out in all large and important buildings, the ordinary dwelling-houses are allowed to be exempt from such salutary provisions. We called attention some time ago to the value of concrete in wall-building, and suggested the use of light timber lattice framing filled in or compacted with concrete. In a recent number of an American journal we find the same idea has been thrown out, and the writer gives a diagram of the system. The plan we suggest is to form a rough lattice of battens or strips 2½ × 3 in. or 3 × 2 in., with spaces of 4 inches or so apart, to fill up both sides with lime concrete, and to finish the two sides by a coat of plaster of the usual thickness. This construction would be cheaper than framing, and be admirably adapted for internal partitions, and for all temporary buildings.

It is occasionally necessary to divide an upper room into two by a partition, and to relieve the floor of unnecessary weight it becomes necessary to truss the former. Now the lattice partition or wall we have referred to becomes a self-sustaining structure, and may be supported easily by corbels at the ends. We are led, in speaking of weight, to say a word in favor of earthenware pottery as an excellent substitute for rubble or stone concrete. Common agricultural drain pipes of small diameter have been introduced by Mr. Pritchett for this purpose, but any kind of cellular construction may be adopted. It is to be regretted that architects do not adopt more largely the indestructible forms of partitions we have mentioned, and thus render a service to both sanitary construction and sound building. It is not less surprising that such ordinary precautions to insure buildings against fire, such as incasing and rendering solid the floors and partitions, should have escaped the vigilance of those who frame our building enactments.—*London Builder.*

The First Steam Ferry Boat Between New York and Jersey City.

In 1810 arrangements were made with Robert Fulton to construct steam ferry boats, and on the 2d of July, 1812, one named the Jersey was put in operation. The event was celebrated with a grand banquet given by the Jerseymen to the New York Common Council. A correspondent, writing to a newspaper of the time, says:

"I crossed the North River yesterday in the steamboat with my family in my carriage without alighting therefrom, in 14 minutes, with an immense crowd of passengers. On both shores were thousands of people viewing the pleasing object. I cannot express to you how much the public mind appeared to be gratified at finding so large and so safe a machine going so well."

This "large machine" was 80 feet long and 30 feet wide.

A year later the York was put on with the Jersey. They were supposed to run every half hour from sunrise to sunset, but frequently an hour was consumed in making a trip. The following is Fulton's description of the boat:

"She is built of two boats, each 10 feet beam, 80 feet long, and 5 feet deep in the hold, which boats are distant from each other 10 feet, confined by strong transverse beam knees and diagonal traces, forming a deck 30 feet wide and 80 feet long. The propelling water wheel is placed between the boats to prevent it from injury from ice and shocks on entering or approaching the dock. The whole of the machinery being placed between the two boats, leaves 10 feet on the deck of each boat for carriages, horses, cattle, etc.; the other having neat benches and covered with an awning, is for passengers, and there is also a passage and stairway to a neat cabin, which is 50 feet long and 5 feet clear from the floor to the beams, furnished with benches and provided with a stove in winter. Although the two boats and space between them gave 30 feet beam, yet they present sharp bows to the water, and have only the resistance in the water of one boat of 20 feet beam. Both ends being alike, and each having a rudder, she never puts about."

Is it Paying?

When the Fall River mule spinners struck work in the face of conditions which made the failure of the strike highly probable, to say the least, the question was raised, "Will it pay?"

The circumstance that the mill owners were able to fill the places of most of the strikers without much delay, leaving the strikers permanently out in the cold, strongly indicated that the answer to our question would have to be in the negative. Its probability is heightened by press reports to the effect that at a meeting of the directors of one of the mills, August 5, it was voted to discontinue the use of about ten thousand mule spindles—about one-fourth of the whole number used in the mill—and to substitute ring frame spindles therefor.

Correspondence.

The New Optical Delusion.

To the Editor of the Scientific American:

In your last issue you illustrate two optical puzzles. The explanation given below shows clearly, I think, that the phenomena depend on the property of the retina to retain images of objects for a certain interval after the latter are removed. Fig. 1, whilst being steadily gazed at, is to be moved in a small circle without being rotated; in other words, the

Fig. 1

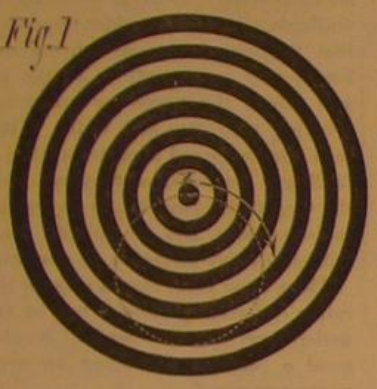
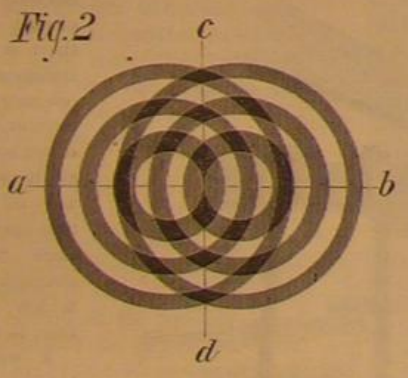


figure is to be moved in the same way that one moves a pail in rinsing it out. The rings will then appear to be rotating about their center in the same direction that one is moving the figure. The center of the circle in Fig. 1 is moved on the line of the dotted circle in the direction shown by the arrow. Suppose, for the sake of explanation, that impressions made on the retina are erased every $\frac{1}{6}$ of a second, and that you move the figure so that its center, x, completes the dotted circle once per second.

An impression of the rings is made on the eye; the rings are then moved so that their center completes an arc of, say, $\frac{1}{16}$ of the dotted circle; a second impression is made on the eye; the first impression is not yet erased, as only $\frac{1}{16}$ of a second of time has passed since it was formed, so that the retina has the two images superimposed, as shown in Fig. 2. In this figure the most white space is shown on the line, $a\,b$, and most black space along $c\,d$; the rings are moved another arc of $\frac{1}{16}$ of the dotted circle, and a third impression is made on the retina; $\frac{1}{6}$ of a second has now elapsed since the first impression was made, and, agreeably to our supposition, it is now obliterated; the figure on the retina is now as in Fig. 3.

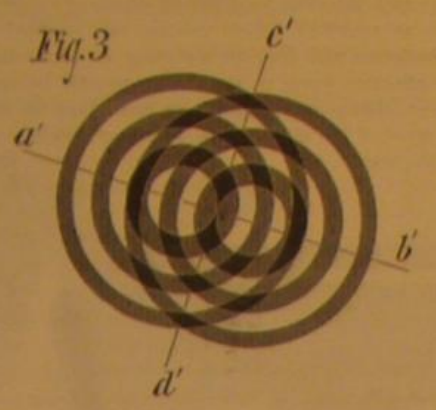
Fig. 2



The line of white parts, let it be observed, has moved from its horizontal position, $a\,b$, Fig. 2, to the inclined position, $a'\,b'$, Fig. 3; similarly the line of dark parts has moved from the vertical to the inclining position. The figure is moved another arc of $\frac{1}{16}$; now $\frac{1}{6}$ of a second has elapsed since the second impression was taken, so that it in turn disappears, leaving on the retina the impression like Fig. 4; here the white parts have moved still further from the horizontal, and the dark parts from the vertical position; the two, in fact, are traveling in a circle, and, as will be seen by imagining this series of figures completed to the number of sixteen, the light and shade will complete a circle every time the center of the rings completes one. It is the light and shade moving in a circle that gives the rings the appearance of revolving. Of course if the rings in the figures overlap each other more or less, or, in other words, if the rings are moved in a larger or smaller circle, the configurations sent to the eye are quite different, but in all of them the lights and shadows are following each other around the circle, and always giving the rings the appearance of revolving.

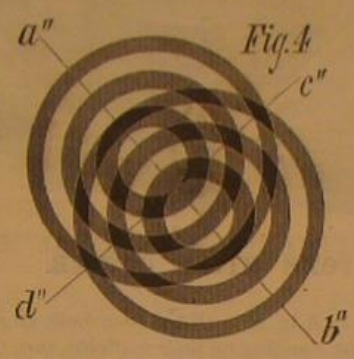
For the cogwheel puzzle, make the same suppositions as for the ring puzzle. An impression of the wheel, Fig. 5, is made on the retina; the wheel is moved an arc of $\frac{1}{16}$ of the dotted circle, when a second impression is made; the first impression still remains, and the eye sees an object like Fig. 6. The actual wheel is represented by the right hand one of the two superimposed figures, the left hand figure representing the first impression. The first impression is, of

Fig. 3



course, not so strong as the last, and therefore the cogs at b, part of the first impression, are not seen with anything like the distinctness of the cogs, a, parts of the actual wheel. The cogs at the right hand side of the right hand wheel (the actual wheel) are not seen as distinctly as those on the left hand side, because they project into a black space; that is, the rays of light coming from these cogs to the eye fall on

Fig. 4

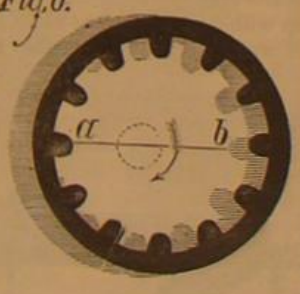


a part of the retina that is occupied by the, as yet unerased, first impression. These cogs, therefore, although on the actual wheel, are vaguely seen; the only cogs seen distinctly, therefore, are those at the left hand side of right hand wheel, at a. While the cogs, a, are clearly seen, the center of the wheel is moved $\frac{1}{16}$ of the way round the dotted circle in the direction of arrow.

The wheel is thus moved in a downward direction; the cogs, a, the only parts distinctly seen, are moved downward.

Fig. 5.

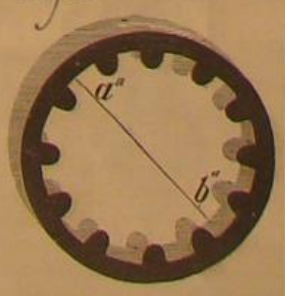
Fig. 6.



This is remarked by the retina, and then the third impression is taken. The first impression of the wheel (that is, the left hand wheel of Fig. 6) now disappears, and the second impression (that is, the right hand wheel of Fig. 6) becomes pale. By the same reasoning employed with Fig. 6, we find that the only cogs seen distinctly in Fig. 7 are those at a', and that they move in the same direction that cogs, a, in Fig. 6, do. Fig. 8 shows a further stage in the reasoning process,

Fig. 7

Fig. 8.



the prominent cogs being at a'', moving also in the same direction as those at a in Fig. 6. Now, all the cogs when distinctly seen are moving in a direction contrary to the hands of a watch, thus giving the wheel the appearance of revolving in that direction.

The drawings can be better understood by tracing Figs. 1 and 5 on tissue paper, and then moving the tissue paper over the prints in the prescribed way. A. O.

Cincinnati, O., August 3, 1879.

The Optical Delusion—An Explanation.

To the Editor of the Scientific American:

In the last SCIENTIFIC AMERICAN, for the week ending August 9, I saw an article respecting some remarkable optical delusions, and as no explanation has been offered, I should like to state a theory which seems very well to answer the conditions of the question involved.

In Fig. 1 we have two sets of parallel lines, one horizontal, the other perpendicular; if we move the paper backward and forward, along the line, A B, the horizontal lines will remain clear and distinct, while the others will be blurred and indistinct. This principle has been applied in the octagonal figure, in Fig. 2. If the paper is moved to the right and left, the sections, A and E, will be clear, while C and G are dim, because of the lines overlapping each other. If it were possible to move the paper first across G and C, then D and H, E and A, and so on around, A and E would shine out clearly, then B and F, while the sections at right angles to these would be dimmed. In this way two bright sections would be seen to advance from section to section, followed by two dim sections; and if it were not for the sharp angles, which arrest the attention, the whole polygon would seem to revolve. If we increase the number of the sides of the polygon, the angles will be less prominent; and if this process is continued, the polygon will become a circle. When we perform the experiment with the circle we are immediately struck by this shadow, which is seen to cross the circle in the direction of the motion, and when it is whirled around, according to the instructions

given, we can see it very distinctly moving around, and giving the impression that the circle itself is in motion. Another reason suggests the truth of this "shadow theory." If, while the circle is in full motion, the observer throws his eyes out of focus (some have that power), all the rings will become blurred, and the shadow will disappear, causing the circle to stand still. This delusion differs from the other in a very marked degree. In Fig. 6—[as H. W. F.'s Fig. 3 corresponds with A. O.'s Fig. 6, we refer to that figure]—suppose that the paper is moved in the direction of the arrow. As we move it in a curve toward the right, the tooth, a, comes into notice; but as the paper retires, in a curve to the left, the tooth is overlapped by the shadow of the ring, which the retina holds. This takes place at each tooth, and the interior of the ring seems to have a retrograde motion. This second delusion is not so easily seen as the first, and I have devised a surer way of seeing it, namely, by making the teeth longer and more numerous, and by filling in the center of the circle with black. In observing this class of phenomena I was much surprised by another curious fact. I was looking at a moving circle, while others on a separate piece of paper lay near me on the table, and, although my

Fig. 2.

attention was concentrated on the moving paper, I could see the other circles going at the same rate of speed. As soon as I looked at a stationary object, the other circles stopped.

I afterward tried the same thing in a different form: I placed the point of my pen near one of the circles, and moved it around, watching it closely all the time. I could then see all the circles spin around, as before.

Stamford, Conn., Aug. 4, 1879. H. W. F.

The Aurora.

Professor Trouvelot states that a beautiful auroral display was observed at Cambridge, on the evening of June 17. It began at about 9:15 P. M., and lasted until 11:45 P. M. The illuminated portion of the sky was nearly 20° E. and 15° W. of the magnetic pole, it extended about 40° vertically to the horizon, being highest in the vicinity of the pole. Many whitish and cream colored streamers were seen, especially to the west of the magnetic meridian, the undulations being well marked and numerous, no rosy-hued streams being observed. Along the horizon and densely massed were dark cumuli clouds, through openings of which could be seen the auroral light, showing distinctly that the effect must have taken place in the atmosphere beyond the clouds in question.

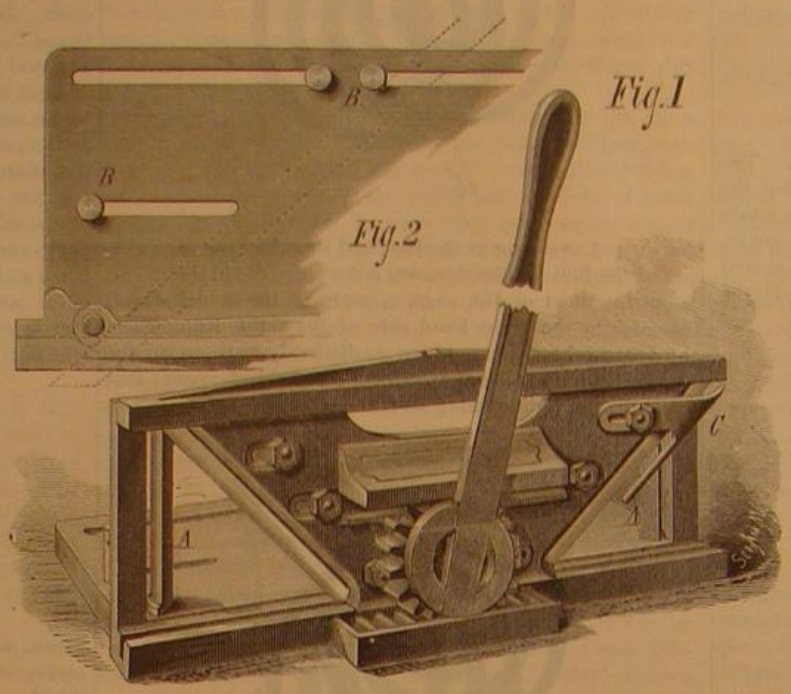
A NEW MITER CUTTER.

The accompanying engraving represents an improved miter cutter recently patented by Mr. W. R. Fox, of Rockfall, Conn. Its construction is so simple that it can be readily understood by a glance at the engraving. The cutters, which are made of the finest cast steel, are secured to a slide that moves in guides along one edge of the bed and the slide is moved by a pinion placed between the rack on its outer side and a rack on the bed, the pinion being provided with a long lever by which cutters may be moved in either direction with force sufficient for any work that the tool is capable of doing.

Upon the bed there are gauges and guide marks to which the work is adjusted. At each end of the bed and near the path of the knife there is a pivoted support for the end of the piece being squared.

This tool seems superior to the block plane, as it will do the work quicker and better. It is particularly useful in squaring across the end of the grain; when used for this purpose, the piece being cut may be backed up by another piece to prevent slivering.

This tool is strong and well designed, and well calculated to meet the wants of wood-workers.



FOX'S MITER CUTTER.

How to make a Bark Lodge.

The Earl of Dunraven gives the following directions for making a hunting lodge, Canadian style: Having selected a level spot, make four low walls of two or three small pine logs, laid one on the other, and on these raise the framework of the camp. This consists of light thin poles stuck into the upper surface of the logs, and the upper ends leaning against and supporting each other. The next operation is to strip large sheets of bark off the birch trees, and thatch these poles to within a foot or two of the top, leaving a sufficient aperture for the smoke to escape. Other poles are then laid upon the sheets of birch bark to keep them in their places. A small doorway is left in one side, and a door is constructed out of slabs of wood or out of the skin of some animal. You next level off the ground inside, and strew it thickly with the small tops of Canada balsam fir for a breadth of about four feet; then take pliant ash saplings and peg them down along the edge of the pine tops to keep the carpet in its place, leaving a bare space in the center of the hut, where you make the fire.

SCREW SCAFFOLDING.

The following is a description of scaffolding recently given in the *Building News* by Mr. Joseph J. Lish. We have prepared an engraving representing a section through the center of tower, showing the screw scaffolding in position. There are four scaffold screws, which bear the whole scaffolding of tower, one being placed in each angle of wall. Each screw works through three nuts, and has a collar carrying a saddle for the support of the ledgers and framing, from which the workmen's platforms or scaffolds are suspended by wrought-iron slings. The wheels of the bearers to outside scaffold travel up the face of the wall as the scaffold rises. Guard rails are fixed where required, to insure the safety of the workmen employed.

In proceeding to fix the scaffolding, where the scaffold screws are to work in the wall, all that is necessary is to place the screws in their proper position in the wall whilst the foundations are being put in, then plumb and build round them, clasping two of the nuts on each screw at the same level and at the required distances apart. If 2 ft. 6 in. of wall is to be built for each lift of scaffold, the nuts will require to be placed every 2 ft 6 in. in height. The screws should next be turned until all the saddles are standing on the same level; the overhead framing, ledgers, and platforms should now be placed in position, the upper nut clasped on where shown, and the work of building from the scaffold begun.

If the platforms are placed about 12 inches below the top of the wall then built, sufficient space will be left between the top nut and the collar to allow of building up nearly to the collar, as required before raising the scaffold. The scaffold platforms will then be standing at about the best height for effective work, as the workman will, by such an arrangement, always be walling from just below his knee to about the level of his elbow, thus avoiding undue stooping and over-reaching.

When the 2 ft. 6 in. of wall has been built all round, the workmen, whilst standing on their scaffolds, turn the screws (by a simple arrangement at the collar) and raise the scaffolding, walling materials, and themselves as well, a height of 2 feet 6 inches. The foot of the scaffold screw will then have passed the bottom nut, leaving it lying loose in the wall. This nut must then be drawn out of the wall (a hole opening to the inside being left for this purpose), and clasped on to the scaffold screw at the level of the upper collar, making it thus a top nut. When, after the next lift of scaffold, the foot of screw has passed up through the lower nut, this nut, in its turn, is lifted up and made a top nut; and so on successively until the full height of the wall has been built. It will thus be seen that a screw never rests in less than two nuts. As the screw by this system travels up with its scaffold, the same screws will do for any height of wall. It is not necessary to clear the platforms previous to raising. Before commencing to plaster, the nut holes in the body of the walls are filled up, and the holes left by the screws are well grouted.

For "cleaning down" the work the outside platforms can be lowered as required from the projecting ends of ledgers.

The scaffolding screws can be used in three separate ways:

1st. Working in the body of the wall.

2d. Against one of the faces of the wall.

3d. Independent of the wall.

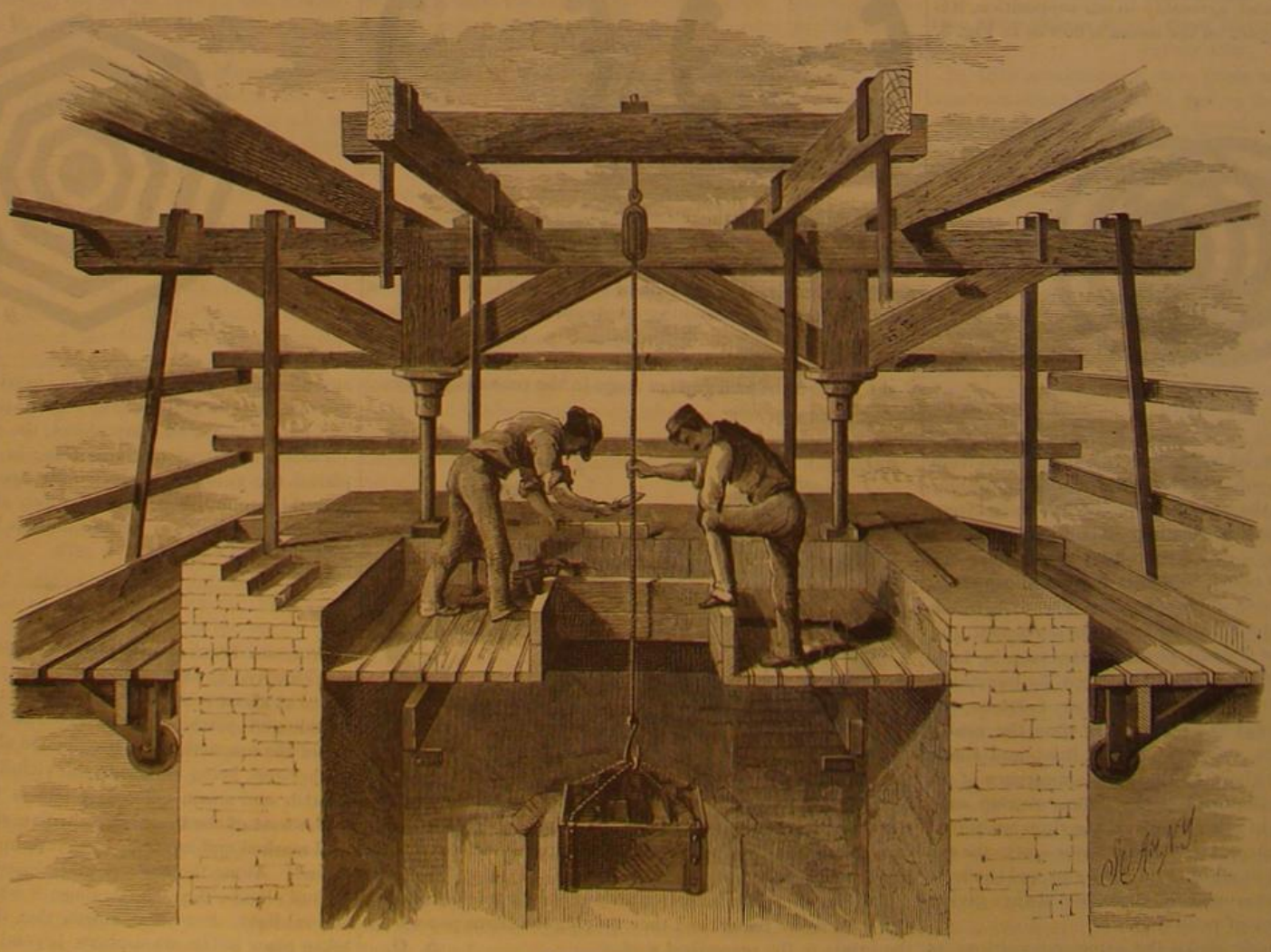
The first method is shown in the engraving.

Where the screws are placed at long distances apart, it may be necessary to truss the ledgers or scaffold-bearers, and where the builder wishes to work with a minimum number of screws, trussed bearers will naturally suggest themselves.

To prevent the possibility of brickbats and building débris flying out into the roadway, a screen may be placed along the front of the building suspended from the scaffolding. This screen, which may be a kind of rope netting, will uncoil as the scaffold rises. If the whole of the material for a work of this kind is raised in the interior of the building, and the outside scaffold platform used for the purposes of setters merely (and not for walling materials), there need be but slight inconvenience, and little or no danger, experienced by the street traffic whilst building operations are carried on. As to the covering in of these scaffolds, all that the builder requires to do for this purpose is to stretch tarpaulings or covers over such portions of the ledgers as will afford the necessary protection to the working platforms and walls. These coverings may be placed in position when the scaffolding is first fixed, as they add but little to the weight, interfere in no way with the raising operations, and go up with the scaffold without further attention or alteration.

There is no valid reason why the whole operation of building should not be carried on under cover, and the "waller" be placed in as good a position for doing his work as the "stone-dresser."

The arrangement here applied to scaffolding could be made available for the extension of existing buildings by raising the roofs entire, and adding to the walls as the roof rose, in place of the tentative methods now resorted to when "roof-raising" is practiced.



SCREW SCAFFOLDING.

MISCELLANEOUS INVENTIONS.

The combination, with wooden strips on bottom and sides of a basket, of metallic strips running under the bottom, up the sides of basket to rim, and overlaid upon the wooden strips, and a horizontal strip running around the body of the basket next to the bottom, has been patented by Mr. Elmer D. Ballou, of Becket, Mass.

Mr. James Hoover, of Gratis, Ohio, has invented an improved electric motor, in which a revolving armature wheel is made use of in connection with fixed electro-magnets arranged in a circle around the armature wheel. The construction is such that by the use of one battery the full power of the magnet is obtained every time the circuit is closed. One magnet only being in circuit at once there is only the resistance of that one magnet to the current, while the effect is the same as it would be were all the magnets energized at once with the stronger battery which would then be required.

A wood type having a face formed by a veneering of rubber or analogous material, and the body and sides of the letter composed mainly of wood, has been patented by Mr. Peter Gfroerer, of Terre Haute, Ind.

An oil press hoop with beveled shoulder and movable beveled perforated bottom, has been patented by Mr. William V. McKenzie, of Rahway, N. J.

THE JAPANESE GOAT ANTELOPE.

Some interesting additions have recently been made to the series of ruminants in the Zoological Gardens, London. There is a specimen of the Japanese antelope, of which we give an illustration. This animal is new to the society's collection, nor has it previously been exhibited in any of the continental gardens, so far as we know.

The Japanese goat antelope (*Capricornus crispus*) is, as its name imports, a native of the Japanese empire, where it is said to be very rare, being only found in the higher mountains of the interior of the islands of Niphon and Sikok. It was first described by Siebold in his well known work "The Fauna Japonica," from two examples in the Leyden Museum. Siebold tells us that its Japanese native name is "nik," but he gives us scarcely any other details respecting this animal. The engraving represents a young male, with his horns growing.

THE JAPANESE GOAT ANTELOPE.

A New Fish.

Professor Baird has forwarded, through Dr. Tarleton H. Bean, now at Gloucester, to Mr. E. G. Blackford, Commissioner of Fisheries, an entirely new fish, which, aside from representing a novel genus, may have a decided commercial value. The first one seen was caught by Capt. W. H. Kirby, of Gloucester. It represents the new genus *Lopholatilus*, one having the general appearance of *Latilus*, but with the addition of a nuchal crest and labial appendages. It has received the name of leopard fish, on account of its spots. The fish were caught 50 miles south by east of Noman's Land, in 75 fathoms of water, while trying for cod and with cod bait. The fish seemed very abundant. A few weeks ago the presence of these fish was totally unheard of. Dr. Bean writes: "The type is in the National Museum, but now we have eight to bear it company." Examining the fish at Mr. Blackford's, it was found to have some very peculiar traits. What was strange was to see an adipose fin like that on the salmon, only that this fin, instead of being near the tail, was on top of the head. The dorsal extended from about two thirds of the fish to the caudal. Below, under the belly, the fin was continuous. The head had no semblance to a cod. The teeth were fairly well developed and sharp. In color it was yellow, with spots. Those who have eaten the leopard fish declare it to be excellent. The fish was about 28 inches long, and would weigh, perhaps, about the same as a cod of the same size

GIANT TREE.

The colossal pao d'arco, or bow wood (*Tecoma speciosa*), and macaranduba (*Mimusops elata*), abound in the virgin forests north of Rio; the timber of both is exceedingly hard and extensively used in carpentry and cabinetmaking. From the latter is extracted, by incision, a whitish, sweet, savory fluid, commonly used while in a liquid state as milk, in tea and coffee; after some hours it coagulates, forming a white elastic mass resembling India-rubber. The bark is very rich in tannin, and is much used in dyeing. The total height of these trees, stem and crown, may be estimated at from 180 to 200 feet; the vast dome of their foliage rises above other forest trees, as does that of a cathedral above other buildings in a city. Logs 100 feet long, squared, from these trees, are not uncommon at the sawmills near Belem. The growth of the buttress-shaped projections around the lower part of the stems, not only of the trees just mentioned, but of all of the larger trees, is a remarkable feature of the forest; the buttresses, generally thin walls of wood, form spacious stall-like compartments, often capable of holding a half dozen persons, and serve as props to the enormous stems.

Economical Use of Coal.

The success of most manufacturing processes depends to a great extent on the economical use of the fuel employed. It is painful to contemplate the enormous waste of fuel which often occurs, and it it is not surprising to find that many minds have been busy in endeavoring to arrange a form of furnace which shall generate and utilize a maximum of heat from a minimum of fuel. Recent inventions, says the *Brewers' Guardian*, seem to indicate that we shall, before long, have practical methods contrived for the conversion of coal into gas before it is used for heating purposes; by taking a given weight of coal and distilling it, and thus separating the solid and gaseous constituents, we undoubtedly effect an economy; the difficulty hitherto has been, and now is, to effect this separation in a practical manner. The very general use of the modern gas engines is evident that coal gas is becoming recognized as an economical fuel; but the man who first invents a practical method of burning coal, so that it is first converted into its solid and gaseous constituents, which are subsequently in the same furnace burnt so as to develop the greatest amount of heat, will realize for himself an enormous pecuniary recompense, and will do a great service to mankind at large.

THE digging of the canal from Cronstadt to St. Petersburg is progressing so rapidly that Admiral Possiett, who directs the work, has assured the Russian government that vessels of light draught will be able to reach the capital by next summer. Its depth will be 20 feet.

ROOT OF A GIANT TREE.

NATURAL HISTORY NOTES.

The Annual Rings of Trees.—Does a single zone of wood invariably indicate the entire annual growth of a tree? This is a question that has not as yet been satisfactorily answered. Generally speaking the number of concentric rings present in a cross section of a trunk will afford a tolerably correct idea of the age of that particular part of the trunk from which the section is taken. To obtain as nearly as possible the age of a tree the section must, of course, be taken from the base of the trunk. It is not easy, however, to prove whether two or more rings are sometimes formed in the trunk of a tree in one year, because it would be necessary to know beforehand the exact age of the tree, and cut the tree down to determine the point. Several writers have given it as their opinion that two rings are occasionally formed in one year, caused by an interruption and resumption of growth. Some of them agree that when there are two rings formed in one season they are not so sharply defined as when there is only one in each season. Last season Mr. L. Kny made some observations and experiments in England with a view of obtaining some more satisfactory and positive results than previous writers had placed on record. At the end of June he completely stripped a number of young trees of their leaves, thinking he would be able to determine the point from their autumn shoot; but being in a nursery quarter they made too little growth for the purpose. But nature herself gave him the best opportunity. The caterpillars of *Lymantria dispar* stripped a large number of trees of their foliage about the same time, and many of them made strong autumn shoots, so that Mr. Kny was able to determine that, in some instances at least, a second distinct ring is formed in one summer; and these rings are as sharply defined and as distinct from each other as the autumn growth one year's ring and the spring growth of a succeeding year's ring. On the other hand, he observed a noteworthy difference in the degree of distinctness in different species of trees, and in the same tree at different heights, and even in the same internode. Moreover, there was a difference in the degree of distinctness of the two rings on the upper and under sides of the horizontal branches of the lime (*Tilia parvifolia*). Respecting the degree of distinctness at different heights, it was ascertained in the branches examined that there was a gradual decrease in distinctness from the younger to the older internodes, until all traces of a second ring seem to disappear. But there is this limitation to it: the two rings are not most distinctly separated in the uppermost internode, but in the second or third from the top. These investigations, as far as they go, seem to show that summer interruptions of growth are too brief to affect the whole system of a large tree, consequently the number of concentric rings of wood in the trunk of a tree represent very closely the actual age of the tree.

The Consciousness of Pain in Inferior Animals.—Professor T. Rymer Jones, in writing of crustaceans, takes occasion to make the following remarks in regard to the susceptibility to pain of these and other animals. Is it really true in philosophy, says he, as it has become a standing axiom in poetry, that—

> "The poor beetle, that we tread upon,
> In corporal sufferance feels a pang as great
> As when a giant dies"?

This is a question upon which modern discoveries in science entitle us to offer an opinion, and the result of the investigation would seem to afford more enlarged views relative to the beneficence displayed in the construction of animals than the assertion of the poet would lead us to anticipate.

Pain, "Nature's kind harbinger of mischief," is only inflicted for wise and important purposes—either to give warning of the existence of disease, or as a powerful stimulus prompting to escape from danger. Acute perceptions of pain could scarcely, therefore, be supposed to exist in animals deprived of all power of remedying the one or of avoiding the other. In man the power of feeling pain is indubitably placed exclusively in the brain; and if communication be cut off between this organ and any part of the body, pain is no longer felt, whatever mutilations may be inflicted. The *medulla spinalis*, which corresponds to the ventral chain of ganglia in articulated animals, can perceive ex-

ternal impressions and originate motions, but not feel pain; hence we may justly conclude that in the articulates likewise, the supra-œsophageal ganglia, the representatives of the brain, and the sole correspondents with the instruments of the higher senses, are alone capable of appreciating sensations of a painful character. Thus, then, we arrive at a very important conclusion, namely, that the perception of pain depends upon the development of the encephalic masses; and, consequently, that as this part of the nervous system becomes more perfect, the power of feeling painful impressions increases in the same ratio; or, in other words, that inasmuch as the strength, activity, and intelligence of an animal, by which it can escape from pain, depends upon the perfection of the brain, so does the perception of torture depend upon the condition of the same organ. How far the feeling of pain *is* acutely developed in the animals we are now considering (articulates) is deducible from everyday observation. The fly seized by the leg will leave its limb behind and alight with apparent unconcern to regale upon the nearest sweets within its reach; the caterpillar enjoys, to all appearance, a tranquil existence while the larvæ of the *ichneumon*, hatched in its body, devour its very viscera; and, in the crustacea, of so little importance is the loss of a leg, that the lobster will throw off its claws if alarmed by the report of a cannon; and, again, should the claw of a lobster be accidentally damaged by accidents, to which creatures incased in such brittle armor must be perpetually exposed, the animal at once breaks off the injured member at a particular part, namely, at a point in the second piece from the body; this operation seems to produce no pain.

How Caterpillars are Protected.—Mr. A. R. Wallace, in "Science for All," says that it is among caterpillars that protective coloring is most general and conspicuous. An immense number of these creatures are green, corresponding with the tints of the leaves on which they feed, or are brown when they rest on bark or twigs; while a large number of the larvæ of the geometridæ, or "loopers," have the habit of sticking themselves out rigidly, like sticks, which they exactly resemble in shape as well as color. Every one knows, however, that there are a number of very brightly colored caterpillars, and it may be asked how these are protected, or why the others need protection if these can do without it. The answer to this question is most instructive, and affords the most conclusive proof that various examples of protective tints in nature really have the effect we impute to them. It has been found by repeated observation and experiment that every green and brown caterpillar, without exception, is greedily eaten by birds and even by frogs, lizards, and spiders, and that they endeavor to conceal themselves from these numerous enemies by feeding usually at night, while during the day they remain motionless upon leaves, twigs, or bark of the same color as themselves. The brightly colored caterpillars, on the other hand, were found to be universally rejected by birds when offered to them, and even by lizards, frogs, and spiders. None of these would touch the common spotted caterpillar of the magpie moth (*Abraxas grossulariata*), nor those of the *Cucullia verbasci, Callimorpha iacobæ*, or the *Anthrocera filipendulæ*. Sometimes the caterpillars were seized in the mouth, but always dropped again, as if in disgust at their taste. The same rule was found to apply to all hairy or spring caterpillars; and, what is very interesting, the habits of these creatures are correspondingly different from those of the green and brown eatable species. They all feed during the day; they do not conceal themselves, but feed openly, as if courting observation and secure in the knowledge of their safety from all enemies.

Under the caption of "A Poisonous Caterpillar," *New Remedies* quotes from the *Journal of the Royal Microscopical Society* an account of a poisonous caterpillar lately discovered in Brazil, and the effects of which, when the spines with which it is covered come in contact with the skin, are described as very severe, and consist of redness and burning of the part, and acute pain, extending, when the hand is the part affected, quite to the armpit. The editor of *New Remedies* remarks that the larva of the Io moth (*Hypercheiria Io*) of this country is capable of causing symptoms quite similar to those above described. To this we may add that the caterpillars of many of our other moths are equally poisonous to man, and it is to the presence of these irritating bristles, undoubtedly, that they seem to be distasteful to birds and other enemies, as remarked by Wallace in the above note. Among the poisonous kinds that occur to us at present, we may mention the "saddle-back caterpillar" (*Empretia stimulea*), which causes the hand that has been touched by it to swell up, with watery pustules, accompanied by intolerable itching; the caterpillar of the common vanessa butterfly (*Vanessa antiopa*), and the "wooly bear" caterpillar (*Arctia Isabella*), both of which are poisonous to children; the caterpillar of the Maia moth (*Vanessa Maia*), which is armed with spines that are still more annoying, stinging the hand like a nettle although accompanied by an acuter pain. Some years ago Mr. J. A. Lintner, of Albany, made some experiments upon himself with this larva, and recorded the results in an interesting article in the "Twenty-third Annual Report of the Regents of the University of the State of New York." Mr. Lintner says that this caterpillar possesses a color in marked contrast with the leaves on which it feeds, so that even a solitary individual would be ill fitted to escape the searching eye of bird or parasite that preys upon it; but the courageous bird that should venture an experimental taste would find in the stinging bristles, as it passes down its throat, no inducement to repeat the experiment.

An Ancient Rose Tree.

Herr Leunis, a well known botanist of Hildesheim (Hanover), thus describes a remarkable rose tree (or rather climber, for it is supported against the wall of a church) growing in his town, and which was in existence when Christianity itself was little more than 1,000 years old; and, if tradition is to be believed, had even then been blooming nearly 300 summers. "The oldest known rose tree in the world," he says, "is one at present growing against the wall of the cathedral of this town (Hildesheim), remarkable alike for its extreme age and for the scanty nourishment with which it has supported itself for so many centuries. It varies but slightly from the common dog rose (*Rosa canina*); the leaves are rather more ovate, the pedicels and lower leaf surfaces more hairy, and the fruit smaller and more globular. The stem is two inches thick at its junction with the root, and the whole plant covers some 24 square feet of the wall. Bishop Hezilo, who flourished between 1054–1079, took special interest in this rose as being a remarkable monument of the past; and when the cathedral was rebuilt, after being burned down in 1061, he had it once more trained against the portion of the wall which had been spared by the fire. Tradition states that, in the year of grace 814, the Emperor Ludwig the Pious, son of Charlemagne, was staying with his court at Elze. Being desirous of hunting in the huge forest where now stands Hildesheim, mass was said by the imperial chaplain at the place of rendezvous. By some mishap, when the service was concluded and the party dispersed, the vessel containing the sacred elements was left behind. On returning to the spot the following day, great was the surprise of the chaplain to find the holy vessel overshadowed by the tender branchlets of a lovely rose, which had sprung up in the night, and now filled the air with the perfume of its flowers. The emperor shortly after arrived, and by his command a chapel was built, with the altar standing on the spot occupied by the roots of the rose, that very rose which is now blooming as freshly as though a single decade, and not a thousand years, had passed over its head." But, tradition aside, certain it is that the roots of the existing rose tree are buried under the altar of the cathedral, and consequently inside the building, the stem being carried through the wall to the outer air by a perforation made expressly for it.

A Nevada Saline Valley.

About 15 miles northwest of Columbus, Nevada, is a level valley of over 4,000 acres, known as Rhodes' Salt Marsh. It is evidently an ancient lake bed, and is surrounded on all sides by high volcanic mountains. According to the *Enterprise*, of Virginia City, this valley is underlaid, a foot or two below the surface, with a solid floor of rock salt, as transparent as ice. Indeed, when the sand that covers the surface is stripped off the salt below bears a very close resemblance to a field of ice. In many places little streams of water bubble up through the mass of salt, and very frequently deep pools are found which look just like the air holes in a frozen lake. The salt made at the marsh is perfectly pure. When a tract of ground has been stripped of the surface soil the salt water rises over the bed of rock salt to the depth of a foot or two. Then crystals of salt begin to form on the surface of the water, and as they form they sink to the bottom. If the salt is to be fine, for table use, workmen stir these crystals about with shovels as they settle to the bottom, thus breaking them up. For use in working silver ore coarse salt is as good as fine, and the solid formation may be dug up with picks if necessary, but the loose crystals are more readily handled, and as much salt of that kind is formed as can be disposed of.

Not only are there inexhaustible stores of salt in the little valley, but immense stores of borax. This borax is of the finest quality known, and two or three cents per pound more can be obtained for it in Europe than for any other borax sent to that market. Splendid specimens of tincal, or natural crystals of borax, are found in the marsh embedded in the clay near the surface. Immense quantities of sulphate of magnesia (Epsom salt) and sulphate of soda (Glauber salt) in a pure state are also found. Nitrate of potassa (saltpeter) is found, but the extent of the deposits is not known.

Common potash is found in great abundance, and among the curious specimens to be obtained are what are called "cotton balls" (boreate of lime) and the fibrous crystalline borax. Also there is found an abundance of an unknown mineral. It is something described in none of the books. It does not appear in the shape of crystals, yet has a regular form of its own, presenting the appearance of branches of coral. It is thought that this may be some new salt. A quantity of it will shortly be sent East for examination.

A New Map of the Solar Spectrum.

Several months ago a new spectroscope, containing compound sulphide of carbon prisms, was constructed by M. Thollon, wherewith he effected a very much greater dispersion of light than had been attained previously. With its aid he has produced a remarkable map of the solar spectrum. The work was done in Italy, as the Italian climate offers great advantages in this respect over that of Paris. Prince Nicholas of Oldenburg, who has taken a lively interest in the subject, provided M. Thollon with a small observatory at San Remo for his operations. The map (which has been presented to the French Academy) is no less than 10 meters (about 33 feet) in length, and is composed of about four thousand lines. The well known map of Angström contained sixteen hundred lines in a length of three meters. M. Thollon has devoted great care to reproducing the physiognomy of each line; and there are many new features revealed, which will doubtless be utilized for theory. The author offers a classification of the solar lines, which is as follows: 1. Lines formed of a nebulosity without a nucleus. 2. Lines formed of a nucleus without apparent nebulosity. 3. Lines composed of a nucleus and a nebulosity, but where the nebulosity predominates. 4. Lines composed of a nucleus and a nebulosity, where the nucleus predominates.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

POSITION OF PLANETS FOR SEPTEMBER, 1879.

Mercury.

On September 1 Mercury rises at 4h. 25m. A.M., and sets at 5h. 46m. P.M.

On September 30 Mercury rises at 5h. 36m. A.M., and sets at 5h. 38m. P.M.

Mercury should be looked for early in the morning; it is at its greatest elongation on September 9, when it will rise a few degrees north of the point of sunrise.

Venus.

On September 1 Venus rises at 8h. 13m. A.M., and sets at 7h. 4m. P.M.

On September 30 Venus rises at 5h. 20m. A.M., and sets at 4h. 38m. P.M.

Venus may be followed in its early evening setting for a few days in September; it then sets so nearly with the sun as to be lost in the twilight; it is in inferior conjunction with the sun on the 23d.

Late in the month Venus may be seen before sunrise.

Mars.

Mars, Jupiter, and Saturn will be seen in the evening sky during September.

Mars rises north of east on September 1 at 9h. 35m. P.M.; on September 30 at 8h. 1m. P.M.

Mars is in conjunction with the moon on September 6; the planet is 7° south of the moon.

Jupiter.

Jupiter, the largest of the planets, and as seen through small telescopes far the most interesting, is at its best position early in September.

It rises on September 1 at 6h. 31m. P.M., and sets at 5h. 19m. A.M. of the next day.

On September 30 Jupiter rises at 4h. 29m. P.M., and sets at 3h. 7m. A.M. of the next day.

If we take the hour between 9 and 10 P.M. for our observations, the most favorable nights for watching the motions of Jupiter's moons will be:

September 5, when the first satellite, or that nearest to the planet, will be seen to leave the face of Jupiter, having been between the earth and the planet.

September 7, when the third, or largest, moon will pass from the face, followed by its black shadow.

September 13, when the fourth moon, which is the most remote from Jupiter, will move from the planet in the same way.

September 14, when the third, or largest, satellite will, during this hour, from 9 to 10 P.M., be seen to enter upon the disk.

September 27, when the first moon will disappear by going behind the planet.

September 28, when the first moon will reappear in the sky during that hour, having been in front of Jupiter; and the second, or smallest satellite, will disappear by going behind Jupiter.

Saturn.

Of the three planets seen in the east in September, Jupiter rises first, Saturn second, and Mars is the third.

On September 1 Saturn rises at 8h. 2m. P.M., and on September 30 Saturn rises at 6h. 4m. P.M.

Saturn is in conjunction with the moon September 3, south of the moon about 8½°. Saturn's light is white; it is smaller than Jupiter, and further from us. It appears much less brilliant, but it is in northern declination, while Jupiter is more than 10° below the celestial equator, so that Saturn at the time of meridian passage is nearer our zenith. Saturn comes into its best position the last of September.

Seen through a glass powerful enough to show its many moons, Saturn is an object of unceasing interest, the positions of the moons and their changes giving great variety to the view, even in a few hours.

Uranus.

Uranus is not likely to be seen, even with a telescope, during September.

It rises on September 1 at 5h. 8m. A.M., and sets at 6h. 24m. P.M.

On the 30th Uranus rises at 3h. 24m. A.M., and sets at 4h. 34m. P.M.

Neptune.

On September 1 Neptune rises at 9h. 6m. P.M., and on September 30 Neptune rises at 7h. 11m. P.M.

A Difficult Swim.

The public is getting a trifle weary of Paul Boyton's swimming feats, yet it may be worth noting that he found his recent swim from Long Branch to Coney Island "twice as terrible and severe" as the swim across the English Channel, which attracted so much attention a year or two ago. The distance from Long Branch to Coney Island was thirty-five miles; time, twenty-eight hours.

BESSEMER STEEL.

[*Continued from first page.*]

minutes. The charge of iron is first melted in a cupola and allowed to run into the converter, previously heated to redness. Before the converter is turned up into a vertical position, the blast is turned on to prevent the entrance of the melted iron into the blast holes of the tuyeres. The air, at a pressure of 20 to 25 pounds per square inch, penetrates the melted metal from 144 apertures, coming into contact with every particle. At first a reddish yellow, faintly luminous flame issues from the neck of the converter; soon it becomes more brilliant, the metal becoming in the meantime hotter and being violently agitated. Sparks appear, consisting of particles of iron and slag, which are thrown out by the rapidly disengaged gases. At this point the roar of the flame becomes terrific, and the light is intense.

During this portion of the process the iron, if it contains much silicon, would be overheated were it not for the introduction of masses of cold pig iron, which keep the temperature down. It is sometimes necessary to introduce cold iron to the amount of two tons. The iron is thrown in at the mouth of the converter in the manner represented in the engraving. This is necessary in case the iron is rich in silicon, as the very high temperature which would otherwise be produced would generate gases in great quantity, which make blow holes, cracks, and imperfections of various kinds in the ingots.

After some minutes blowing the sparks cease, the action becomes less violent, and the flame presents the bluish violet characteristic of carbonic oxide; finally, when the whole of the carbon is oxidized, the carbonic oxide flame is replaced by a stream of intensely heated gas, consisting chiefly of nitrogen resulting from the oxidation of the iron by the air. At this moment the foreman turns down the converter and shuts off the blast. A few seconds delay at this point may entirely spoil the product. A quantity of spiegeleisen, equal to 8 or 10 per cent of the whole, is now run into the converter, when another flame reaction occurs. The converter is turned still further down, and the steel runs into the ladle supported by the hydraulic crane standing in the center of the circular pit. Around the side of the pit, opposite the converters, there are fourteen heavy iron ingot moulds, seven of them being always in reserve while the other seven are being filled. These moulds contain one ton each. They are lined with a clay wash to prevent grooving and to insure the easy separation of the mould from the ingot. The ladle containing the charge of melted steel is swung around over the moulds, and the melted metal is allowed to escape through a valve opening in the bottom into the several moulds in succession.

After the steel solidifies and cools sufficiently, the moulds are removed from the ingots, leaving them standing. A hydraulic crane outside of the pit, armed with a grapple something like a pair of huge ice tongs, picks up the red hot ingots and places them on an iron car, to be trundled off to the rolling mill, where they are converted into rails, each ingot being sufficient for three or four rails. The largest production in a single day of 24 hours at these works was on December 5, 1878, when 35 tons 19 cwt. (2,240 lb. to ton) were made.

The facility with which these huge pieces of machinery are made to handle such masses of hot metal is something wonderful. The movements of the converters, the air blast, and the ponderous cranes are all controlled by the foreman, who sits in the gallery seen in the background, and by the movement of a few levers admits water here and there under a pressure of 400 pounds to the square inch, moving the strong iron arms with a celerity and precision that could not be attained by other means.

It may not be uninteresting in this connection to give the chemical changes that take place in the converter, as indicated by the changes in the composition of the gas evolved at different stages of the process.

	2 Min.	4 Min.	6 Min.	10 Min.	12 Min.	14 Min.
Carbonic oxide	....	3·95	4·52	19·59	29·30	31·11
Carbonic dioxide	10·71	8·57	8·30	5·58	2·30	1·34
Oxygen	92	....	....	....	....	....
Hydrogen	....	·88	2·00	2·00	2·16	2·00
Nitrogen	88·37	86·58	85·28	74·83	66·24	65·55

The corresponding alterations in the composition of the metal are shown by the following analyses by Snelus of portions taken out of the converter during different stages of the operation:

	Gray pig operated upon.	Composition of metal after blowing.			Steel.	
		6 Min.	9 Min.	13 Min.	Ingot.	Rail.
Carbon { graphitic	2·070	....	....	....	....	....
Carbon { combined	1·200	2·170	1·550	·097	·566	·519
Silicon	1·952	·795	·635	·020	·030	·030
Sulphur	·014	Trace.	Trace.	Trace.	Trace	Trace
Phosphorus	·048	·051	·064	·067	·053	·053
Manganese	·086	Trace.	Trace.	Trace.	·309	·309
Copper	....	....	....	....	·039	·039

It will be seen that a portion of the sulphur present in the pig is eliminated; the greater part of the silicon is also separated, together with the carbon, and almost in the same proportion; but the phosphorus is not removed, and owing to the oxidation of some iron the amount is actually greater in the finished steel than in the pig iron. The copper and manganese present in the steel are due to the manganiferous pig iron added at the end of the operation.

The *Manufacturer* furnishes the following list of Bessemer steel works now in operation in the United States:

The Bessemer steel works of the Albany and Rensselaer Iron and Steel Company, Troy, N. Y., was the first erected in the United States, having made its first blow February 15, 1865. It has two 7-ton converters. The next was the Pennsylvania steel works, at Baldwin station, near Harrisburg, Pa., which has two 6½-ton converters, and made its first blow in June, 1867. The third was the Cleveland Rolling Mill Company's Bessemer works, at Cleveland, O., which made its first blow October 15, 1868, and has two 6-ton converters. The remaining eight works went into operation on the dates following: Cambria Iron Company's plant, Johnstown, Pa., July 10, 1871; two 5-ton converters. Union Rolling Mill Company's plant, Chicago, Ill., July 26, 1871; two 6-ton converters. North Chicago, April 10, 1872; two 6-ton converters. Joliet, Ill., March 15, 1873; two 6¾-ton converters. Bethlehem, at Bethlehem, Pa., October 4, 1873; two 7-ton converters. Edgar Thomson steel works, Pittsburg, September 1, 1875; two 7-ton converters. Lackawanna, at Scranton, Pa., October 23, 1875; two 5-ton converters. Vulcan, St. Louis, Mo., September 1, 1876; two 7-ton converters. The last named have been idle for several years, but we understand they will be put in operation on the 1st of October, the company already having orders to keep the works busy for six months. The Bessemer works throughout the entire country are rushed with work. They were, perhaps, never so busy before. Some years ago it almost appeared as if this business had been overdone like so many other branches of manufacture in the United States; but it does not look so now.

ENGINEERING INVENTIONS.

An improved instrument for measuring the distance of a remote object has been patented by Mr. John Boger, of Powhatan Point, Ohio. The invention is based upon the general principle of the employment of two right-angular bars, one of which is provided with a sighting-glass, and is directed toward the object, and the other graduated and provided with another sighting-instrument, which, when adjusted to a certain position upon the bar and turned to the object, indicates by the angle at such position the distance of the object, the distances which the different angles and positions together indicated being previously determined by careful measurement.

Mr. William Jackson, of Millerstown, Pa., has patented an improvement in air-compressing apparatus for locomotives, which consists in forming the wheels of the locomotive, preferably the driving-wheels, with radial air-compressing cylinders and pistons that are operated by eccentric motion of the tire with reference to the main body of the wheel, so that as the locomotive moves forward the pistons act in succession to force air through the hollow axle of the wheel into a compression-chamber, where it is stored for use in driving the locomotive.

An improved swinging gate, that is to be placed across a railroad track to keep cattle and other animals off, has been patented by Messrs. David A. Walker and John R. Smith, of Fort Benton, Montana Territory. It is to be opened by the contact of the pilot or cow-catcher of the locomotive, and will close automatically immediately after the passage of the train.

A lubricator for journals, provided with a roller arranged longitudinally in contact with the journal, inclosed in a top slot of bearing, and connected by a corresponding slot directly with the oil-reservoir, has been patented by Messrs. C. H. Leonard and W. B. Hick, of Wilkesbarre, Pa.

The August Meteors.

On the 10th of August last the earth, in its accustomed journey through space, reached the outer edge of the supposed meteoric ring which it annually passes through at this period of the year. In the vicinity of New York large numbers of meteors were seen during the night of August 10, some of them being of comparatively large size, very bright, and leaving long trails. Dr. Lewis Swift, in a recent letter to the Rochester *Express*, gives the following information concerning these remarkable heavenly bodies:

Meteoric astronomy now takes rank as a distinctive branch of astronomical science. Not forty years have elapsed since it was ascertained that star showers are periodical. Even then, and for many years after, it was supposed there were but two, called the August and November showers. Now, not less than one hundred have been detected, and others are constantly being added to the list. The accounts of the showers that occurred in ancient times came down to us clothed in such extravagant language that, until the great star shower of November 13, 1833, astronomers were loth to believe them. Now they know not only the cause, but are able to predict their recurrence with almost as much exactness as eclipses, and the popular mind observes these displays with equanimity and delight instead of fear and alarm, or thinking the day of judgment has come. Science has disarmed not only them, but eclipses and comets as well, of their terrors.

All know what a shooting star looks like, but no living man can tell us what it really is, for not one has ever been known to reach the earth. Those heavy, stony, and still more weighty metallic masses, called meteorites, meteoric stones, etc., which occasionally fall to the earth from the celestial regions, of which the one that recently fell in Iowa was a remarkable example, belong to another class of objects entirely, of the origin of which man knows nothing.

A shooting star is only visible while undergoing the process of combustion, which lasts from one to three seconds, seldom longer. Previous to this they exist in a dark, probably solid condition, not much, if any, larger than peas, too small to be seen by daylight, and in the night, being in the earth's shadow, are eclipsed, and consequently invisible. Only while being burned are they visible to us, as then they shine by their own light.

Each meteoroid moves in an orbit, revolving around the sun with as much regularity as the larger planets. In fact, each is in every sense of the word a planet, obeying strictly the laws of gravitation and planetary motion. All space is filled with them; they are as numerous as the sand. The earth and they in their journey round the sun encounter each other; the earth by its superior attraction draws them toward it, but to reach it they must pass through the atmosphere, which not one is able to do. Only meteoric stones are able to reach the earth, and they have their surfaces blackened, and converted to scoria by the terrible heat engendered by the friction with the atmosphere and by arrested motion.

Shooting stars move in all directions, and at velocities probably equal to the earth's, nearly nineteen miles a second. One moving retrograde, therefore (from east to west), would plunge into the atmosphere at a relative velocity of some thirty-eight miles a second, and, if allowance be made for accelerated motion caused by the earth's attraction, probably double that, or seventy-five miles a second. The encounter is fearful, and but for the atmosphere which acts as a cushion, the effect would be disastrous, for not less than 800,000,000 would rain upon the earth every day.

The source from whence these meteoroids come is comets, especially from their tails. The tail of the great comet of 1811 was 150,000,000 miles in length and 15,000,000 in diameter. It is improbable in the highest degree that the comet could gather its tail to itself again. It is left behind, forming part of a ring, which in time may become continuous. Another comet comes and it does the same, and during the ages which are past this process has been going on till the interplanetary spaces are filled with not only meteoroids, but something still more marvelous.

In about three thousand years that great comet will return again and repeat the process, forming part of another ring, or adding to the first, depending on circumstances which need not be considered here. Whenever the earth, in its annual journey, passes through any ring made by some comet, no man knows when, we get a star shower. The four most notable ones in our times take place at the following dates, namely, on the mornings of August 11 and November 14, and the evenings of November 24 and 27. The last two are caused by the earth passing through the track of meteoroids left behind by the fragments of Bida's comet, which divided into two parts in 1846. In this way meteoric rings are formed, of which the solar system is filled, but none are visible to us, except those the earth passes through. By some such process was the August ring formed, which the earth passed diagonally through on the evening of the 10th and morning of the 11th of the present month.

The first August shower mentioned in history occurred on July 25th, A.D. 811, and has appeared with unfailing regularity down to our own time, except a break of eighty-three years between 841 and 924, and another and much longer one of three hundred and ten years, between 933 and 1243, owing, probably, to breaks in the ring, or, which is more likely, to a failure to record them. The period of the above comet is about one hundred and twenty-three years, and it will therefore make its next appearance about the year 1985.

The eccentricity of the August ring is very great, its perihelion distance being equal to that of the earth, and its aphelion distance far beyond the orbit of Neptune, making the circumference of the ring more than 11,000,000,000 miles, and as the earth is ten days passing through it, its thickness must be at least 16,000,000 miles.

A Fall of 260 Feet.

Recently Mr. David M. Anderson, of this city, joined a party of friends who had been picnicking on the Palisades, near Englewood, N. J. Being engaged in business during the day he did not join the party until evening. The horses were hitched near the edge of a deep gorge which indents the face of the cliff, and one of them becoming restless Mr. Anderson started to remove it to a safer position. As he stepped forward, horse and carriage began slipping over the precipice. Seeing this, and thinking he could save them, he sprang upon what he supposed was solid ground between two openings in the cliff. His footing proved to be nothing but a bush growing outward, and gave way as he stepped upon it. He was precipitated 260 feet, striking upon rocks and stones as he partly fell and partly slid. He was found in an upright position, tightly wedged between rocks and trees. His face was so cut and torn by the rocks that it could with difficulty be recognized. Near him lay the dead horse and broken carriage. Strange to say, Mr. Anderson was not killed; and though severely injured was, at last reports, likely to recover.

Mr. Gladstone on America's Future.

At the opening of the Art Exhibition at Chester (Eng.), August 11, Mr. Gladstone said that when America learned to trust entirely to her own splendid natural resources, the great genius of her people, and their marvelous proficiency in the adaptation of labor-saving appliances, in which she was at the head of the world, she would be a formidable competitor with the English manufacturer.

Are we to infer that America has not yet become a "formidable competitor" to England? If so, the attention which American manufacturers are receiving in England must be curiously out of proportion to existing conditions.

Adaptation of Electricity to Useful Purposes.

Until the invention of the electric telegraph it had not been found practicable to apply the power stored up in electricity to useful purposes. Its nature and characteristics had indeed engaged the attention of scientific investigators for many years, and nebulous ideas of the possibility of utilizing it for the service of mankind had occurred to those who were engaged in its study, but without practical result. Finally Cooke in England and Morse in America, neither of whom belonged to the scientific fraternity, succeeded in solving the problem which had so long baffled the most able scientists of the world, and invented systems of electric-telegraphic communication which proved to be practical and successful. It is but justice, however, to concede that their inventions were only possible through the investigations and discoveries of the philosophers who for so many decades previously had made electricity a study.

These inventions have had an importance and a far-reaching effect, which probably was but dimly foreseen, even by the inventors or the enthusiasts whom they succeeded in interesting in their inventions. Within little more than the life-time of a generation they have revolutionized the social and business systems of the world. Year by year the telegraph is more and more indispensable, and has already become so essential that a total suspension of telegraphic communication, even for a day, would be regarded as a public calamity. The crude but effective apparatus at first used has been simplified and improved upon, and the capacity of conductors for electrical transmission has been developed and practically utilized, and these have become so familiar to the public that results which but a short time since would have been regarded as marvelous and scarcely credible, are now looked upon as of no very special note. Inventions which double and quadruple the available capacity of conductors are not regarded as worthy of special notice, and we are looking expectantly for the time when these results shall be notably exceeded, and six, eight, and even a larger number of circuits shall be regularly operated over a single conductor, as six and eight have already been worked in experimental trials.

The speaking telephone opened up a new field of telegraphic experience and research, and although but recently invented, has already been generally adopted for special and private lines. By means of telephone exchanges, which are being established in all parts of the country, a person is placed in direct oral communication with the persons and places of business of those with whom it is desired to confer, and thus business and social intercourse is facilitated and promoted. The number of telephones already manufactured and in use in this country is probably not less than 50,000, and is being increased as rapidly as they can be manufactured. It naturally makes its way more slowly in Europe, but is being extensively introduced there, and the American system of telephone exchanges is beginning to be looked upon with favor.

By the invention of the telephone we are enabled not only to communicate orally over considerable distances, but also to study the utterances of nature. The voices of the volcano and the earthquake, telephonically reported, reveal to us the titanic workings in the great laboratory of the earth. The lightning announces its coming before even the flash is visible. The pulsations of the vital fluid within our veins and arteries convey to the ear of the physician and surgeon valuable information of our physical condition. Daily new uses are found for the telephone and microphone, and it is not likely that these will be soon exhausted.

Electricity guards our buildings and property against the spread of conflagrations and the attacks of burglars and thieves; it gives us light rivaling almost the brilliancy of the sun itself; it pierces the hardest rocks and metals, and furnishes the motive power required to run our sewing machines. It traces our pictures, and prepares the plates for the printer; it regulates the movements of our clocks and plows our fields (though not the latter as yet to any considerable extent). It is, in fact, becoming the universal servant and agent of mankind, and it is impossible for us to conceive to what uses it may not yet be put for our convenience and benefit. So much has already been accomplished through electrical agency that the public mind is prepared to credit even the most marvelous achievements which may be claimed for it. It is indeed a wonderful manifestation of a force without doubt co-extensive with the universe itself, and one of the most useful and terrible agencies.—*Journal of the Telegraph.*

The Colors of Double Stars.

To test the question whether the colors of double stars depend in any way upon their relative distance from the observer, M. Niestein, of the Brussels Royal Observatory, has drawn up a table of colors of 20 binary groups, according to nearly a century of observations by astronomers. The results of his inquiry, as given in the London *Times*, are briefly these:

1. In systems with well marked orbital motion, and especially in those of short period, the two components have ordinarily the same yellow or white tints.

2. In systems, about which we have color observations sufficient to enable us to connect the color with the position of the satellite in its orbit, the principal star is white or pale yellow, when the companion is at its periaster (*i. e.*, nearest the principal), whereas, in the other positions, it is yellow, gold-yellow, or orange.

3. The companion follows the principal star in its fluctuation of color, and often surpasses that in color as it withdraws from periaster.

4. The same similarity of tints in the two stars appears both in binary groups with rectilinear motion, and in those with orbital motion and long periods of revolution.

5. In perspective binary groups the companion is almost always blue. This last observation is thought to point to a superposition of tint (as in the case of distant mountains looking blue). From these groups the small star may be reasonably supposed much further distant than the large one; in fact, near the confines of the visible world. May not this blue color (it is asked) be due to a gaseous medium expanded in celestial space, acting on luminous rays which traverse it quite like our own atmosphere, of which it is, perhaps, merely the continuation?

The Cost of Living.

The following table of the retail prices of the more important articles of food and clothing in Lewiston in 1860 and 1879 will be found, says the Lewiston (Me.) *Journal*, of value in determining whether farm products and the wages of labor to-day will secure more or less of the conveniences of life than they would before the war:

	May 11, 1860. Retail.	May 11, 1879. Retail.
Beans, bushel	$1.25 @ $1.75	$1.70 @ $1.85
Beef, pound	6 @ 12	8 @ 20
Cheese, pound	10 @ 12	10 @ 12
Chickens, pound	9 @ 11	12 @ 13
Coffee, pound	12 @ 25	15 @ 30
Corn, bushel	— @ 1.00	— @ 55
Eggs, dozen	12 @ 14	12 @ 14
Flour, barrel	5.50 @ 8.00	5.50 @ 8.00
Molasses, Havana, gallon	26 @ 28	— @ 40
Molasses, Porto Rico, gallon	35 @ 36	— @ 50
Oats, bushel	— @ 40	— @ 37
Pork, pound	8 @ 10	6 @ 9
Potatoes, bushel	40 @ 42	80 @ 90
Raisins, pound	10 @ 14	8 @ 12
Sugar, white, pound	10 @ 11	8 @ 9
Good print, yard	10 @ 12	5 @ 6
Sheetings, yard	8 @ 12	7 @ 8
Tea, pound	36 @ 65	30 @ 60
Butter, pound	18 @ 20	18 @ 20
Dry hardwood, cord	4.50 @ 5.00	5.00 @ 5.50
Hay, ton	10.00 @ 13.00	10.00 @ 13.00

It will be noticed that most of the articles which are higher than before the war are farm products, and this increase is beneficial to the farmers. Beans, beef, chickens, potatoes, and some other articles of farm produce are higher than before the war, while most articles of manufacture, pork, corn, sugar, prints, and sheetings are lower than before the war. Butter, hay, and flour are about the same. On the whole, a family can probably purchase the necessaries of life at least as cheaply as before the war, while wages are generally higher than they were then. The expenses of many families are greater than before the war, because flush times led all of us into new purchases. More and better clothing is bought, many and more frequent changes in obedience to the dictates of fashion are made, and many more articles of luxury are purchased than before the war. By the practice of as strict economy in all respects as before the war, the same degree of industry would be better rewarded than it was then.

Who will Can Cream?

A London physician, J. Milner Fothergill, M.D., thinks that we ought to export cream to be eaten with the canned fruit which we send abroad so largely. He says, in a recent letter to the *Herald*:

"It is quite certain that such cream would soon sell freely, and at a price which would be remunerative. What practical difficulties there may be in putting cream into tins, and whether the lactic acid would act upon the tin injuriously, and whether the cream should be prepared after the Devonshire fashion or the ordinary plan, of course I can form no conjecture. But these could soon be overcome I feel sure, and an unlimited supply of cream would not only be a boon to the householder, but would be of service to the medical profession. Cream with stewed fruits would be a very palatable food, much more so than cod liver oil, and could be had all through the winter if prepared in the manner I suggest. For invalids, dyspeptics, and convalescents such a dietary in winter would be most desirable, to say nothing of those who would take it from choice.

"If cream could be so provided, and the practical difficulties overcome, the American farmer would be benefited and the English consumer would be grateful."

A Better Butter-package Wanted.

A correspondent of the Cincinnati *Commercial* maintains that there is a fortune awaiting the man or woman who can devise a neat, cheap, tasteful package which will enable the tidy housewife and the careful dairyman to place before the public their gilt edged butter all redolent with new mown hay, and suggestive of cool springs, shady groves, rich pastures, and peace and plenty among clover blossoms and fragrant shrubs. A package is wanted that will protect the handiwork and pride of the dairymaid from the ruthless, greasy touch of the huckster and grocer's boy. The butter makers want to place their choicest butter in its freshness, sweetness, and fragrance in dainty pats and attractive form, on the table of their customers unsullied by the defiling touch of any middleman. He may be and must be their carrier, but the wants of the business will never be met until a neat, cheap, and tasteful butter-package protects the butter in the transit from the milk house to the table of the consumer.

Particular stress is laid on the appearance of the package, for the imagination of the buyer is first and mainly appealed to through the eye. That organ captured, he tries by the nose, and that not offended, the butter must be tasted. If the first appeal is a captivating success, the butter will sell, though the organs of smell and taste be not so highly pleased. Assuming that the butter itself is good and satisfactory in all respects when packed, the dealer, in selecting his package, will be careful to guard against four things, which will depreciate the butter before it may reach the consumer:

1. Any foreign taste of wood, or gum, or oil.
2. All contact with air.
3. The variations of temperature.
4. Leakage or soakage.

Pure tin will meet these conditions, but it is too costly. Tin-lined wood answers indifferently well. Paper will not do at all. Possibly, however, a case of moulded paper saturated with pure white paraffine, or some other inert, inodorous, clean, and comparatively inexpensive water and acid proof compound, might answer the requirements for the inner package. Of course the external envelope must be stronger to bear exposure and rough handling. Our inventors ought to take this matter in hand.

Platinum in California.

Mr. Edison's call for platinum has developed considerable interest in the search for that metal. According to Prof. Stewart, of Virginia City, Nevada, platinum has been found in Santa Clara county, California, in a seam of talc, incased in hard schistose rock. About two years ago men worked the mine, selling the platinum in San Francisco for $12 or $15 an ounce. They mashed up the talc and separated the crystals of platinum by some simple process. The schistose rock was so hard, however, and the seam of talc so narrow—being only from 12 to 15 inches wide—that the men were compelled to give up the work as unprofitable. But the professor has an idea that by the application of proper instruments the mine might be made to pay. The seam, although narrow where explored, might widen as depth was gained. At any rate, that probability would be in favor of the miners.

It is also stated on the same authority that in Trinity and Humboldt counties, California, in the early days, the gold was so heavily alloyed with drift platinum that the purchasers of gold dust, not knowing the value of platinum, frequently refused to buy the alloy at all. Sometimes the gold would be alloyed to such an extent that it would not fetch more than $3 or $4 an ounce. The presence of platinum joined with the gold of those localities leads Prof. Stewart to think that a body of the mineral might be found there if looked for. No platinum has yet been found in Nevada.

Catching the Bonito.

At the north point at the mouth of the bay (St. Vincent, Cape Verde Islands) was a regular fishing station, where two young Africans were fishing, and where the whole rock was reeking of dead and decaying fish, and a small cave was full of débris, having evidently been made use of by fishermen for many years. The two young negroes at first occupied themselves in catching small fish with a short bamboo rod, baiting with pounded fish, and catching various little rock fish and a scarus. They then began pounding and breaking up the small fish and throwing the largest pieces into the verge of the surf off the point to attract large fish. They watched until they saw a large fish taking these baits on the top of the water, and then they threw a bait on a hook attached to a long cod line. They thus caught a large cavalli (*Caraux*) of the mackerel tribe, which they had to play for some time and finish with a spear. Large garfish (*Belone*) sometimes came within reach and were easily caught, being very ravenous. One fish, a kind of bonito or tunny (*Thynnus argentivittatus*), of about 25 lb. in weight, was attracted by the baits, and coming close in, swam backward and forward in front of the stand on the rock, taking every bait thrown on to the top of the water. The negroes kept feeding the fish for some time to give it confidence. A very strong piece of cord, with a hook like a salmon gaff made fast to it, was then baited with a small bit of fish, just enough to cover the point of the hook, and a stout bamboo was used as a rod. The cord was hitched tight round one end of it, with about a foot of it left dangling with the hook. One negro held the rod and the other the cord. The bait was held just touching the surface of the water. The fish swam up directly and took it. The negro holding the bamboo struck sharply and drove the big hook right through the fish's upper jaw, and both men caught hold of the line and pulled the fish straight out on to the rock. The negroes evidently felt quite certain of their fish directly they saw it swimming backward and forward in front of the rock. I was astonished that so large a fish could be caught in so absurd a manner. The negro holding the pole was not six feet from the fish when it took the bait. —*H. N. Moseley.*

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the U. S. Circuit Court.—Southern District of New York.

STOVE TRADE MARK.—FILLEY *vs.* CHILD.

The plaintiff having acquiesced for a long time in the manufacture and sale by defendant of cooking stoves containing certain improvements patented by plaintiff, and to which the name "Charter Oak" had been applied as a trade mark, and the patent having expired, defendant cannot be prevented from calling such stoves by the name of "Charter Oak," so long as he does not represent them as being made by the plaintiff, or induce others to believe that they are made by the plaintiff.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Pat. Steam Hoisting Mach'y. See Illus. adv., p. 125.

Golden Healing Ointment. See adv., page 141.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2118 Frankford Ave., Phila., Pa.

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American Watches.—A reduced price list of over 100 styles of solid Gold and Silver Watches just issued by a reliable jeweler, which will be mailed free to any address by N H. White, Newark, N. J.

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The American Standard Gauge and Tool Works of Philadelphia has consolidated with the Betts Machine Company of Wilmington, Del. Standard gauges as well as heavy machine tools now in stock.

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Inexhaustible Beds of Kaolin or Clay.—Wanted experienced pottery men to take an interest in the white, pink, and yellow kaolin beds. Digging and shipping on cars will cost 50 cents per ton. M. J. Dobschutz, Belleville, Ill., Agent.

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Wood-working Machinery, Waymouth Lathes. Specialty, Wardwell Patent Saw Bench; it has no equal. Improved Patent Planers, Elevators; Dowel Machines. Rollstone Machine Company, Fitchburg, Mass.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

The new "Otto" Silent Gas Engine is simple in construction, easy of management, and the cheapest motor known for intermittent work. Schleicher, Schumm & Co., Philadelphia, Pa.

Machines for cutting and threading wrought iron pipe a specialty. D. Saunders' Sons, Yonkers, N. Y.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 29.

Wanted.—Responsible party to build and introduce Thomas' Patent Steam Wheel. Monopoly to right party. Write for description and particulars, to J. C. Thomas, Carlinville, Ill.

NEW BOOKS AND PUBLICATIONS.

DIGEST OF SEEDING MACHINES AND IMPLEMENTS PATENTED IN THE UNITED STATES FROM THE YEAR 1800 to January, 1879. Compiled and published by James T. Allen, United States Patent Office, Washington, D. C. Quarto, pp. 1,326. Price $25.

By permission of the Commissioner of Patents, Mr. Allen has made, with great care and labor, a thorough digest of all the American patents on seeding machines and implements granted to the beginning of the current year. It embraces nearly 4,000 patents, the drawings copied by photo-lithography, the claims given in full, and also brief descriptions of the inventions in such cases as seem likely to be of service. To facilitate examinations the patents have been arranged chronologically under the official classification of thirty-four subdivisions, and the whole work is so indexed that the drawing or claim of any patent may be found by name, number, or date. The advantage of such a work to inventors, manufacturers, patent attorneys, and libraries goes without telling.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) R. F. B. asks: 1. What is the relative electro-motive force of the gravity battery as compared with the Smee and Bunsen batteries? A. The electro-motive force of the gravity battery is 1·079 volt; Smee's, when not in action, 1·090 volt; when in action, 0·482 volt; Bunsen's chromic acid, 2·028 volts. 2. Can it be used successfully and economically in electro-plating? A. Yes. 3. How many cells are necessary, and how much zinc surface? A. Use a zinc surface equivalent to the surface to be plated. 4. How often should the zincs be amalgamated in a gravity battery constantly in use? A. The zincs in a gravity battery are never amalgamated. 5. At what temperature (Fah.) should rubber hand stamps be vulcanized, and how long continued in the heat? A. The temperature will vary with the percentage of sulphur incorporated with the rubber. As the rubber is usually prepared it will require at least 2 hours at a temperature of from 250° to 275° Fah. (85 to 100 lb. pressure). See pp. 48 and 105, Vol. 39, SCIENTIFIC AMERICAN.

(2) J. C. W. writes: In answer to query No. 12, in the SCIENTIFIC AMERICAN for May 31, 1879, you suggest that F. R. D. may use weak solution of ammonia for removing logwood stains from the hands. I would respectfully offer the following as more effectual and speedy, and will also answer the purpose of removing nearly all organic colors, not only from the skin, but from most fabrics: Prepare a concentrated solution of sulphite or hyposulphite of soda, by dissolving either of these salts in water to saturation. I think the sulphite preferable, as the hyposulphite deposits sulphur in the course of the process, which is not always to be desired. This solution may be kept ready for use. Label it No. 1. Prepare a solution of permanganate of potassium in water, using one part of the salt to about one hundred parts of water. It does not keep perfectly well; but as long as it is of a deep purple color it is good. Label it No. 2. Next procure a bottle of ordinary or commercial muriatic acid, which label No. 3. In using this acid it may generally be diluted with from one to ten volumes of water, or if the stain is obstinate it may be used without dilution, and beyond the smarting sensation it produces on the hands no harm will result unless it is used excessively and not washed off soon. If the smarting is too severe it should be washed off at once, and a solution or small quantity of dry bicarbonate of sodium (cooking soda) applied to neutralize the acid, thus converting it into a solution of common salt. Having these solutions—namely, No. 1, sulphite of sodium; No. 2, permanganate of potassium; No. 3, muriatic (hydrochloric) acid—they may be used alternately, without much regard to order, except that, as a general rule, No. 3 must be used last, and the process finished with water applied until the acid is washed away. Nos. 1 and 3 are in most cases sufficient; but should No. 2 be required it should be followed by both Nos. 1 and 3, always finishing with water. Silk and woolen goods will not stand long treatment with these chemicals. Cotton and linen seem to be unhurt unless the acid is used strong and suffered to remain in the fabric until it is dry. I have never known the skin to be injured beyond the temporary stinging above mentioned. Ink stains and iron rust will succumb to these agents if properly managed. As a matter of caution they should not be used on such colored goods as are wished to retain their colors. The bleaching agent is what is ordinarily known as sulphurous acid, and will be recognized by the familiar odor of burning sulphur or matches with sulphur tips. This odor escapes from the hands rapidly, and in this respect the process is far preferable to any in which chlorine with its disagreeable and more persistent odor is employed. [We have found the use of such reagents seldom necessary; good soap and plenty of water, aided by a little pumice stone, will remove most stains from the hands. When these fail the substances recommended will often prove serviceable; but a small quantity of common bleaching powder, followed by water and a little antichlore (sodium hyposulphite), to destroy any odor occasioned by the former, will generally prove more effectual. For obstinate iron or ink stains, dilute hydrochloric acid should, of course, be used instead.]

(3) A. B. T. asks (1) why salt is used in freezing ice cream. A. The freezing point of salt water is somewhat lower than that of pure water; hence salt causes the rapid liquefaction of ice. A given quantity of ice in melting absorbs a certain amount of heat, and if the liquefaction is accelerated by salt this amount of heat is absorbed in a space of time proportionately less. 2. What is the process of bronzing any article, such as a gun barrel? A. Mix powdered chloride of antimony to a thin cream with olive oil (by trituration), and add a few drops of nitric acid. Spread this uniformly over the warmed iron, and let it remain until the proper color is developed. The brushing and marking is done with the scratch brush and burnisher. Polish with a piece of smooth, hard wood (polishing wood), lacquer with thin alcoholic shellac, and polish again.

(4) D. D. asks: 1. Will a 12 foot double deck boiler steam better than a 14 foot one? A. We cannot answer this query without seeing the plans of the boiler. 2. What size of smoke stack do I require for a double deck boiler containing 84 4-inch tubes? A. 36 inches diameter, if your tubes are properly proportioned to the grate.

(5) E. J. D. asks for recipe for making tar varnish. I have tried to mix the benzine and tar both hot and cold, but have always failed on account of the tar thickening up and curdling. A. The curdling is due chiefly to the presence of moisture. Heat it in an iron pot to boiling for 7 or 8 hours, add say 10 per cent of boiled oil, and, when nearly cold, reduce with the solvent.

(6) G. L. writes: I have a shed with quite a flat roof, shingled a few years ago with poor shingles, and, of course, leaks. What is the cheapest and best composition to put on it to stop the leaks and make the shingles more durable? A. Such roofs are sometimes coated with melted asphaltum, and, while this is soft, sprinkled thickly with clean gravel. A roof with a pitch of less than 30° should not be shingled.

(7) J. W. T. asks: What liquid is used in ice machines to make the water freeze? A. Ether, sulphurous anhydride, petroleum ether or chymogene, and liquefied ammonia are commonly employed. See "Ice and Ice Making Machines," SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 85 and 91, also SCIENTIFIC AMERICAN, pp. 159 and 387, Vol. 38, and 95, 335 and 168, Vol. 37.

(8) W. M. H. asks: Is a pound of baker's bread as nourishing as a pound of home made? What is the best test to discover whether corn starch intended for food has been adulterated? A. Usually the difference in this respect is not great; in many cases the former is to be preferred. The corn starch found in our markets is usually quite free from adulteration. No single test would suffice to detect the foreign substance which may be present. You would require the assistance of an analyst.

(9) J. R. L. asks: 1. Has granite ware proved safe for cooking utensils? A. Yes, when properly made. 2. Is it likely to be superseded by the new mode of treating iron vessels with superheated steam, noticed lately by you, whereby the liability to rust is obviated? A. Probably not. 3. Is annealed glass ware in the market? If not, why not? Have seen nails driven with a hardened glass chimney; but beyond this know of no ware of hardened glass on sale? A. Yes, but the manufacture is chiefly confined to lamp chimneys and similar articles.

(10) S. V. H. asks: 1. What is the resistance of a line, 1¼ miles long, of No. 16 galvanized iron wire? A. 104 ohms. 2. What and how much wire should I put in each spool of an electro-magnet to produce this same resistance? A. About 500 feet of No. 34. 3. Would not a magnet of still higher resistance work still better on this line with a given battery? A. No, the resistance in your instrument and in the line should be equal. 4. At the end of a line I run a wire underground to a well 30 feet from house, in which well I hang a plate of galvanized iron. Should the underground wire be insulated? A. No. 5. A friend and myself made a thermostat of brass and type metal. On heating, the type metal expands the most apparently, as it forces the bar to bend towards the brass. And yet if I understand aright, brass expands much more than type metal in a given variation of temperature. A. The expansion of type metal by heat is greater than that of brass.

(11) J. H. W. M. asks for a first class receipt for a freezing mixture, something similar to salt and ice, but that will last longer. A. For practical purposes the mixture of salt and ice is the cheapest and best. See p. 107 (17), Vol. 38, SCIENTIFIC AMERICAN.

(12) T. E. C. writes: 1. I send sample of residue found in my boilers which floats upon the water. I should like to ascertain what it is. A. It consists chiefly of silica, silicate of alumina, and lime carbonate, with a small quantity of carbonaceous matters. Much of this would be removed by the use of a feed water heater. 2. Is there any work which treats fully on the use of the steam engine indicator, and what is it called? A. "The Indicator Diagram," by N. P. Burgh.

(13) D. S. S. asks: Could you give the name of anything that will remove the stain in a Brussels carpet made by a purple aniline ink? A. Have you tried alcohol and hot water? It will be difficult to remove the stain completely without injuring the pattern.

(14) M. L. asks (1) for a receipt for making best printer's composition rollers. A. Soak 1 lb. of fine glue in enough cold soft water for 8 hours. Then heat it in a water bath until it is well dissolved, and stir in 1 lb. of hot concentrated glycerine. Molasses is sometimes substituted in part for the glycerine, and resin soap and small quantities of oil and earthy matters are occasionally introduced. The heating must be continued until the greater part of the water has been expelled, when the composition is ready for casting in copper moulds, oiled and warmed. 2. What will remove copying ink stains from the hands? A. Use ammonia water, muriatic acid, and plenty of water alternately, assisted by pumice stone if necessary.

(15) R. E. G. asks: What is the relative strength of steel, iron, brass, and copper wire? A. The following table gives the result of recent experiments made by Mr. David Kirkaldy, of London, to ascertain the tensile strength and resistance to torsion of wire made of various materials:

Specimens of wire tested.	Pulling stress per sq. inch. Hard. Pounds.	Annealed. Pounds.
Copper	63,122	37,002
Brass	81,156	51,550
Charcoal iron	65,834	46,160
Coke iron	64,321	61,294
Steel	120,976	74,637
Phosphor bronze, No. 1	159,515	58,852
" No. 2	151,119	64,569
" No. 3	139,141	54,111
" No. 4	120,900	53,381

Specimens of wire tested.	Ultimate extension in per ct. Annealed.	No. of twists in 5 inches. Hard.	Annealed.
Copper	34·1	86·8	96
Brass	36·5	14·7	57
Charcoal iron	28	48	87
Coke iron	17	26	44
Steel	10·9	*	79
Phosphor bronze No. 1	46·6	13·3	65
" No. 2	42·8	15·8	60
" No. 3	44·9	17·3	53
" No. 4	42·4	13	124

* Of the 8 pieces of steel tested, 3 stood from 40 to 45 twists, and 5 stood from 1¼ to 4 twists.

(16) J. E. L. asks for formula for number of strokes of (1) steam, (2) compressed air, engine when the diameter of cylinder, length of stroke, absolute steam pressure—with valves wide open—are given, the stroke to be horizontal and the friction supposed to be zero. A. There is no formula for length of stroke, of any value, although some are given in published works. By a good engineer the length of stroke is determined by the character of the work to which it is to be applied.

(17) G. P. P. asks: 1. What kind of steel is best for a permanent magnet? A. A low grade of cast steel seems to answer best for this purpose. 2. In what proportion by weight is the powdered carbon and peroxide of manganese used in the porous vase of a Leclanche battery? A. About equal parts. 3. I have the impression that if a current of electricity be passed through chemically prepared paper, the paper will be turned blue; am I right? A. Yes. 4. How is the paper prepared, and what, and in what proportions, are the chemicals used? A. See p. 124 (24), current volume of SCIENTIFIC AMERICAN. 5. Is there any way of charging a Leyden jar directly from a galvanic battery? A. No; an induction coil must be used.

(18) G. D. writes: My friend says his microscope magnifies 300 times. I say mine magnifies 300 diameters. Assuming that these claims are correct, which is the more powerful instrument? A. If your microscope magnifies 300 diameters, it is equivalent to 90,000 times. Superficial magnification equals the square of linear magnification.

(19) W. S. P. asks: 1. What can I use on a marble imposing stone to harden it, so that it will not be so easily scratched? A. We know of no practical method of accomplishing this. 2. Is sulphur water injurious to steam boilers? A. Yes.

(20) J. K. T. writes: Please give botanical name of plant and commercial name of substance sold as "Persian insect powder"—I mean the powder used for destroying insects, etc. A. So-called "Persian insect powder consists of the dried and powdered flowers of certain species of *Pyrethrum—Pyrethrum carneum*, *P. roseum*, and *Pelecarpha foliun*. The last named is usually distinguished from the others commercially as Dalmatian powder, and is much more energetic than the others.

(21) M. A. M. writes: I wish to know where I am wrong in making the Japan ink after receipt in the SUPPLEMENT, No. 157? I have followed the receipt, but after using it awhile it will corrode the pen and will not flow freely. A. Use more borax or add a small quantity of soda. 2. What is soluble Prussian blue? A. Soluble Prussian blue is a commercial article and is used for laundry blue.

(22) R. B. asks: How long will a box made of galvanized iron, No. 18 gauge, filled with calcined plaster of Paris in liquid state, remain free from rust holes, or show signs of weakness—it of course being understood the box will have a tight cover on, and the plaster of Paris have the usual amount of sulphuric acid and lime in it? A. Soft water and ordinary plaster will have very little action on the metal. If sealed it would last indefinitely.

(23) H. T. S. asks: Do you know of any solution, acid, or composition, that will remove leading from a gun barrel without injuring the barrel? How can I remove rust from the inside of a gun barrel? A. The lead cannot be removed by chemical means. Gun makers usually supply a tool for mechanically cleaning the bore. The rust may be removed by means of emery flour and oil applied on a cloth wound on this tool.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Eclipse Portable Engine. See illustrated adv., p. 126.

Eagle Anvils, 9 cents per pound. Fully warranted.

Bradley's cushioned helve hammers. See illus. ad. p. 142.

Band Saws a specialty. F. H. Clement, Rochester, N.Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Ornamental Penman's Pocketbook of Alphabets. 32 plates, 30c. Mail free. E. & F. N. Spon, 446 Broome St., N. Y.

New 8½ foot Boring and Turning Mill for sale cheap. A first class tool. Hilles & Jones, Wilmington, Del.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Best Turkey Emery in bbls., kegs, and cases. Special rates for large quantities. Greene, Tweed & Co., N. Y.

Shafting, Pulleys, and Hangers. Nadig & Bro., Allentown, Pa.

$250 Horizontal Engine, 20 horse power. See illustrated advertisement, page 61.

For Sale.—Very low for cash, Engine Lathe, in good order, made by New Haven Mfg. Co. 30 inches swing; will turn 13 feet. Apply to Noble & Hall, Erie, Pa.

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

D. A. R.—Chiefly an amethystine-quartz sand, of little value.—J. G. N.—It consists chiefly of feldspar and biotite, a variety of mica. Not valuable.

COMMUNICATIONS RECEIVED.

On Optical Delusion. By S. E. C., C. W. B.
On the Optical Delusion. By J. P. McD.
On Traveling Rocks. By N. P. S.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

July 22, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Animal clamping hook, J. Robertson 217,747
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Chewing and smoking tobacco and cigars, J. M. Bobbitt 7,538
Cigars, Oliver & Robinson 7,544
Cigars, cigarettes, and smoking tobacco, M. Jacoby & Co 7,526
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Sheetings, shirtings, cambrics, prints, and cloths, W. H. Oakley, Jr. 7,536
Soap, J. H. Friday 7,521
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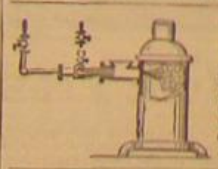

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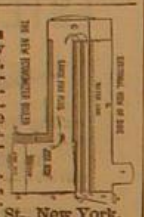

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THE BELGIAN SYSTEM OF CANAL TOWING.

There are now navigating the canals of this State over five thousand boats, which are kept in motion by either steam or animal power; by far the greater proportion are propelled by animals. Whether the power is economically applied or not is a matter of great importance, as the quantity of freight that is moved on these artificial waters is immense.

The reward offered by the State in 1871, for an economical system of canal propulsion, has been the means of directing the attention of inventors to this subject, and improvements of more or less merit have been developed; but the hoped-for new system, if we may judge from the continued employment of animals, has not been adopted if it really exists.

The Belgian system itself is not new, it having been employed in Europe for more than 18 years, and long before that, boats were hauled by means of submerged chains. The modern improvements, which render the system and machinery complete, consist in the substitution of wire rope for the ponderous and more expensive chain, and a clip drum or driving wheel for the ordinary indented windlass. This system has been adopted by the New York Steam Cable Towing Company, who have for several years towed boats on this plan from Buffalo, N. Y , to Lockport, proving not only the economy of the system, but its perfect adaptability to canals, and especially to the Erie Canal. Meantime they have perfected the mechanism of their boats. The State has granted to them 50 years' exclusive privilege of laying cables in the Erie Canal between Buffalo and Albany for this purpose, and the cables will be laid as far as Rochester this season.

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The tow boat, which is shown in Fig. 2, is 78 feet 6 inches long, 16 feet broad, and draws, when loaded with coal, 5 feet of water. It has a rudder at each end, the one at the bow being always locked, as in the case of our New York ferry boats. The boat carries a screw at one end, 4 feet in diameter and 7 feet pitch, which is used merely to propel the boat through the locks. Upon one side of the boat are three wheels, each 6 feet in diameter, the center one, as shown in Fig. 3, carrying around its periphery clips, which grasp the cable tightly as it passes over the top of the wheel. This wheel is secured to a 6 inch shaft, which is about on a level with the deck; the shaft receives its power from the engine shaft through a train of gearing which causes it to make about one revolution to eight of the engine. The wheels at the sides of the clip wheel are simply tighteners, to hold the cable down to the clip wheel. They are supported on studs projecting from blocks which slide in the inclined ways, and are moved by screws passing through the blocks. The cable is taken up by two sheaves, like that shown in Fig. 4, placed one near each end, as shown in Fig. 2.

The engine is an inverted vertical of the plain, substantial style usually built at the Pound Mfg. Co.'s Works in Lock-

[*Continued on page* 146.]

THE BELGIAN SYSTEM OF CABLE TOWING.—THE LOCKS AT LOCKPORT, N. Y.

Scientific American.

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VOL. XLI., No. 10. [NEW SERIES.] *Thirty-fifth Year.*

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INTELLIGENT WORKMEN NEEDED.

Notice was taken in a recent issue of this paper of the experience of a large shoe manufacturer of this State, who advertised in Boston and New York for twenty-five shoe fitters to work in his factory, offering full current rates and steady work. The advertisement brought one application.

About the same time a Boston firm advertised for a book-keeper, and the next day's mail brought three hundred and forty-seven answers.

During the same month an advertisement for a clerk, in a Detroit paper, brought one hundred and thirty applications the first day, and a greater number of letters and personal applications the next day.

An advertisement for a week in the same city, calling for a good carpenter, brought only four replies.

It is altogether probable that in any considerable city in the land, an advertisement for a book-keeper or retail clerk will bring fifty times as many replies as an advertisement for a fair workman in any trade.

It is also probable that in any and every city the average earnings of clerks are nowhere near so large as the earnings of workmen of average skill in the various trades.

Further, it is fairly certain that, with equal capacity, industry, and thrift, the young man who learns any trade will achieve a reasonable competence sooner than the young man who sticks to clerking; while the chances for materially improving one's condition are more numerous in the trades than behind the counter or at the desk.

Why is it, then, that the boys all want to be clerks? Why is it that intelligent parents encourage them in looking for a chance to "get into business," and in looking down on mechanical employments—as though there could be any calling more wretchedly mechanical than average clerking? Why is it that teachers almost invariably train their pupils to "look above" mechanical pursuits?

What the country wants now is workmen—intelligent, industrious, thrifty workmen; men who can do skillfully the work that waits for the doing—who can invent new means and better processes for developing the crude resources of the land, and for converting brute matter into life sustaining and life-enriching wealth. Mere clerks and record keepers are at a discount. There are too many of them. And the professions, so called, are almost equally crowded with men who have nothing to do. There never was a time when ability to do something real and practical was worth so much as now. Yet our young men swarm after clerkships. Why is it?

HYDROPHOBIA SUCCESSFULLY TREATED WITH CURARE.

The *Medical Record* of Aug. 9 gives a detailed report of a case of hydrophobia successfully treated with curare, by Dr. Ad. Offenberg, of Wickrath, Rhenish Prussia.

The subject was a servant girl, 24 years of age, who was bit in the heel by a rabid Spitz dog, July 28, 1874. Two days after the wound was cauterized by means of a concentrated solution of caustic potash, and shortly after the girl underwent a course of treatment for hydrophobia. Subsequently, for three months or more, the wound was kept suppurating under the direction of a local physician. Seeing that the case was not receiving proper treatment, the pastor of the place brought about the transfer of the patient to a hospital, where she was received October 8. At that time the wound, on the outside of the left foot, extending from the tendo Achillis over the dorsum, presented a reddish granulating surface about the size of the palm of the hand. Under a simple dressing the granulating surface became much smaller, and until October 16 no change was observed in the patient's health and temper. Symptoms of rabies appeared that evening, and by 10:45 P.M. were pronounced and decided. Curare was then injected under the skin, and the dose was repeated several times during the night, with favorable effects. The last convulsion occurred at twenty-three minutes past four in the morning.

The details of the case would be out of place here; suffice it to say that the patient slowly recovered health and strength, isolated convulsive movements of slight severity occurring at intervals until the 24th, while impaired vision and oversensitiveness of the eyes to light continued still longer. On Dec. 3, the wound on the foot being completely cicatrized, and the patient's general health being good, she was allowed to return to her home. By January, 1875, she was able to resume her duties as servant, though her original health and strength were not restored for more than a year.

The case seems to have been one of genuine hydrophobia, notwithstanding the fact of recovery. The circumstance, however, that the patient attended a hydrophobic neighbor (who was bit by a rabid dog a few days before she was, and died of the disease), witnessing his convulsions and other symptoms, makes her case possibly one of simulation.

EARLY ADVOCATES OF SHIP RAILWAYS.

Since prominence has been given to Capt. Eads' suggestion for a ship railway across the Isthmus of Panama, there have arisen quite a number of claimants to the credit of first proposing this solution to the great problem. Thus far we have seen none antedating the plan illustrated in the first volume of the SCIENTIFIC AMERICAN; and no one seems to have taken the matter more to heart than the late Horace Day, for he went so far as to take out patents for his devices in this connection.

Before that time, however, the project of transporting ships by railways had been enthusiastically advocated by Mr. Philip C. Friese, in "An Essay on Party," published in this city as early as 1856, and copyrighted the year before. While discussing the competence of the general government to undertake investigations and experiments of a scientific and useful character, for the furtherance of national prosperity, Mr. Friese observed that water conveyances had been increased in size, through many increments, from the slight canoe to the vast steam ship, while land carriages had made no such progress. At that time the rail-car in use was but a small remove from the common road wagon. The American rail-car now shows a considerable increase in carrying capacity, yet the gain in no way approaches that made in shipping.

From this point of view Mr. Friese asked: "Why do we not construct rail-cars as broad and capacious as steamships? Why do we not dip up steamships from a river or ocean, place them in a rail-car, and whirl them overland to another river or ocean? Is it not pitiful that the swift and magnificent vehicles which convey our citizens and our commerce over the stormy deep, and which bear within them the power to scale the lofty mountains and skim the wide plains of our continent, should be checked in their proud career by a narrow isthmus? Why shall not the same power which turns a paddle-wheel through the water be made, by an easy mechanical contrivance, to turn a driving-wheel on a rail? The same power will be immensely more efficient on a rail than on the water, from the fact that friction on a rail is much less than on the water at the same speed, especially at a high rate of speed. Steamships themselves might form the bodies of cars, when placed in a frame, or cradle, over suitable running gear. If the track be made wide enough, cars may be converted into rolling hotels, two or more stories high, and may contain the chambers, parlors, dining-rooms, and other conveniences of steamships, if not of stationary public houses. The great law of economy, in regard to time and power, and fuel and labor, demands the establishment of broad roads, suitable for ships, and for large cars on the principal thoroughfares, say, on the isthmus routes of Panama, Tehuantepec, and Nicaragua, and on the trunk, if not on the branches of the great road which must connect the Atlantic with the Pacific, across the center of our continent. So the Isthmus of Suez may be overcome by a ship railroad. Unless unusual physical obstacles intervene, ship railroads may connect the Black Sea and the Caspian, and perhaps even the Aral, and this with the river Yang Tse Kiang. There would be as much comparative saving of time and power and labor by the employment of large cars instead of small ones, as there is in the employment of ships instead of canoes. Large cars could be driven with safety at a rate of speed not attainable by small ones. If the cars be adapted to steamships, these can leave the Atlantic ports, either going east or west overland, and arrive in the East Indies in a few days, without breaking bulk. For such a road, rivers, lakes, and inland seas would serve as switches and depots."

It is needless to follow Mr. Friese in his remarks concerning the military and naval advantages of ship railways, or to criticise his sweeping indifference to geographical obstructions. Practical railway men will probably laugh now, as they did a quarter of a century ago, at the idea of increasing the economy of ordinary transportation by largely increasing the size of cars; yet it is quite possible that for short portages, to avoid long voyages, ship railways may be more easily constructed and more economically than ship canals; in which case Mr. Friese is obviously entitled to his share of credit for early appreciating their advantages. That the idea of such a means of transportation was original with him is not for a moment to be supposed. The same may be said of Mr. N. W. Evans, who also claims priority in the invention, though he first suggested it in 1854, some ten years after the project had been illustrated in the SCIENTIFIC AMERICAN. Mr. Charles W. S. Heaton, who also puts in a claim, is fully twenty years behind, his proposition having been made as late as "1864, or early in 1865."

AMERICAN VINES IN FRANCE.

A notable illustration of the balance between animal and vegetable life under natural conditions is furnished by the power of American vines to withstand the attacks of phylloxera. For unnumbered ages the conflict between the plant and the insect has been going on in this country, the result being the survival of those species of the grape capable of enduring the attacks of the parasite. This power of resistance has been found to reside in the rapid lignifying of the roots of the American grapes, so that the punctures of the phylloxera are comparatively harmless. They affect the outer bark only, causing little excrescences which fall off like warts. European vines, on the other hand, have not been subject to such invasions (until recently), and are entirely unable to cope with the pest. When pierced by the insect the tender roots decay, and the entire plant perishes. The consequence is that having once been introduced in Europe, as it was about twenty years ago, the phylloxera meets with no resistance, and the indications are that nothing short of the extermination of all European vines will stay its destroying progress.

Our readers are familiar with the decision of the French Commissioners in favor of the substitution of the native grape stocks by those of American origin, as set forth in their official report, translated for the issue of the SCIENTIFIC AMERICAN, dated August 2. Our American Consul at La Rochelle, Mr. George L. Catlin, now writes that the prefect of that department has taken steps to establish there a monster nursery of American grapes (notably the Jacquez

and Herbemont) to afford the French vine growers, whose vineyards have been ravaged by the phylloxera, an opportunity to re-establish them with resisting stocks. Already the prefect has had planted in a vineyard of his own 42,000 American shoots; and Mr. Catlin anticipates a very large demand for American vines throughout France.

READING AT SEVEN AND A HALF MILES DISTANCE FROM THE CANDLE.

On the evening of July 12, the Maxim electric light was put in operation on the tower of the Grand Union Hotel, Saratoga Springs, N. Y., with a view to test the extent of its illuminating powers. An open parabolic reflector was used—no lenses—and care was taken by Mr. Maxim to set the points of the carbons a little at one side of each other, and to adjust them to the exact focus of the reflector. When this was fairly accomplished the light was turned toward a spot in Ballston Spa, New York, 7½ miles distant, where, by previous arrangement, a group of several hundred persons were assembled to witness the experiment. So powerful was the light, so accurate the focusing and alignment, that the designated place in Ballston was instantly illuminated, so that ordinary print could be read, the time seen on watches, etc. The night was clear, still, and dark. The experiment was made at 9½ o'clock P. M. This is believed to be the greatest distance at which illumination of equal degree has been accomplished. We are indebted to Mr. H. S. Maxim for the above particulars.

A COVERING WANTED FOR COTTON BALES.

Among the matters of general interest brought forward at the recent convention of the National Cotton Exchange in this city, one ought to be of special interest to inventors. Speaking of the proposed reform in selling cotton, namely by net weight, President Lafitte said that it would be to the interest of planters not to have any allowance made for bagging. The cheap bagging now used is a poor protection to the cotton, and would soon be superseded under the new rule. In his own words: "If cotton were sold by net weight, some inventive genius would, in a few years, introduce good non-inflammable light material," for covering the bales, thus saving much waste, damage, extra freightage, and so on. The problem does not appear to be a very difficult one, and its solution would pay well. The disadvantages attending the use of unrotted flax bagging was particularly noted. The texture is rough and open, affording an insufficient covering, and allowing the cotton to deteriorate in value, while the expenses for mending the bales were considerably increased. Mr. John G. Dale, agent of the British and Foreign Marine Insurance Company, said that his company had sustained heavy losses from the use of such bagging, and had been obliged to make large deductions from claims by way of protest.

Mr. Trenholm estimated the cotton crop of this year at 5,250,000 bales. If they were placed together in one long string they would measure about 4,500 miles, and stretch from New Orleans to New York, and thence across the Atlantic Ocean. Every linear foot would represent 100 lb. of cotton. With regard to the prospects of the future, Mr. Trenholm said that now but one bale of cotton was produced to 2 4-10 acres of land, but it was possible, by proper management, as experience had demonstrated, to raise one bale to every acre. He believed that ultimately our crop would be 12,500,000 bales.

In view of these figures it is needless to urge the importance of the invention called for. Our wide awake inventors should see that the want is met promptly.

A SINGULAR MEMORY.

Marvelous stories are told of the curious memory of D. P. Hicks, a Rochester youth, associated with a not less curious faculty for distinguishing sounds. He spent his earlier years in Buffalo, N. Y., where he became known to railway men for his singular knowledge of locomotive bells and numbers.

A short time ago he removed to Rochester, where he is employed at a distance from the railway so great that he rarely hears a passing train. Yet he is able to give the numbers of nearly three hundred locomotives on hearing their bells. The engines that run in the night he names with unerring accuracy, as his house is situated near the track and the bells are heard very plainly. Railroad men state that this is the only case of the kind they ever knew. Old and experienced engineers, switchmen, and those whose work bring them within the hearing of a large number of engine bells, say that at the most they can learn to know only a very few compared to the great number Mr. Hicks can name readily, almost without thought. He can not only give the numbers of several hundred, but in cases where locomotives have been remodeled and renumbered, he can give the old number as well as the new one. He says there are six locomotives familiar to him, the bells of which are keyed in pairs. These six locomotives are the only ones, to his knowledge, in the old class, which have the same key. The new locomotives, that is, those the numbers of which are above 500, are all keyed nearly alike.

The Rochester *Democrat and Chronicle* relates that not long ago an old switch engine, used in the yard at Buffalo, was sent to Rochester for some special purpose. As it passed Dean street Mr. Hicks heard the bell and remarked that the engine was of a certain number, and that he had not heard its bell for six years. A boarder in the house, anxious to test the case, ran to the track and found that Mr. Hicks was correct. Not long since the young man went to Syracuse on business. He heard an engine coming out of the round house, and remarked to a friend that he knew the bell, although he had not heard it in five years. When the engine came into view the number given was found to be correct.

This faculty, it is said, has been tested hundreds of times, and a mistake is rarely made.

FOUR HOURS IN THE DARK.

It is a humiliating confession to make—but geography is pitiless, and our national vainglory must bow to its decrees—that for four hours in every twenty-four the entire territory of the United States is deprived of sunshine. As the sun goes down on our farthest Aleutian island its morning rays are just lighting up the hill tops of the western coast of Ireland, and the breadth of the Atlantic lies between us and daylight. To our Fenian citizens this may be another and cogent reason for annexing the dear little isle of the harp and the shamrock; but until it is done the exultant cry of the *Rocky Mountain Presbyterian*, that the sun never sets on the United States, must be admitted to be a trifle exaggerated. It does set every day, and, paradoxically, four hours before it rises.

In the depth of our humiliation we may possibly console ourselves with the reflection that—though our British cousins can say with truth what we cannot—the sun really shines on the United States when it is up. We have to submit to four hours of sunlessness a day: England is lucky to get four hours of sunshine. So life has its compensations, and existence in the United States remains endurable, though we do not (geographically speaking) make quite so great a spread as we thought.

The New Eddystone Lighthouse.

The foundation stone of the new Eddystone Lighthouse was laid, August 19, by the Duke of Edinburgh. The formal commencement of the structure on the 21st of June, as first proposed, was prevented by the roughness of the sea. On the day of the final celebration the weather was rainy, but the water was sufficiently smooth to permit the carrying out of the programme.

The Eddystone rocks are situated in the English Channel, 14 miles southwest of the port of Plymouth and 12½ from Rame Head. They are almost in the line which joins the Start and Lizard points, and in the fair way of all vessels coasting the southern shore of England. So exposed are they to the ocean swell from the south and west that even in comparatively calm weather the waves go raging and thundering over their ledges, and their name indicates the incessant swirl of the deep about them.

The new lighthouse will stand 127 feet from the present tower on the South Reef, a rock which the House Rock protects from the southwest, but which has the disadvantage of being much lower, its highest part being never uncovered before half tide, while the lowest parts, on which most of the foundation rests, are 4 feet beneath the low water level of an ordinary spring tide.

Most of the work done thus far has had to be done under water, and owing to the force of the waves the work could be carried on only at brief and specially favorable intervals. It is expected that the high water level will be reached early next year, when the work will proceed more rapidly, as the courses of stone are all accurately fitted together on shore. It is thought that it will take five years to complete the lighthouse, which is to follow generally the lines of the present one, though it will differ from it slightly in form and considerably in size. To a height of 25½ feet above high water mark the tower will be solid, with the exception of a space for a water tank. The side walls beginning at this level will be 8½ feet thick, diminishing to 2¼ feet at the top. Nothing but granite will be used, and the blocks will be large enough to form the entire thickness of the hollow portion of the tower. Under the cornice, to the top of which it is 138 feet from the rock, the diameter of the tower will be 18½ feet; it will contain nine rooms, besides the lantern, each being 10 feet high and the seven uppermost ones 14 feet in diameter. The focal plane of the new lighthouse will be 130 feet above high water, as compared with 72 feet in the present building, and the actual useful range of the light will thus be extended from 14 to 17½ nautical miles. About 5,100 tons of granite will be employed in the construction, and 50 tons of iron for door casings and the like. The fog-bell, erected in 1872, will be replaced by a powerful siren and the electric light probably be used. The estimated cost of the entire work is between $300,000 and $350,000. A large engraving of the Old Light house, with a view of the foundation of the new structure, is given in the SCIENTIFIC AMERICAN SUPPLEMENT, for August 23.

American Dental Convention.

The twenty-fifth annual session of the American Dental Convention was held in Saratoga, August 12. The attendance was small. The relative merits of gold, amalgam, and other plastic fillings for teeth, were discussed, the prevailing opinion being in favor of the first named, and against the "new departure," so called, in the direction of substitutes for gold fillings.

The Oldest Scientific Lecturer.

M. Chevreul, now in his 93d year, began his usual course of lectures on organic chemistry at the Museum of Natural History, Paris, on June 10.

A New Fluorescent Body.

According to the *Journal of the Chemical Society*, C. O. Harz has discovered a new fluorescent body in *spergulin*. This product occurs in the seed-coverings of the caryophyllaceous plants, *Spergula vulgaris* and *S. maxima* (Anglice "Spurrey"). It is produced at the time when the seeds blacken and are nearly ripe. Spergulin is very soluble in absolute and aqueous alcohol. Viewed by transmitted light the solution appears nearly colorless, with a shade of olive-green; by reflected light it exhibits a dark-blue fluorescence. It has not yet been obtained in the form of crystals. It is very soluble in methylic alcohol, less so in amylic alcohol, and scarcely soluble in ether or petroleum. Concentrated sulphuric acid dissolves it, forming a dark-blue liquid. The fluorescence of an alcoholic solution of spergulin is maintained for more than a year if the liquid be kept in darkness, but is rapidly destroyed by the action of direct sunlight, and more slowly by that of diffused light. Small quantities of caustic alkalies, or alkaline carbonates, added to an alcoholic solution of spergulin, transform it into an emerald-green fluorescent body; and basic lead acetate produces a precipitate. The new compound contains 61·85 per cent of carbon, 7·05 of hydrogen, and 31·8 of oxygen. It appears to be related to chlorophyl, and is probably closely allied to phyllocyanin. An alcoholic solution of the product showed strong absorption, almost entirely in the violet; and in this respect differs considerably from chlorophyl, phyllocyanin, and phylloxanthin. Mr. Harz is disposed to regard spergulin as a feeble acid, the acid salts of which, as well as the acid itself, exhibit blue fluorescence, the neutral salts exhibit green fluorescence, and the basic salts are destitute of fluorescent properties.

The Railroads of the United States.

The twelfth annual number of Poor's Manual of Railroads of the United States is unprecedentedly full of information, owing to the more detailed statements furnished by the companies and the reports of State departments for the general oversight of railroads. For the first time for several years the introductory article is able to record a very decided recovery of the railway interests of the country from their recent depressed condition. The total mileage in operation at the close of the year was 81,841 miles, 2,694 miles of new line having been opened during the year.

The construction of railways has been entered upon with renewed energy and activity, and it is predicted that construction will proceed rapidly until the mileage is more than double what it is now. In the five years since 1873 there have been constructed in the United States 11,563 miles of railway. A remarkable feature in the railroad operations of the country for several years past has been the enormously increased tonnage in the face of a large falling off of earnings. The decline in earnings has been due to very great reductions in charges for transportation. Within the last decade the tonnage traffic of our railroads longest in operation has been fully doubled, while there has been only an inconsiderable increase in earnings from this source. Since 1873, the year in which the earnings of our railroads reached their maximum, the increase of their tonnage has equaled 50 per cent, although the period has been one of unexampled business depression. At the very time at which there has been the greatest complaint of hard times, the movement of merchandise has steadily and largely increased.

The gross earnings of all the roads whose operations have been reported, have equaled $490,103,361, against $472,909,272 for 1877, $497,257,959 for 1876, and $503,065,505 for 1875.

Sydney Exhibition.

The last number of the *Illustrated Sydney News* received at this office represents, by a number of well executed wood engravings, the progress of the Sydney Exhibition, showing the arrival and placing of exhibits from all countries, and exhibiting that same degree of hurly-burly activity which was witnessed just before the opening of our Centennial show, and which prevailed just before the opening of the French Exhibition last year.

From these illustrations and the statements of the newspapers of that far-away colony, the success of the Exhibition would seem to be secured. Now for the New York World's Fair in 1883. Are we to have it? If so, it is time steps were taken to select a site, and some announcement made of what the committee intend doing.

Professor Archibald Geikie.

Professor Geikie, the accomplished chief of the Geological Survey of Scotland, recently passed through this city on his way to the West. His purpose was to go first to Ogden, then, after visiting Salt Lake, to study the Wahsatch and Uintah mountains and the ancient lake basins of that region. On his return to the East, Prof. Geikie will deliver a course of lectures on "Geographical Evolution" at the Lowell Institute.

The California Big Ferry Boat.

We are indebted to Dr. Edward Gray, M.D., for some additional particulars concerning this vessel, the Solano, recently noticed in our paper. Her length is 425 feet; breadth, 115 feet; built at Oakland, where she is now receiving her finishing touches. The vessel is to ply on the Straits of Carquinez, between the railway station of that name and Benicia, and not on San Francisco bay as stated.

THE BELGIAN SYSTEM OF CANAL TOWING.

[*Continued from first page.*]

port. It is 14 inch bore and 16 inch stroke. The boiler—of the locomotive style—has a 5 foot shell, and is 14 feet long.

The screw receives its motion through clutch gearing, shown in Fig. 5. The miter wheels on the engine shaft are loose. The clutch slides on a feather, so that when it is brought into engagement with either wheel it will carry it, and consequently drive the wheel on the screw shaft. This mode of gearing is found to answer the purpose as the screw is seldom used.

The boats are calculated for towing from four to five canal boats at a speed of three miles per hour. The method of making up and towing a train of boats is shown in the front page engraving. The machinery for these boats is built by the Pound Manufacturing Co., of Lockport, N. Y. The boats are built by H. Benedict & Co., of Lockport. Ten of these boats have already been built; fifteen more are to be completed next winter The company intend to build eighty in all.

Our large engraving not only gives an excellent idea of the Belgian system of towing, but it also shows the locks of Lockport, where the boats are raised and lowered 60 feet The difference in the two water levels affords the city of Lockport one of the finest water privileges in the world. Clustered around the locks and along the course of a race on the left bank are factories which are driven by water from the upper canal level. Beyond the bank on the left and in the hollow just out of sight in our view are the Pound Works. The large buildings on the right of the locks are the Holly Works, of which we have several times made mention. At the foot of the locks is a small building containing the pumps that supply Lockport with water for extinguishing fires and all other purposes, except cooking and drinking.

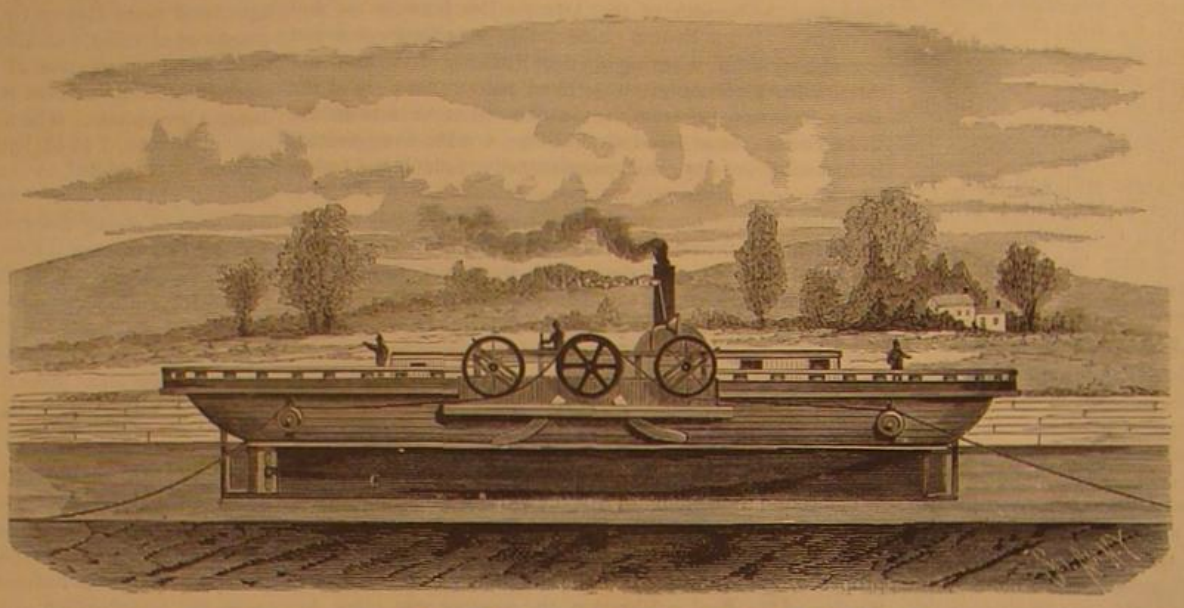
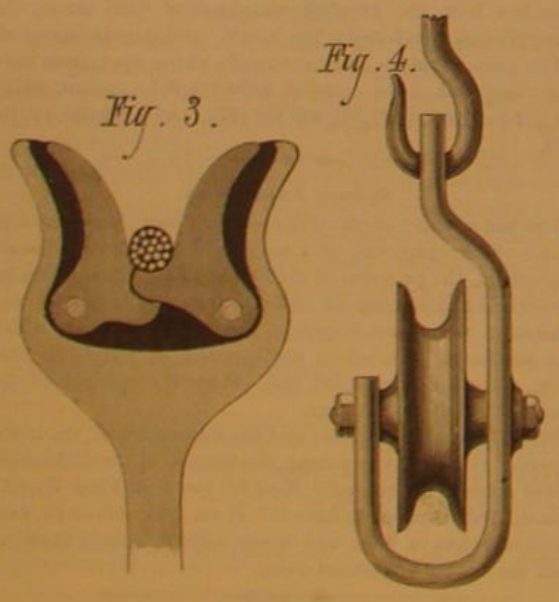


Fig. 2.—SIDE ELEVATION OF CABLE TOW BOAT.

There is another matter of engineering interest connected with the spot shown in the engraving, namely, the transmission of power by means of wire cables. There is probably not another place in the country where this method of transmitting power is employed to such an extent as within the area covered by our engraving. A 30 inch turbine at the Pound Works distributes power through five cables to manufacturers of various kinds upon and beyond the embankment. The Richmond Works, on the extreme right of the engraving, supply power through two cables that run across the gully, one being 2,100 feet long, the other 1,600 feet; also through other cables to five other establishments upon and beyond the right bank. A 40 inch turbine under a 65 foot head supplies the power. One of these cables, 1,100 feet long, runs around corners and is supported upon poles. About 20,000 feet of cable are kept in motion by these two turbines.



CLIP IN DRIVE WHEEL. TAKE-UP SHEAVE.

MISCELLANEOUS INVENTIONS.

Mr. George H. Hutton, of Boonsborough, Md., has patented an improvement in jump-seats for vehicles, which consists of a stop or locking device for supporting the pivoted or shifting seats of vehicles and holding them firmly when elevated, so that they will have no swaying or lateral movement.

A seal and a lock for doors of freight cars, and also stationary structures, have been patented by Mr. John T. Kilham, of Harper's Ferry, W. Va. It is so constructed that when the seal or plate containing the seal proper is duly attached it prevents the lock bolt which secures the hasp from being withdrawn, and hence the door cannot be opened. When the seal plate is broken the lock bolt is released, and by proper manipulation can be withdrawn from the lock, thus in turn releasing the hasp and allowing the door to be opened.

An improved fire extinguishing attachment for buildings, which is so constructed that water may be thrown over all parts of the buildings, inside and outside, to prevent them from taking fire from a contiguous burning building, and to extinguish the fire if it has already started, has been patented by Mr. Edward M. Whyler, of Hays City, Kan.

An improvement in gates, patented by Mr. Moses Derby, of Pepin, Wis., consists in certain novel features of construction, whereby the gate is adapted for swinging in either direction, and may be raised to clear obstructions.

Mr. Marshall McDonald, of Lexington, Va., has patented an improved fishway, in which is utilized the velocity or pressure of the head of water at the dam by directing the head of water through a series of openings on an incline, the openings being arranged to discharge upwardly, so that an initial upward current on the incline is produced, which enables the fish to ascend the incline.

A lamp top or burner, having a socket in its upper portion and a detachable mouthpiece or tip provided with a tenon or reduced portion which fits therein, has been patented by Mr. William C. McCormack, of Stanford, Ky.

An improved check for oil wells has been patented by Mr. Jasper Neath, of Shamburg, Pa. It consists in an external packing device applied in connection with the usual packing devices, or at one of the lower joints in the tubing, to prevent any flow of oil through the tubing, so that when sufficient pressure has accumulated to cause a flow the oil will pass outside the tubing by the casing to the tanks.

Mr. Griffith B. Thomas, of Point Pleasant, West Va., has invented an improvement in iron roofing, which consists in forming the joints between the sheets by crimping the edge of one over the turned up edge of the adjoining sheet the whole length, and then fastening them by clips of tin.

Mr. Benjamin F. Wood, of New Haven, Conn., has invented an improved frame for drying lace curtains under tension. It is simple in construction, and will hold the curtains under a uniform tension while drying. When not required for use it can be folded into compact form for storage or transportation.

Mr. Paul H. Seager, of Manteno, Ill., has patented an improvement in stovepipes, which consists of a section of pipe unriveted at the lower end so that its diameter at this end can be increased and diminished at pleasure by means of a lever pivoted to the pipe on one side and connected by a strap with the other side. By moving the lever back and forth the pipe is contracted and expanded, and secured in any desired position by a pawl engaging a ratchet guard over the lever.

An improvement in flour bolts has been patented by Mr. Josiah J. Zinn, of Union City, Pa. The object of this invention is to construct the reels so that a smoother surface will be given to the bolting cloth, for the purpose of permitting a sliding motion of the meal when it is in operation, and thus enable the flour to be bolted more evenly and cleanly than is now done.

Mr. Rienza A. Goldsmith, of Washingtonville, N. Y., has invented an improvement in thill couplings, which consists in forming upon the head of a coupling bolt a plate with a hole through which the cam bolt passes, so that the coupling bolt may be secured by the nut that holds the cam bolt.

A composition for water filters, formed of clay, sand, wood sawdust, pulverized pumice stone, and English calcimine, mixed together in about equal quantities, with sufficient water to reduce the mixture to a plastic state, has been patented by Mr. Jean B. Ader, Aîné, of New Orleans, La.

An improved flood gate, which is so constructed as to swing open as the water rises and swing shut as the water falls, which will prevent trash from lodging about its hinges, and may be readily adjusted to the height of the water at different seasons of the year, has been patented by Mr. William B. Akers, of Little River, Va.

Mr. John Ames, Jr., of New York city, has patented an improvement in making brushes. The invention consists in a knot formed by dipping the loose butts of the bristles into melted pitch, glue, or cement, and inserting them in a form, where they are allowed to cool or harden.

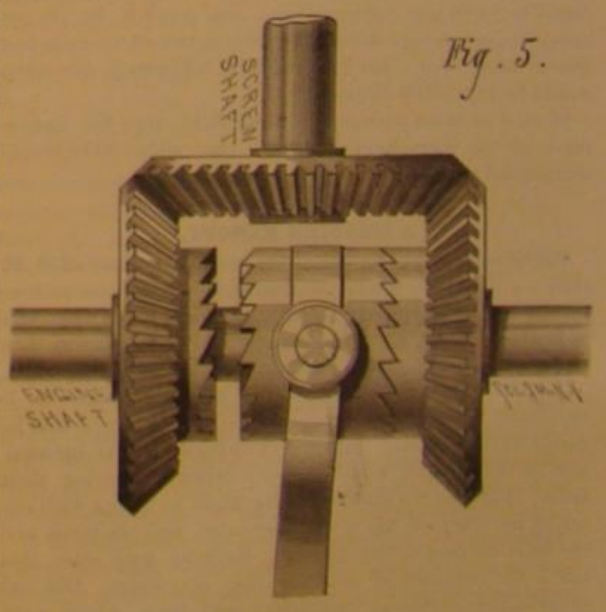
Mr. Louis A. Bringier, of Ascension Parish, La., has patented an improvement in back-bands for plow harnesses. It consists in a connecting device of peculiar form for holding the traces and preventing their detachment.

An improvement in the class of foot-rests which are composed of two plates or thin boards hinged together, so that when the device is in use one of the plates will be at right angles to the other, but when not in use one plate may be folded flat upon the other, is the invention of Mr. Henry Jungmann, of Madison, Wis.

Mr. Maximilian C. F. Nitze, of Dresden, Saxony, has patented an improvement in application of electric light to a speculum. The object of the invention is to provide a means for direct illumination and examination of internal parts or cavities of the body, as the urethra, the bladder, the larynx, the esophagus, the stomach, the uterus, the outer auditory passage. This method, and the instruments constructed according to this method, afford the possibility of introducing the source of light into the internal parts or cavities themselves for examining the part directly, or its reflected image. Lenses or lens systems for enlarging the field of view may be employed in combination with his instruments. The source of light employed in these instruments consists in a platinum wire made incandescent by an electric current. The white heat of this wire is taken up and made harmless by means of a cold water current flowing along the circuit wire.

An improved machine for perforating papers, so that letters, numbers, or other characters may be represented thereon by a series of perforations, has been patented by M. Henri L. Poirier, of Paris, France. The punch holder is so constructed that the punches may be readily replaced when they are worn, and they may be grouped in the prisms so as to change the characters to be reproduced in perforations.

Mr. Albion B. Parkman, of St. Albans, Me., has invented an improved hame fastener, which consists of the hollow shank or body containing snap hooks, the shank of one of which has sharp teeth on its upper face, while the shank of the other is provided with square teeth on its upper face, which are held in the shank by the dogs that are pivoted within the body of the fastener, and made to engage with the teeth of the snap hooks by a curved spring.



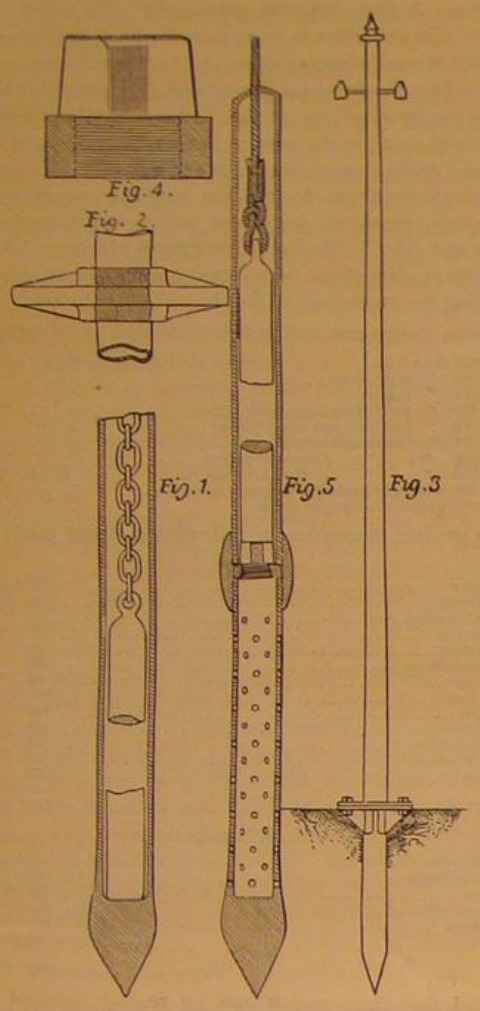
SCREW DRIVING GEAR.

An improved washing machine has been patented by Mr. Zohar Doyle, of Ogden, Ill. It consists of two semi conical pressers, with air tubes to prevent suction, mounted in a head held upon a frame operated by a lever and springs, and adapted to be shifted about, so as to be directed upon the surface of all the clothing.

Mr. Emery M. Pike, of McDonough, N. Y., has patented improvements on the butter worker for which letters patent No. 179,053 were granted to him June 20, 1876. In that apparatus a frame, provided with a trough or gutter, supported a reciprocating tank provided with an eduction pipe. The present invention consists in details of construction and arrangement of various parts of the apparatus, whereby provision is made for lessening the friction, for disposing of the brine, and for insuring the proper operation of the apparatus

TUBULAR PILES.

A novel and ingenious system of constructing and driving piles has of late been introduced into practice by Messrs. Le Grand & Sutcliff, of London, artesian well engineers. It involves a considerable departure from ordinary practice, inasmuch as the piles are driven internally and at the bottom, instead of externally and at the top. The invention originated with the senior member of the firm, whilst the credit of some of the applications of the principle is due to the junior member. The piles, says *Engineering*, are tubular, and can



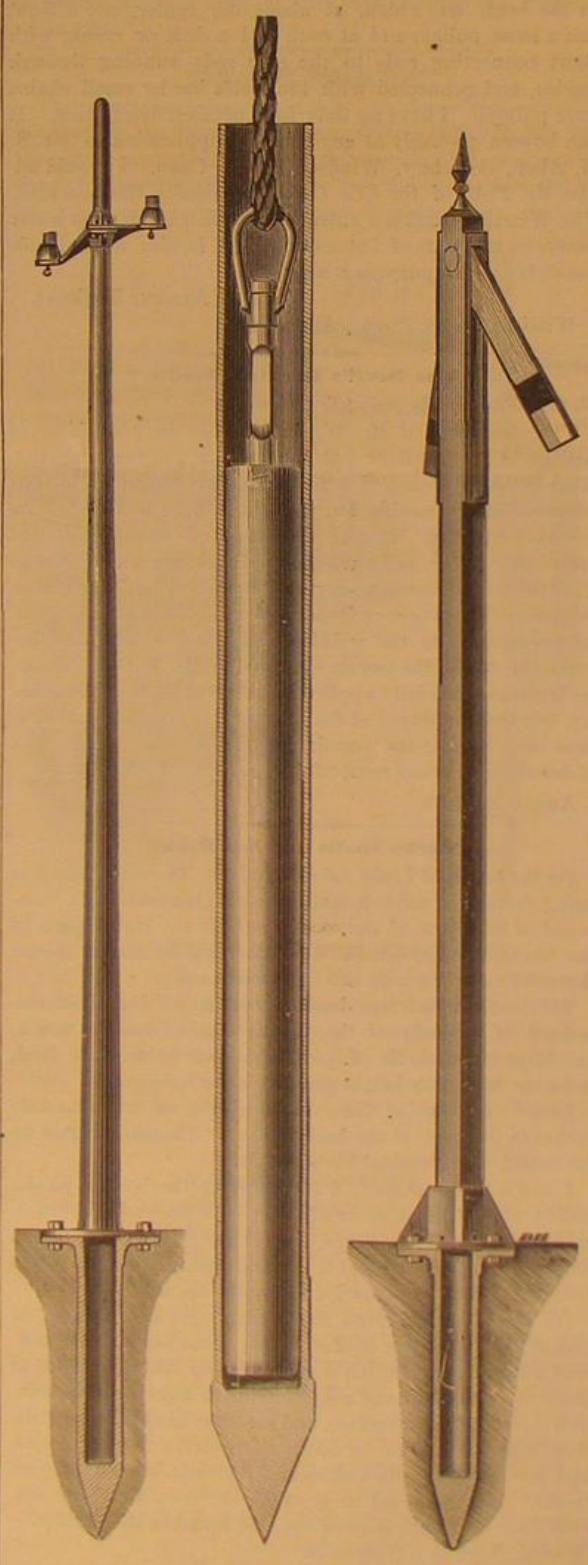
TUBULAR PILES.

be made of either wrought or cast iron, and the thickness of the metal can be proportioned to suit the varying circumstances of construction. The lower end of the pile, as shown in Figs. 1 and 6 of our engravings, is made solid and pointed, and is generally of wrought iron and steel tipped. The piles are made in sections, which are screwed together by strong steel sockets or joint covers, which are barrel shaped on the outside in order to diminish friction when being driven.

The method of driving these piles is as simple as it is novel. Instead of the blows being delivered on the head of the pile, the driving force is expended just where it is wanted, namely, at the point. This result is attained by using an elongated cylindrical driving weight, which travels easily inside the tube. The weight is raised by means of rope or rods, and is allowed to fall on the flat head of the solid point, the pile thus forming its own guide for the driving weight. The effect of each blow is to drag rather than to drive the pile down. It will be seen that the point is swelled, and is of sufficient diameter to effect a clearance for the joint covers which have to follow it down. The form of the joint cover is seen in Fig. 5. A considerable experience in driving tubes into the ground has shown the inventors that, thus made, the point does all the real work, and that a very slight strain is brought on the joints above. An increase of stability is given to these piles in cases where the depth to which they have to be driven is previously known by the use of a flange which is proportioned to suit the nature of the soil into which the pile has to be driven. This flange is shown at Fig. 2, and is so placed that at the final driving it just embeds itself on the river or sea bottom. The tubes forming the pile are screwed into the flange, which in this case takes the place of the usual steel socket, and unites the two lengths of the pile together. It thus in no way diminishes the strength of the pile as it would if screwed on to the tube below an ordinary socket.

With this system of piles it is not necessary to test the ground previously to driving them, inasmuch as lengths can always be added until a firm foundation is reached, failing which the pile can be withdrawn. In prospecting for a site small tubes can very rapidly be driven to ascertain the nature of the soil. Another advantage the system possesses is that piles can be driven in deep water with great facility, and they can be of extreme length. Their strength, moreover, can be increased by filling them in with concrete after they have been driven, if desired. When meeting with obstructions, screw piles have a tendency to become diverted from their position, and are liable to loosen the ground around them. The tubular pile, on the other hand, is not open to this objection, as it will fracture and pass through minor obstructions until it reaches a solid foundation, and being forcibly driven into the ground, the earth firmly surrounds it. These piles are applicable to all classes of engineering work, and they are now being tried by the Royal Engineer Committee, under instructions from the Under Secretary of State for War.

The principle of internal driving has been applied by Messrs. Le Grand & Sutcliff to the sinking of tube wells, driving the foundations for telegraph posts (as shown in Figs 3, 7, and 8), flagstaffs, and the like. When used in connection with tube wells a slightly modified arrangement has to be employed in consequence of the necessity which then arises for keeping out of the tube the water, which in the ordinary way flows in through the perforations. In this case the first socket above the perforated end is made sufficiently long to admit of a stout iron ring or washer being placed in the center of it in such a way that the two lengths of tube when screwed tightly together butt against it, one on the under and one on the upper surface. The interior of this ring is of sufficient size to allow the water to pass freely through it, but it has a screw thread cut throughout its whole length. During the operation of driving, the opening in this ring is closed by a steel plug, which is screwed down into it until the upper part butts on the ring, as seen at Fig. 4, where the ring is shown in section. The upper part of the plug forms an anvil, upon which the driving weight falls, the blow being thus delivered a short distance above the point of the tube instead of directly upon it, as in the case of the piles. In the center of a plug a hole is bored and tapped, into which a rod can be screwed for removing the plug when the driving has been completed. The male thread on the exterior of the plug is cut left handed, so that ordinary boring rods can be used in removing the plug without incurring the risk of unscrewing them.

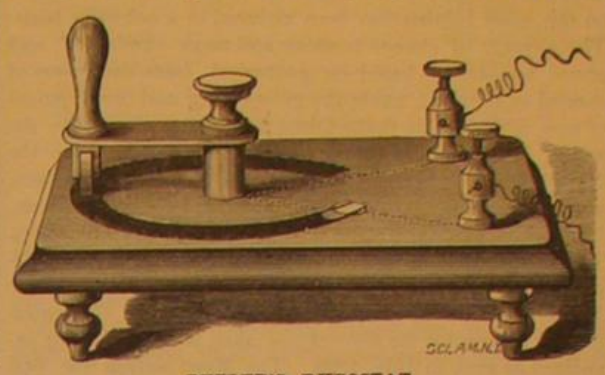


TUBULAR PILES.

The general arrangement of this system of driving tube wells is shown at Fig. 5. It will be seen that the water cannot rise in the tube above the underside of the steel plug, and in practice no difficulty has been experienced in any other respect. Altogether the system is one which commends itself for its simplicity, and for the facility it offers for carrying out that class of works to which the invention addresses itself.

IMPROVED RHEOSTAT.

The rheostat shown in the engraving is the invention of Mr. John Butler, of this city. It is designed for introducing more or less resistance into an electrical circuit. The bed plate is made of non-conducting material, and in an annular groove in its upper surface there is a film or plate of material that offers considerable resistance to the electrical current. Generally the groove is partly filled with plumbago. One end of the resistant is connected with a battery, and the current is completed through a movable key whose pivot is at the center of the circular groove. The key is provided with a roller



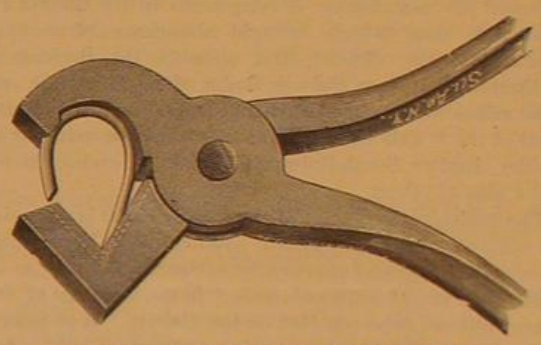
BUTLER'S RHEOSTAT.

which rests upon the plumbago and moves over its surface without abrading it.

This rheostat seems especially adapted to the use of physicians and experimenters.

IMPROVED INSTRUMENT FOR RINGING SWINE.

The instrument shown in the engraving is used for forcing through the flesh and gristle of a hog's nose one end of a piece of wire, while the other end remains at rest. The main object is to close the ends of the wire together outside of the flesh, so that the joint cannot enter and irritate the wound. The invention consists of a pair of pincers having



INSTRUMENT FOR RINGING SWINE.

one curved and one V shaped jaw, each jaw having a guide groove for receiving the pointed wire which forms the ring. The wire, slightly curved at one end, is inserted between the jaws, when, by closing the handle, the end of the wire will be forced through the hog's nose and bent up into a ring.

This device is the invention of Mr. W. D. Brown, of Indianapolis, Ind.

Wood Stains.

To turn oak black so as to cause it to resemble ebony, the wood should be immersed for forty-eight hours in a hot saturated solution of alum, and then brushed over several times with a logwood decoction, prepared as follows: Boil one part of best logwood with ten parts of water, filter through linen, and evaporate at a gentle heat until the volume is reduced one half. To every quart of this add from ten to fifteen drops of a saturated solution of indigo, completely neutral. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained. To imitate rosewood a concentrated solution of hypermanganate of potassa is spread on the surface of the wood, and allowed to act until the desired shade is obtained. Five minutes suffice ordinarily to give a deep color. A few trials will indicate the proper proportions. The hypermanganate of potassa is decomposed by the vegetable fibers with the precipitation of brown peroxide of manganese, which the influence of the potassa, at the same time set free, fixes in a durable manner on the fibers. When the action is terminated, the wood is carefully washed with water, dried, and then oiled and polished in the usual manner. The effect produced by this process on several woods is remarkable. On the cherry, especially, it gives a beautiful red color.

Antidote to Poison.

If a person swallows any poison whatever, or has fallen into convulsions from having overloaded the stomach, an instantaneous remedy, most efficient and applicable in a large number of cases, is a heaping teaspoonful of common salt, and as much ground mustard, stirred rapidly in a teacupful of water, warm or cold, and swallowed instantly. It is scarcely down before it begins to come up, bringing with it the remaining contents of the stomach; and lest there be any remnant of the poison, however small, let the white of an egg or a teaspoonful of strong coffee be swallowed as soon as the stomach is quiet, because these very common articles nullify a large number of virulent poisons.—*Medical Brief.*

Correspondence.

The Bodie Mining District.

To the Editor of the Scientific American:

The most promising field for mining enterprise on the Pacific Coast at the present time is undoubtedly the Bodie District. The Comstock Lode has ceased any longer to attract that universal attention which for so many years it has monopolized. The dividends of its mines have stopped, and investors are looking to the Bodie and other fields for opportunities that the Comstock no longer furnishes. Here on the coast mining has been reduced to a scientific basis. The element of chance is more and more eliminated; and sound hypotheses based on geological facts and years of careful experiment, guide the prospecting and development of new mines. The Bodie District, which I purpose to describe, is located in Mono county, California, near the Nevada line. It is about 36 hours' ride from San Francisco, almost due west. It is reached, however, by way of Carson, from which place you stage it over the country 110 miles. The first individual who discovered valuable mineral deposits in this district was W. S. Bodie, of Poughkeepsie, New York. This was as long ago as 1859, and from this enterprising prospector the district has taken its name, being organized as such in July, 1860. The Mono section was first worked, but not systematically; and in 1861, what was then known as Bunker Hill (since famous as the Standard) was discovered. A company, with a nominal capital of $1,110,000, was incorporated in 1863, but failed in any practical results, although such names as Leland Stanford and F. K. Bechtel were at its head. In the following year the Empire Company of New York was incorporated, combining four or five other mines, with $10,000,000 capital. Trenor W Park succeeded in raising $300,000 actual money on stock sales for development purposes. The effort as a whole, however, proved entirely theatrical. A very good mill had been erected, and ten years later, when the Syndicate Company was incorporated with large privileges, this was refitted, and with a sufficient capital work began in earnest. Then followed the astonishing developments in the Bunker Hill (Standard) mine which brought abundance of working capital into the district, and speedily the Bechtel, the McClinton, Belvidere, Bulwer, Bodie, Mono, Tioga-Con., and other mines were opened up; followed, since the establishment of the "Veta Madre" theory (or mother vein), by the Dudley, Jupiter, South Bulwer, Chieftain, Noonday, Richer, and a host of others.

The geological character of the entire district is volcanic—"a volcano within a volcano; a chemical caldron subsequent to a widespread upheaval by subterranean fires," as one writer puts it. "Bodie mountain," in the language of Professor Silliman, who reported on the district, "is an isolated mass of trachytic porphyry, having white crystals of a feldspathic mineral implanted in a lavender colored paste; it is an island of irruptive rocks. The whole surface of the surrounding region is covered with decomposed porphyry, in which are seams, abundantly supplied with fragments of quartz, jasper, chalcedony, and other vein stones derived from the breaking up of the crests of the mineral lodes. The eye experienced in gold bearing drifts recognizes at once, in the aspects of the sides of this mountain, the probability of the existence there of profitable deposits of gold." Silliman thoroughly believed in the existence of one great *mother lode*. Subsequent discoveries tend to substantiate this. A transverse section of Bodie Bluff shows the many veins of ore, spread out like the sticks of an open fan; that is, they all tend to a common center, where they are supposed to meet and unite with the mother vein. This formation extends through the entire district, but no cross cuts have yet been made. A theory entertained by many is that the whole geological formation was riven asunder, and the chasm filled by sedimentary action. Professor William P. Blake, of the Sheffield School of Mining, believes that the structure of the rock indicates that "the veins were deposited gradually in fissures, by thermal springs." Both theories would favor the great depth of the veins. On the surface the veins are hard and sterile of metal; at sufficient depth they become soft, friable, and rich; and deeper still more rich, and so decomposed as to even yield to the shovel. The extent of the mineral ledge is between *two* and *three* miles. It was supposed at first that the general dip of the veins was in a southwesterly direction, but recent developments prove conclusively that they run easterly, and the probabilities amount almost to a certainty that the Dudley and Jupiter claims, on the east side of the ridge, have the same rich ore bodies that maintains in the Syndicate, Standard, and Bodie. In all these leading mines the farther they prospect the more ample and richer become the mineral deposits, tending more and more to prove the "*veta madre*" or mother vein theory. They are down over 400 feet in the Bodie, 520 feet in the Tioga, and over 700 feet in the Standard, but in the latter are temporarily drowned out with water. The Bruce drift in the Bodie has proved immensely rich and increases as it goes southward. In the Standard there is a thousand feet of rich ore laid bare. All these veins are mingled with carbonate of lime, a good indication for permanency. This formation extends clear through to Noonday on the extremest south, with the certainty that the rich veins of the Standard and Bodie bear off to the east, through the east side of Mono. There is every probability that the next bonanza will be opened in Jupiter and Dudley, which are just to the south and east of Bodie and Mono. Good ore is already being taken out, but they are waiting for their pumping machinery, so that they may penetrate to the lower levels below the barren cap rock which covers the district. When this is accomplished these mines will likely prove a *dividend proposition*. A large amount of machinery is being brought into the whole district. The Noonday is erecting a 20 stamp mill. The Standard and Bulwer Companies are jointly putting up a 30 stamp mill; and pumping and hoisting machinery has been ordered for a number of other mines.

There is unquestionably a big future before them all. The gold and silver mineral is not found in pockets, but is disseminated with average yield throughout the length and breadth of all the veins. Resembling the Comstock in many striking particulars, the Bodie bids fair to outrival that veteran district, which has so long dominated the stock market of the Pacific Coast. H. S. W.

San Francisco, August 1, 1879.

A Canal Mowing Machine.

To the Editor of the Scientific American:

I notice in your paper for August 16 an article with the following heading, "A Canal Mowing Machine Wanted," and wish to say that such a machine, and one which is as much superior to the one described in that article as a land mowing machine is to a scythe, has already been invented, and has been in operation every summer for a number of years on the canal of the Connecticut River Company, at Windsor Locks, Conn It is driven by belting from the engine of a steamer built especially for it, and works well. It will be run a part or the whole of the coming week.

The machine consists of a frame of as near as I can guess 12x8 or 10 feet, with a shaft at the end to be attached to the boat, on which, at about the center, are a tight and a loose pulley, and at each end a disk or crank, with short connecting rods to the side rods running through guides, and connected with the knife bar by small chains over pulleys. I have no time for a detailed description. It can be seen probably at any time, on application to Mr. S. H. Allen, Secretary, Windsor Locks, Conn. I would advise Mr. Fish, of the Erie Canal, to examine this machine. The Windsor Canal is 6 miles long, and is the largest water power in the State of Connecticut. It is also a navigable canal, for which purpose it was built.

J. S. ALLEN, Engineer.

Windsor Locks, Conn., August 16.

"The Devil's Darning Needle."

To the Editor of the Scientific American:

The statement of Mr. W. M. McGee, in your issue of August 16, to the effect that the thick-legged walking-stick (*Diapheromera femorata*), which I recently treated of in your columns, may sometimes survive the winter, is founded on mistaken identity. It dies with the first severe frost, and passes the winter, as I have shown, in the egg state. Not so with the water boatmen—certain elongate long-legged heteropterous insects (genus *Ranatra*)—which bear a very general resemblance to the walking-sticks, and which were, beyond any doubt, the insects observed by Mr. McGee. Popular terms are variously applied in different parts of the country, but that employed at the head of this communication is most associated in the popular mind with the dragon flies (*Libellulidæ*). Yours respectfully, C. V. RILEY.

August 16, 1879.

Turbo Shells and Sea Beans.

On the beach of Little Saba Island (St. Thomas) there was being formed a reddish sandstone conglomerate rock composed of the *débris* of the rock of which the higher parts of the island consist, cemented together by calcareous matter derived from the corals and calcareous sand.

This rock, which was hard and compact, contained embedded in it plenty of the various corals from the beach, and large turbo shells (*T. pica*) with their nacre quite fresh in luster, and their bright greenish color unimpaired.

Large examples of these turbo shells, as much as two inches in diameter at the base, are in St. Thomas, carried up far inland by terrestrial hermit crabs.

I saw a large number of them among the bush at an elevation of 1,000 feet, some of them with the crabs in them, many empty. These large, heavy sea shells occurring in abundance at great heights puzzled geologists, until it was found that they were carried up by the crabs.

On the shore at Little Saba Island grow a number of plants of *Guilandina bonduc*. This plant bears a pod covered with prickles, which contains nearly spherical beans of about the size of a hazel nut, which have a perfectly smooth, as it were, enameled surface, and are flinty hard. These seeds float, and are carried by ocean currents to distant shores, and are in Tristan da Cunha and Bermuda known as "sea beans," and supposed to grow at the bottom of the sea. Don Jose de Canto showed me one found in the Azores.—*Moseley, Notes by a Naturalist.*

WE have it on the authority of Dr. Bock, of Leipsic, that the nervousness and peevishness of our times are chiefly attributable to tea and coffee; the digestive organs of confirmed coffee drinkers are in a state of chronic derangement, which reacts on the brain, producing fretful and lachrymose moods. Ladies addicted to strong coffee have a characteristic temper, which might be described as a mania for acting the persecuted saint. Chocolate, he adds, is neutral in its psychic effects, and is really the most harmless of our fashionable drinks.

CUTTING PACKING COMPANY.—ONE OF THE LARGEST ESTABLISHMENTS OF THE KIND IN THE COUNTRY.

Next to mining, the fruit products of the Pacific coast give it celebrity throughout the world. The size, quality, and abundance of these products render them especially suitable for foreign markets, where they are largely shipped in the shape of canned goods, prepared so as to retain their natural flavor, and cheapen their comparative cost to the consumer.

As illustrating this large and growing industry, the Cutting Packing Company, both by merit and reputation, is well worthy of description. The house was established in 1853, on Commercial Street, San Francisco, Cal., under the name of Cutting & Co., and was necessarily very small in its capacity and imperfect in its appointments at that time.

In 1875 it was incorporated as the Cutting Packing Company, and by careful management and a proper spirit of enterprise the development of the business has been constant and reliable, until at the present time its magnitude is enormous and really a monument to the energy that developed it. Besides canning fruits, the concern now can meats, vegetables, honey, preserves, jams, and jellies, and manufacture pickles and cider. The following figures will prove interesting to the readers of the SCIENTIFIC AMERICAN, as concisely exhibiting the magnitude of this important industry:

GOODS PREPARED FOR MARKET IN THE YEAR 1878.

900,000 cans fruit	averaging	2½ lb.	each.
475,000 " vegetables	"	2½ "	"
110,000 " meats	"	2½ "	"
285,000 " preserves, jams, and jellies	"	2 "	"
76,000 " strained and comb honey	"	2 "	"
24,000 glass packages honey	"	2 "	"
18,000 " " jams and jellies	"	2 "	"
15,000 " " pickles and sauces	"	½ gal.	"
16,000 wood packages pickles and sauces	"	25 "	"
12,000 quarts champagne cider.			

This product represents the following material used:

FRUITS.

Apples	190 tons.
Apricots	110 "
Blackberries	75 "
Currants	45 "
Cherries	25 "
Gooseberries	30 "
Grapes	60 "
Peaches	325 "
Plums	100 "
Quinces	40 "
Raspberries	12 "
Strawberries	45 "
Pears	210 "
Total	1,317 "

VEGETABLES.

Asparagus	15 tons.
String-beans	45 "
Peas	60 "
Tomatoes	350 "
Pickles	175 "
Corn	25 "
Total	670 "

MEATS.

Beef, boned	220,000 lb.
Mutton, "	90,000 "
Pork, etc., "	12,000 "
Total	322,000 "

MISCELLANEOUS.

Salt	160,000 lb.
Vinegar	72,000 gal.
Sugar	360,000 lb.
Honey	110 tons.

The tin cans for putting up this immense quantity of goods are all manufactured by the concern, and it requires 1,750,000 of these, averaging 2½ lb. each. For their construction 7,500 boxes of tin plate are used, 15 tons of pig lead, and 15 tons of pig tin. The plate tin is imported from England, the pig tin from Australia, and the pig lead is mined on the coast. Sugar is purchased by the car load, and salt by the schooner load. In fact everything is conducted on a wholesale principle, yet the most scrupulous regard is paid to the minutiæ of the business, and each department works in perfect harmony with the others toward the advancement of the whole.

The warehouses and factory are located on Main Street, Nos. 17 to 41, just off from Market Street, the principal street of the city. The extent of the premises is 180 feet on Main Street, and 275 feet deep; stables, cooper and machine shops are attached; the main building for general manufacturing is 90x137 feet, and four stories high.

When I visited this large factory the peach season was at its height, and the capacity of the establishment was taxed to the utmost to dispose of the fine harvest of this abundant product of the State. Stepping on the elevator with one of the proprietors of the house, we were taken up to the fourth floor, where between five and six hundred women were busily engaged at long tables in peeling, pitting, and canning the luscious fruit. The most admirable system prevails here for the dispatch of business, and it requires but a few minutes for fruit that had been harvested the same day in the neighborhood of San Francisco, to be put in proper shape for the consumer in some far off market. An elevated railway runs the length of the room between two rows of tables; this facilitates the transportation of the filled cans to the siruping room, where boiled sirup is poured among the peaches, filling every crevice. They are then soldered up and cooked the necessary time which experience has suggested as best.

The concern manufacture their own sirups from the best "*A*" crushed sugar. They are strained twice to exclude all possible impurities.

I was shown a very neat device for soldering the tops and bottoms of the cans, upon which the concern has a patent. It consists of a simple piece of solder wire, which is cut and bent so as to just fit nicely around the edges of the can. After the wire has been properly dropped into position, the can is placed with the top or bottom, as the case may be, in a close fitting aperture on a hot oven; the wire speedily

melts into the crevices, forming a thoroughly tight joint all around.

All the jellies, jams, and preserves that the concern manufacture are made from the pure juice of the fruit with the very best sugars. A hydraulic press is used to extract the juice, which is boiled in copper kettles until thoroughly jellied.

The meat used is bought slaughtered. In the boning department, on the second floor, expert hands cut out every particle of bone. It is then taken to the third floor and cooked in large meat vats, and afterward nicely canned.

The champagne cider is manufactured after approved methods; portions of the second and third floors are devoted to this department.

The department for preparing pickles is just across the alley from the main building. Gherkins, peppers, limes, beans, cauliflower, and a variety of others are manufactured. There are six large pickle tanks, with a capacity of 8,000 gallons each. These are filled solid with pickles, which are prepared every fall, and are allowed to stand in the brine from four to six weeks until wanted. In the pickle packing room they are treated with spices and vinegar, and kept in large quantities to be drawn upon. The concern manufacture their own brine and all their wooden packages. The company make a specialty of manufacturing all pickles for family use in pure malt vinegar.

The first floor, or basement, of the main building is largely devoted to the storage of fruit juices, which are hermetically sealed in large cans and placed on racks, to be drawn upon for jellying during the winter. The floor of this basement is thoroughly "scowed," so as to keep out the tide, which in this part of the city rises several feet.

The labeling department occupies a portion of the third floor. All the cans are lacquered to prevent sea damp and moulding. They are then handsomely labeled and packed in boxes, containing one or more dozen, for shipment.

In the rear of this department the glassing of pickles and sauces is done. Each bottle or glass is corked, bladdered, waxed, and capped with foil to be properly hermetically sealed for shipment. The honey used by the concern is the finest the bee ranches of California can furnish. It is simply run into cans and jars, either with or without the comb. Some kinds of sauces and catchups are put up in barrels. There is manufactured however, a very fine Worcestershire sauce which is handsomely bottled. Olives are prepared in the factory both from native growths and imported. Some very fine stuffed peppers are manufactured, besides a variety of other small articles. The premises have ample water privileges, are perfectly neat and clean, and devoid of any bad odor.

The concern owns and operates three large salmon canneries: one is located at Eagle Cliff on the Columbia, one on Eel River, California, and one in Alaska. Besides manufacturing eleven different kinds of preserved meats, eight different kinds of sauces, eleven kinds of jellies, and nine kinds of jams, the concern are agents for many of the best Eastern preparations, as well as all of Burnett's extracts.

During the busy season, from May till November, the business requires the employment of 500 hands on the average, and 150 hands from November till April. The weekly payroll averages from $2,500 to $3,000. Goods are shipped to the East Indies, to China, to Australia, and the coast is supplied. It is an industry as diversified as it is extensive, and it utilizes the products of nature in a semi-tropical climate for the benefit of mankind everywhere. H. S. W.

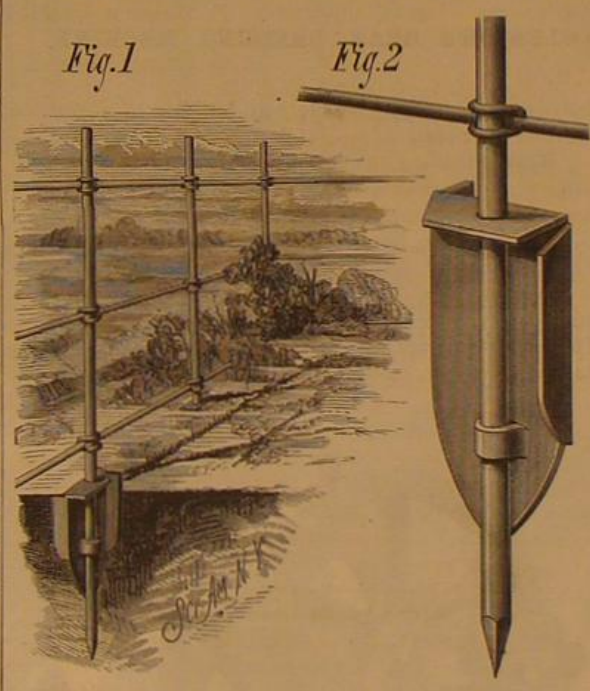
Secretary Evarts on American Industries.

In concluding an official review of the information furnished by American consular agents abroad, with respect to the conditions of trade, wages paid, cost of living, commercial prospects, and so on, in foreign countries, Secretary Evarts says:

"For the first time our manufactures are now assuming international proportions. At a time of universal depression we have met those nations which held a monopoly of the world's markets, met them in their strongholds, and established the fact that American manufactures are second to the manufactures of no other nation, and that, with a proper and patriotic understanding between capitalist and laborer, we can command a fair share of the buying world's patronage, and command that patronage with larger profits to the capitalist and higher wages to the laborer than can be made or paid in any other country. There is something in the Republic which gives an individuality to the people of the United States possessed by no other people to such a degree. Our inventive genius in mechanical appliances is original, and at least 25 years ahead of Europe. Our people accept innovation, are prepared for it by anticipation; Europeans do not. One workman in the United States does as much as two workmen in most of the countries of Europe; even the immigrant from Europe attains this progressive spirit by a few years' association with American workmen. We have no oppressed and stupid peasantry, little more intelligent than the tools they handle. All are self-thinking, self-acting, and self-supporting. Within the last 15 years we have demonstrated our ability, by the brilliant development of our own resources, to exclude, by honest competition, foreign manufactures, to a large extent, from our shores. The question which now peremptorily challenges all thinking minds is how to create a foreign demand for those manufactures which are left after supplying our home demands. We cannot stand still, for the momentum of increase will soon become so great that it will push us outward anyway; to push us safely and profitably is of so much importance as to almost overtop all other public questions of the hour. This question appeals equally to the selfishness and patriotism of all our citizens, but to the laborer it appeals with tenfold force, for without work he cannot live, and unless we can extend the markets for our manufactures he cannot expect steady work, and unless our manufacturers can undersell foreign manufacturers we cannot enlarge our foreign market. The first great truth to be learned by the manufacturers and workingmen is that the days of sudden fortunes and double wages are gone. We must realize the fact that ocean steam communication has annihilated distance and brought the nations face to face. This drawing together of the nations means equalization in trade, profits, wages, etc., the advantage being with those who soonest accept the situation, and show the most sensible continuity in the new paths of success. The Consul at Newcastle-upon-Tyne shows that that city is commercially nearer to New York than to London. If steam communication can thus bring one of the leading cities of a small island like England nearer to New York than to its own capital, it can work equal wonders with the leading seaport cities of all Europe in their commercial intercourse with the seaport cities of the United States. This is a question of great importance to both laborer and capitalist, for it must revolutionize all past theories of trade and commerce, by establishing international equalization. In the near future, the workingman of New York cannot expect twice or thrice the wages of his fellow worker in Europe, while all other things—food, rent, clothing, etc.—are on an equality; nor can the coal miner of Pennsylvania expect twice the wages of the Northumberland miner, while coal from the Northumberland mines can be landed in New York at less than the price of Pennsylvania coal."

NEW IRON FENCE POST.

The engraving shows a novel iron fence post recently patented by Mr. James Carpenter, of New Hope, N. Y. The invention consists in an iron bar forming the post, and a flanged pointed blade that slides over the bar and is driven into the ground to prevent the post from swaying. By looking at Fig. 1 the construction of the post will be readily understood; and Fig. 2 shows a fence built with these posts.



CARPENTER'S IMPROVED FENCE POST.

It is claimed by the inventor that two men can put up and finish 100 rods of this fence in a day, the posts being one rod apart, and three strands of barbed fence wire being used. The cost of this fence, compared with other kinds, is said to be very low.

A Vegetable Curiosity.

A remarkable freak of vegetation has appeared in the grounds of R. B. Tatman, at Worcester, in the shape of a potato vine which bears tomatoes. It appears to be a mixture of the two vegetables, and is accounted for by the fact that a strong tomato vine from chance-sown seed grew in the same hill with the potatoes, and the pollen of the two plants became mixed. Unfortunately the vines were pulled up before the peculiarity of the growth was noticed. Some of our agriculturists may derive a valuable suggestion from this. As both the potato and the tomato are of the solanaceæ family, it is not impossible that one should be fertilized by the other, and a remarkable economy of labor might be effected if careful and scientific cultivation should produce a plant which should bear good potatoes at the roots and good tomatoes on the tops.—*Springfield (Mass.) Union.*

Arsenic in Paper Collars.

Attention having been called by the SCIENTIFIC AMERICAN to the poisonous character of the starch used for some laundry purposes, the paragraph was reproduced and attracted attention in the English papers. The result has been an analysis of certain paper collars and cuffs, by a doctor, at the instance of a patient who showed symptoms of arsenical poisoning. The doctor reports that he has extracted 10·4 grains of arsenic from a single collar.—*Science News.*

The July Product of Petroleum.

According to *Stowell's Petroleum Reporter*, the number of producing wells at the close of July was 11,468, being an increase in July of 245. Total production in July, 1,714,517 bbls. Daily average for the month, 55,307 bbls. The average daily production of each well for the month was 4·9 bbls.

The total shipments of crude, and refined reduced to crude equivalent, by railroad, river, and pipes to the following points, were 1,625,035 barrels

New York took	706,135 bbls.
Pittsburg "	278,030 "
Cleveland "	292,924 "
Philadelphia "	139,968 "
Boston "	85,696 "
Baltimore "	57,187 "
Ohio River refiners took	20,336 "
Other local points "	44,759 "
Total shipments	1,625,035 "

Included in the above shipment there were 212,213 barrels of refined from Titusville and Oil City, which is equal to 318,320 barrels of crude.

The stock in the producing regions has been increased during the month, 89,482 barrels, making the total stock at the close of the month, 7,330,132 barrels, and is held by pipe companies, tankers, and operators.

Retouching Varnish.

A good retouching varnish is a boon to all retouchers, and those who are unfortunate enough to be plagued by too thin films will gladly hail a formula which promises this desideratum. In his recent work on retouching, M. Janssen, the *Photo. Correspondenz* says, recommends the following varnish:

Alcohol (sp. gr. 0·830)	60 parts.
Sandarac	10 "
Camphor	2 "
Venetian turpentine	4 "
Oil of lavender	3 "

This varnish may also be used for paper pictures. The retoucher should not set to work as soon as the negative has been varnished, as the film will not then be hard enough to bear the touch of a lead pencil. The varnished film is in the best condition for retouching when a day old.

GLOSS FOR PHOTOS.

The same gentleman also gives a formula (said to be used by Salomon, of Paris) for a cerate for giving a high gloss to albumenized pictures. The components are:

White wax	800 grammes.
Elemi resin	10 "
Oil of lavender	300 "
Benzoin resin	200 "
Oil of spikenard	15 "

Olives in California.

Recently Mr. Elwood Cooper, of Santa Barbara, California, shipped to San Francisco 1,000 gallons of well clarified olive oil, the product of his orchard at Santa Barbara. According to the San Francisco *Alta*, Mr. Cooper has 6,000 trees, some of them 7 years old, and these produce 20 gallons of berries each on an average in a good year, and one gallon of oil is obtained from seven of berries. Trees 10 years old in a good soil will average 50 gallons of berries in a good year, but sometimes will yield 150 gallons. After a good crop the tree usually takes a year's rest, so that its good years alternate. The whole yield from a mature orchard may be set down at 200 gallons of oil to the acre, and of this 50 gallons may be deducted to pay for gathering the berries and making and marketing the oil.

The *Alta* believes that the olive should receive more attention in California, since it will bear good crops, on poor soil, with less care than any other plant. The hillsides, now worthless, should be covered with olives. The olive requires no irrigation, grows on clayey or rocky soil without much cultivation, and begins to bear in five years, coming to full bearing in ten years.

Rat and Mice Exterminator.

A German newspaper gives the following simple method for exterminating rats and mice, which, it states, has been successfully tried by one Baron Von Backhofen and others for some time past: "A mixture of two parts of well bruised common squills and three parts of finely chopped bacon is made into a stiff mass, with as much meal as may be required, and then baked into small cakes, which are put around for the rats to eat." Several correspondents of the paper write to confirm the experience of the noble baron and his neighbors in the extirpation of rats and mice by this simple remedy.

Transparency of Metals.

With the aid of electricity films of several metals of such minute thickness as to allow the light to pass through them can be produced. An electric current is passed into a wire of one of the metals, that extends into a glass tube containing rarefied air or gases. The particles of metal that the electric current loosens from the wire are deposited on the sides of the tube and form a transparent film. The light that passed through gold was a very handsome green, silver produced blue, copper light green, platina bluish gray, zinc dark bluish gray, and iron brown.—*Chemiker Zeitung.*

IRON AND WOOD GEAR-DRESSING MACHINE.

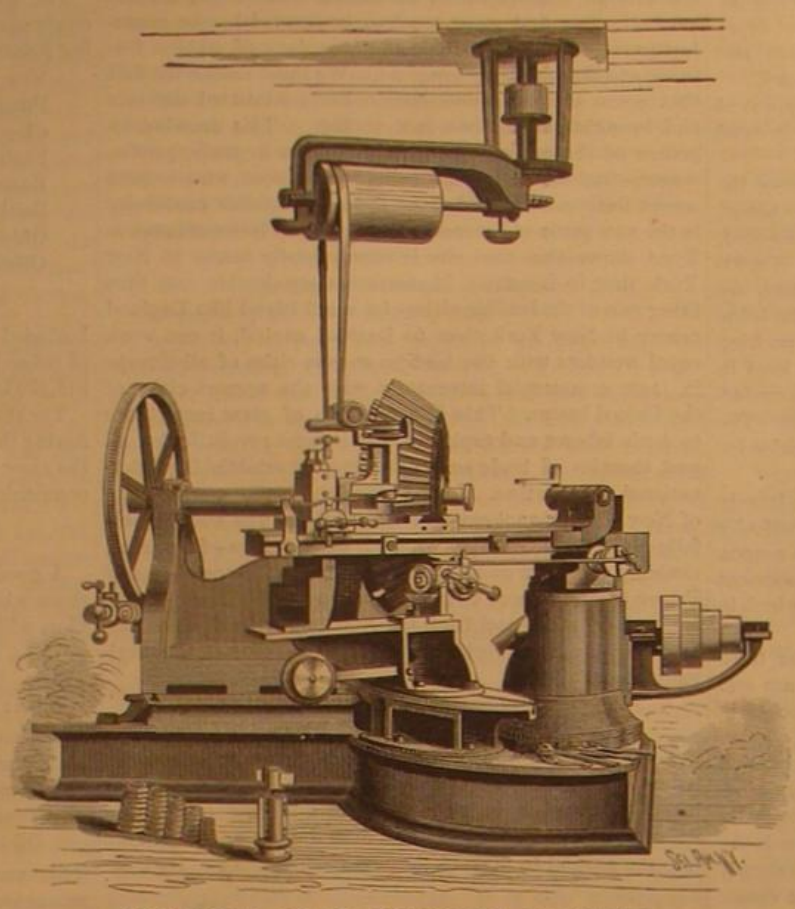
We give herewith an engraving of a novel machine recently patented by Mr. William Gleason, of Rochester, N. Y., for dressing the teeth of iron wheels and for shaping the cogs of wooden gears. The machine may be changed from iron to wood without any delay or change of parts. The gear to be dressed is chucked on the overhanging end of the spindle, the dividing wheel being on the opposite end. The tool holding the slide moves on a bar which may be swung to any required angle for bevels, and power is imparted to the gear-dressing tool by a belt from a drum on an overhead shaft that swings to accommodate the position of the bar that supports the tool slide.

The tool may also be readily adjusted to move parallel with the wheel supporting spindle for dressing spur gears. The bar is jointed both horizontally and vertically, so that it may follow a template or form at or near the outer end of the bar having the shape of the tooth to be dressed. By means of this arrangement the perfect shape of tooth for beveled wheels is secured. For spur gears the form is placed directly under the tool holder.

The movements of the slide carrying the tool are similar to those of a crank planer having a quick return movement. In dressing wooden gears both reciprocating and rotary motions are used, and in place of the ordinary tool, a bracket supporting a spindle and circular saw is carried by the tool holder. A quick rotary motion is communicated to the saw spindle from the overhead shaft by a belt, and the tool holder is reciprocated in the same manner as in dressing iron teeth. The machine does its work perfectly and very rapidly, as the saw cuts on the back stroke as well as on the forward stroke. The face and ends of the teeth may be dressed without rechucking the wheel.

It will be noticed that this machine shapes both wood and iron teeth without the use of expensive rotary cutters, and it has the advantage of making perfect teeth on bevel wheels, a thing impossible with rotary cutters used in the ordinary way.

We understand that this machine is in use in some of the largest shops in the country, giving good satisfaction in every case.

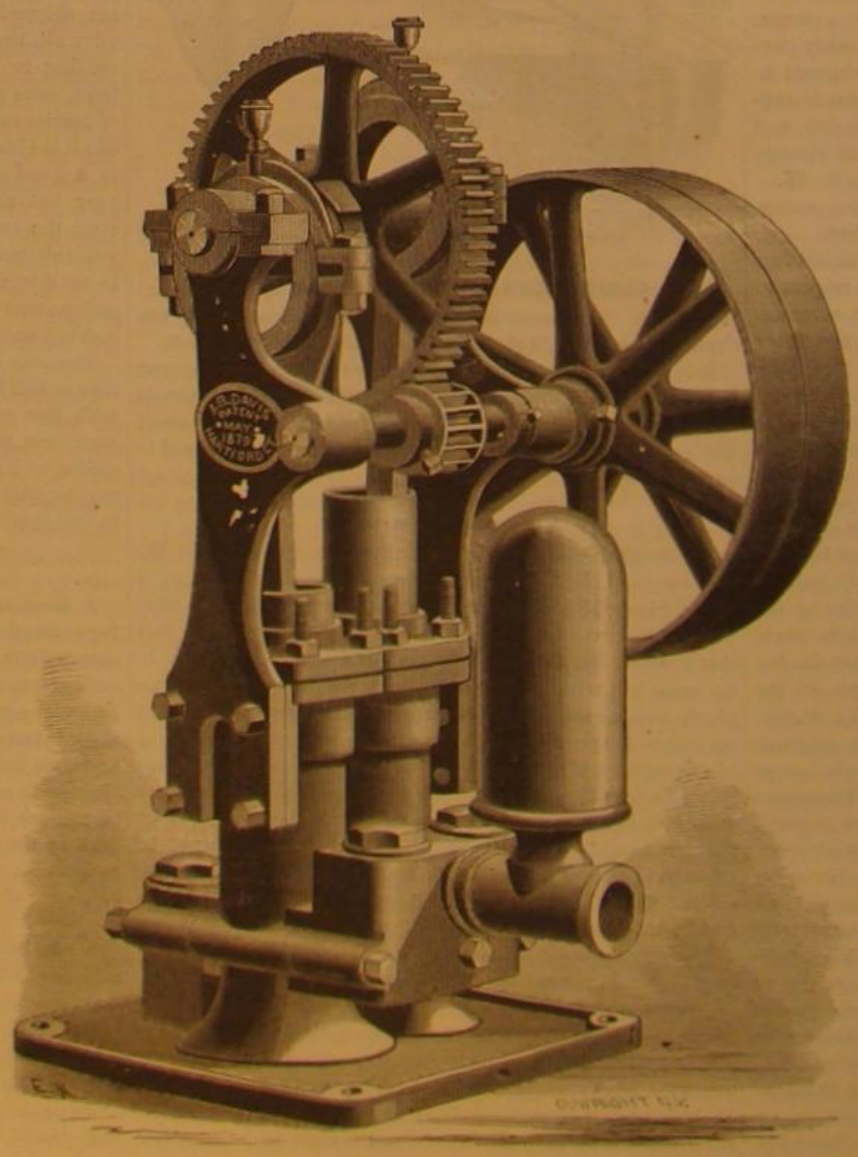


GLEASON'S GEAR DRESSING MACHINE.

IMPROVED BOILER FEED PUMP.

The accompanying cut represents an improved boiler feed pump patented by I. B. Davis, Hartford, Conn., May 29, 1879

It is an established fact that the most economical of all methods of supplying steam boilers with feed water is by the use of a pump driven by a belt, the economy being much greater than is generally supposed. The "Economic" boiler feed pump, as the inventor calls it, is designed to supply a want for a cheap, durable pump, economical in its workings, and not liable to get out of repair. As will be seen by the cut, it is a double pump driven by a single set of gears. All the parts are made very heavy and well finished. The valves, the only part that can wear or get out of order, are made separate and distinct from the pump, and are attached to it by bolts. They can be got at by unscrewing a brass cap, and in case of any accident a duplicate can be put in its place without disturbing any other part of the pump, as they are made interchangeable in all its parts. It is completed ready to run by attaching a water pipe to and from it, and putting on a driving belt. The gear being made from cut iron pattern, and the pump being double acting, make its action much smoother and quieter than other geared pumps. It is especially valuable in sandy water, as the valve can, if worn by the action of the sand, be ground tight in a few minutes by any one. We are informed that its cost is below other pumps of equal capacity. It is made by I. B. Davis, Hartford, Conn., who has offices at 93 and 94 Liberty Street, N. Y., and 43 South 4th street, Philadelphia, managed by H. T. Brewster; and at Boston, 36 and 38 Oliver Street, managed by R. B. Lincoln, Jr.



DAVIS' BOILER FEED PUMP.

The American vs. the British Miller.

A correspondent in the *Miller* (English) berates his countrymen for not being more fully alive to the causes which give the American miller pre eminence over the English miller.

While British millers, he says, are wondering at the ever increasing importations of American flour, wasting both time and money in discussing various systems, with minds not always open to conviction, Jonathan has discovered a market for his flour under the very nose of the British miller, and has even converted the latter into his salesman.

The writer also refers to our worthy contemporary, the *American Miller*, where, he acknowledges, may be found instructive reading for old-style English millers who will hug their hesitation, deplore foreign competition, and seek for deliverance in every possible way but that of a genuine effort on their part.

"While admitting the serious nature of foreign competition, with strange inconsistency too many British millers cling tenaciously to old methods and machinery, and are wilfully blind to the more improved methods at their command. The equipment of British mills, as a rule, is much inferior to American mills, if we except a few of the largest mills in this country, which are a stride in advance of the latter. The interest in improved machinery here is *superficial* and its adoption *slow*, while the adversary, judging from the paper to which I refer, remodels his mill, improves his flour both in quality and quantity, and no doubt "calculates" on the indecision of the millers here, for some time at least, enabling him to make a small fortune. Ultimately finding us alive to the fact that we have lost ground, and increase our pace, he takes another jump ahead—not so thoughtlessly as may be supposed; on the contrary, his mind is more open to new ideas, and he is ever seeking the way to go ahead, while we pine for a corner in which we can lie down and feel snug. The relative advantages of new over older systems of milling are discussed in a very half-hearted and skeptical spirit by old-style millers; indeed there seems little hope that, without resorting to a surgical operation, some will ever be convinced. Unfortunately there is no recognized system of grading or testing flour, in this country, made under various systems and from certain wheats, both as to quality and quantity. There must, therefore, always be indecision, controversy, and little result, until some test of these systems that can be relied upon is made."

Sawmills Wanted in Brazil.

Mr. Maurice Mauris, the explorer of the Amazon, says that sawmills are much needed in Brazil, and that their establishment could scarcely fail to prove extremely profitable. In many cases, more especially on the Madeira, the current conveys the largest logs of excellent woods, which the sawyer would only have to capture and land. At Serpa, near the mouth of the Madeira, a Portuguese speculator built a sawmill, and the cedar carried down the river supplied his concern in five months with sufficient timber for a whole year's work. So well did his work prosper that this speculator was enabled to retire after a few years independently wealthy, although he had been assisted only by the rudest machinery and unskilled, intractable workmen. Though situated on the confines of a vast forest, Para consumes large quantities of North American timber, only a single sawmill existing in the city. A dozen boards of red cedar (a very common wood) cost about $30 at Santarem.

Useful Hints on Sewerage.

To sewer a town, and then leave house drains to haphazard construction, is simply little better than to waste the ratepayers' money. Comfort and means for health are only to be secured by the best house drainage, and the best house drainage will not be accomplished by builders working under no responsibility. The sewerage of a town or village will consist of waste water and excreta from the houses, and the volume, in round figures, may range from 100 to 250 gallons per day from each house. This volume will probably flow off in about eight hours, so that the sewers must provide for not less than three times this volume, if every drop of roof and surface water can be excluded. As this cannot in all cases be accomplished, the sewers should provide for not less than 1,000 gallons from each house, or, for a town of 1,000 houses (5,500 population), have a delivering capacity of about 1,000,000 gallons. An outlet sewer of two feet diameter, laid with a fall of five feet per mile, will deliver upward of 2,000,000 gallons, flowing a little more than half full; and, as provision should be made for an increase of population, a sewer of two feet diameter may be provided for each 5,500 persons, where no better fall than one in one thousand can be obtained. Lesser diameters will answer where there are no greater falls.

Towns situated on land rising considerably will best be sewered in zones; that is, by intercepting lines of sewers contouring the site, as such sewers will prevent gorging the low-level districts, and also prevent the rush of sewage down steep gradients at high velocities, which, in times of heavy rain, may burst the low-level sewers at the steep gradient junctions. Sewers with steep gradients, if the flow of sewage is unbroken, get up a velocity in the sewage, which is liable to be very injurious in its wearing action on the sewers. Sewage should not be allowed (except when flushing is in operation) to acquire a greater velocity at any state or time of more than six feet per second, as any higher velocity will take grit or other solids along the sewer invert with a cutting and disintegrating action rapidly destructive to the material of the sewer.—*Rawlinson's Suggestions.*

THE largest tree in the Southern States, a tulip bearing poplar tree near Augusta, Ga., is 155 feet high and 9 feet in diameter, its lowest branches being 55 feet from the ground.

The Missouri Tornado of April 14, 1879.

Dr. J. L. R. Wadsworth and Francis E. Nipher, Secretary of the St. Louis Academy of Science, have made and published a careful study of the tornado which wrecked a portion of Collinsville, Mo., last April. The storm reached St. Louis at 2 P. M. From this point it pursued an even course with the same velocity, reaching Collinsville, 10½ miles east, at 2:35; Lebanon, 21 miles east, at 3; and Highland, 29 miles east, at 3:30 (St. Louis time). It would seem that the necessary elementary conditions for the development of the tornado were found over the American Bottom, and that this development was purely local and did not extend much over ten miles, and had no apparent influence upon the general storm that was passing at a higher altitude to the eastward. The tornado consisted of a principal vortex, of very considerable power, accompanied by six collateral vortices, of much less power, that seemed to possess more than an incidental relationship to the principal; and a second principal vortex apparently independent in time and direction. The direction of the principal vortex was 15° north of east, and, while there was a probable swaying to the one side or the other, the paths of the vortices were in straight lines. The first four collateral vortices were *convergent* upon the path of the principal vortex, and the two last were *divergent*. The principal vortex was in contact with the surface while it was receiving the first four, and had left the surface before it gave off the last two collateral vortices. The height of the principal vortex was about 500 feet; the heights of the collaterals were comparatively small. The rotary spiral motion was in the direction opposed to the movement of the hands of a watch and of great velocity. The progressive motion was about one mile a minute. It had also a vertical or lifting motion, which was often quite abrupt. The path was narrow on the approach to Collinsville—about 100 feet, gradually widening—the vortex at the same time exhibiting less force. At the zinc works it was 600 feet wide. Its lifting power was sufficient to carry large roofs at least 600 feet high; this, with a power equal to the momentum of a body moving sixty miles an hour, would carry heavy *débris* some distance. The effect of these motions was to break up every object the whirl carried up with it; even lumber, taken up free from all contact with anything else, would come down, in many instances, in kindling wood.

In about half an hour after the vortex passed there was a return current from the north, accompanied with severe rain and hail and terrific electrical discharges. There was no thunder and lightning with the vortex, and very little if any rain.

The difficulty in obtaining exact and comprehensive information, from eyewitnesses, of what goes on in a storm of this nature is aptly illustrated by the following incident: A clear-headed and observant citizen of Collinsville, perceiving the approach of the storm, although some blocks distant, ran from a very dangerous position, and found himself only across the street, holding on to a loose stump, when the tornado passed over him. Afterward, while detailing the predicament he was found in, a bystander called attention to a large tree which had just escaped falling upon him. Looking at it for a moment, he quaintly remarked, "I never knew that tree fell there."

A New Weather Theory.

The Rev. Henry Roe, F.R.A.S. (Eng.), sends to the London *Times* a new theory of the weather. He claims to have determined by careful observations, covering nearly thirty years, that dry and wet periods succeed one another in alternate waves of nearly equal length. Not that this equality of duration is quite absolute, or that the wave of one period is exactly the same *facsimile* of that of a corresponding period at an earlier or a later time; but there is enough of regularity and uniformity about the waves to make the family likeness clearly discernible to any eye that looks for it.

These periods extend over three whole years for each, and the following simple rules will enable any one to work out the several cycles of years for himself:

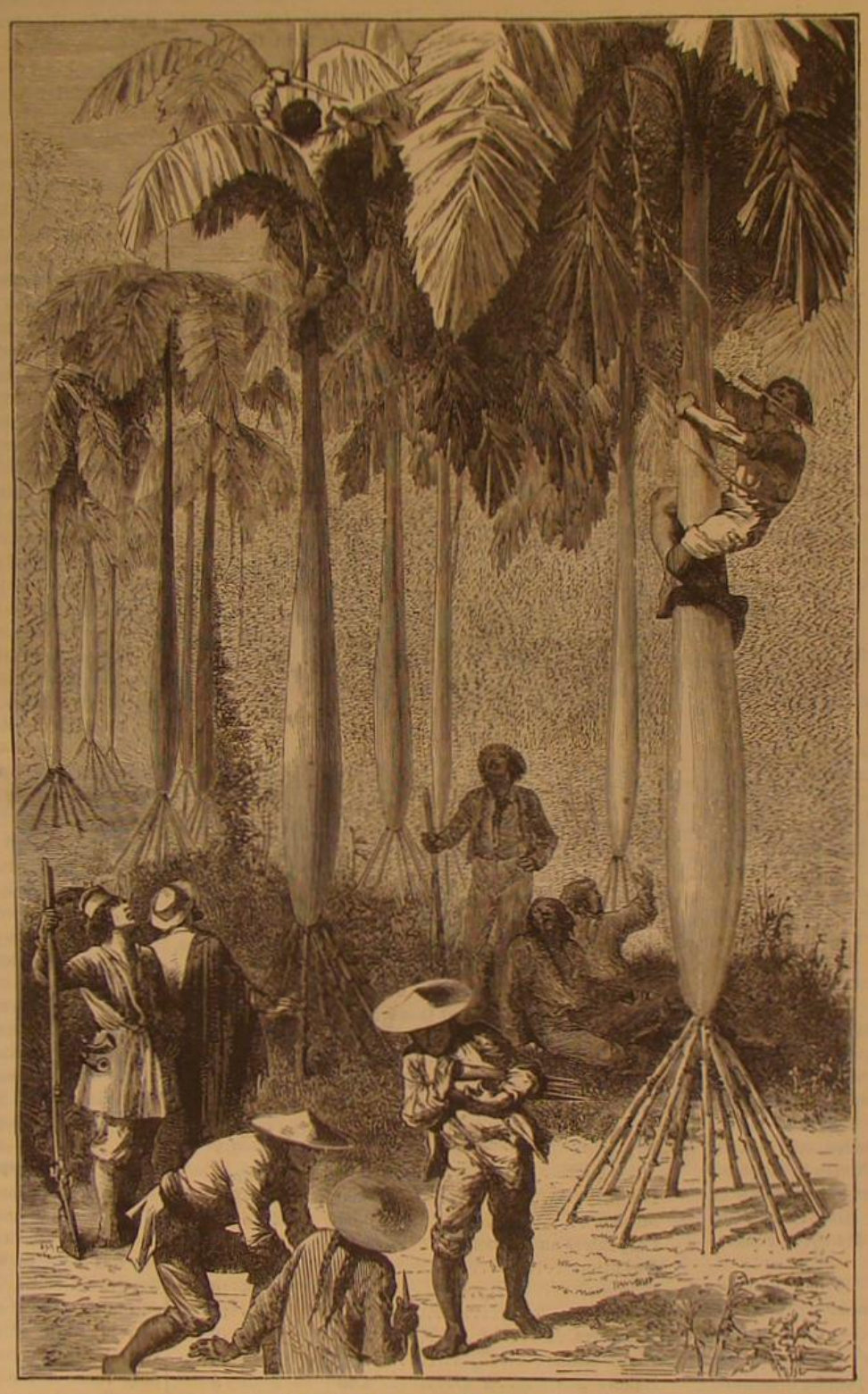
1. When the number representing any given year is even and exactly divisible by three, that year is the middle one of three cold and wet summers.

2. When the number representing the year is odd and divisible by three, then that year is the middle one of a triad of dry and hot summers.

After testing by these rules the successive seasons of the past twenty-seven years, and finding fact to conform to theory, Mr. Roe predicts that 1881 will be the middle one in a triad of hot and dry summers. What relations these dry and wet periods have (if any) to the recognized cycles of sun spots he has not made out; nor does an examination of recent seasons confirm the alleged harmony of theory with fact.

THE SWELLED TRUNK PALM.

The lower part of the trunk of this peculiar palm tree is swelled and supported from seven to nine feet above the ground by a number of radiating and inclined roots. These roots shoot out from the tree during the rainy season, and support it without aid from the main root, which finally disappears. The leaves are from 10 to 14 feet long. This tree is found on the banks of the Amazon. The illustration is copied from *La Vie Végétale*.



THE SWELLED TRUNK PALM.—*Iriartea Ventricosa Mart.*

An Explosion of Starch.

Nearly two years ago a violent explosion occurred in a candy factory in this city, causing the death of thirteen persons. The cause of the explosion was never clearly known, though the evidence pointed strongly to the starch room as the source of the disaster. A similar, but fortunately less fatal, accident occurred in another candy factory in Elm street, August 7, under conditions which leave no doubt that starch dust was the explosive material.

The explosion took place in a drying room on the second floor, where the temperature ranges from 140° to 180°. The drying rooms are 5 feet by 6 and 6 feet by 8 respectively, and are 12 feet high. In each is a furnace kept constantly red hot. The walls are built strongly of brick incased in wood. In the rooms are arranged slides for starch boxes, in which the candies enveloped in powdered starch are placed to dry. The small room has slides for 2,000 boxes, and the large room slides for 3,000. Four men were at work in the drying room taking the candies from the racks. One was on a step-ladder to hand down the trays to the others, who stood around the furnace. He had five trays in his hands, and was about to hand them down when his foot slipped on the step-ladder, the trays fell, and in falling turned over so that a heavy cloud of heated starch dust was thrown against the red hot furnace. The sharp explosion that followed shook the building and filled the room with a sudden flame. The intensely dried woodwork of the drying room caught fire instantly, and the apartment was swept by flames which threatened the entire building. The hands of the factory, however, attacked the flames and extinguished them before any serious damage had been done. The four workmen were severely but not fatally burned.

MECHANICAL INVENTIONS.

An improvement on what is known as the "slow" or bark tanning process has been patented by Mr. George King, of Washington, D. C. Its chief feature consists in alternately subjecting the skins or hides to the action of fresh tanning liquor, then raising them out of it and allowing the liquor to drip or drain off, and, lastly, conducting that portion of the drained liquor which was last in contact with the hides back into the leach to be again passed through the bark, and thus strengthened by taking up an additional quantity of the astringent principle or tanning agent. The apparatus consists of a rotating drum, in whose several compartments the hides are placed, and into which the tanning liquor is constantly fed, and from which it is being constantly withdrawn when its strength has become partly exhausted.

Mr. William H. Watson, of Cheshire, Ohio, has patented an improvement in hay presses which embodies several novel features that cannot be clearly described without an engraving.

Mr. James A. Webster, of South Boston, Va., has patented improved attachments for sawing machines, for converting a sawing machine into a planing machine at a small expense, so that the timber may be sawed or resawed and dressed upon the same machine.

An improvement in the class of wooden axle-skeins provided with a tapering extension for receiving the ends of the axle, has been patented by Mr. Philip Neder, of Stockton, Utah Ter. The improvement consists in hooks, by which the skein is secured to the axle, so as to prevent its endwise movement thereon.

Mr. Joseph V. Morton, of Winchester, Ky., has patented a door fastener that is adjustable to doors of different thicknesses. The invention consists of two handles pivoted to a common connection that extends through the door and connected at the top with a wedge piece that operates the latch. The handle on one side of the door is pushed to open the door; the handle on the other side is pulled.

An improved device for feeding paper to ruling machines has been patented by Mr. John S. Young, of Philadelphia, Pa. It is simple and reliable, and is capable of feeding the paper to the machines one sheet at a time or continuously. It may readily be adjusted to feed thicker or thinner paper, as may be required.

An improved machine for forming dovetailed veneer boxes, so constructed as to form the boxes out of seasoned veneer, has been patented by Mr. David F. Noyes, of Lewiston, Me. The machine, although very simple, cannot be explained without an engraving.

Mr. Harvey Smoot, of Maurertown, Va., has patented a washing machine that is an improvement upon the washing machine constituting the subject of letters patent No. 127,075. In that machine a reciprocating dasher or plunger alternately exerts mechanical pressure on the clothes, and changes their position by the force of the reactive flow of water. The improvement pertains to a trough-like support, receptacle, or holder for the clothes while being soaped, and after having been washed.

Improvements in the buckets of turbine water wheels and the devices for operating the gate ring and governing its movement, have been patented by Mr. Isaac Mallery, of Dryden, N. Y. The object of the invention is to increase the power and durability of the wheel and simplify its construction.

Farm Wages and the Cost of Living.

The Department of Agriculture has been gathering information in every county in the United States, with regard to the wages paid to farm laborers and the average cost of living, for a chapter in the forthcoming report of the Commissioner.

The returns disclose the fact that in all quarters of the Union (with the exception of Minnesota, California, Colorado, Oregon, New Mexico, and Washington Territory) the average monthly rate of pay for farm laborers declined during the year ending last April from 3 to 15 per cent. At the same time, the expense of living in the majority of States declined in equal or greater proportion, so that the relative condition of the laborer really improved during the year.

The average rate of pay in New England for farm laborers on yearly engagements, without board, averages $20.31 per month, against $22.60 at the beginning of the year, a decline of 10 per cent. The average cost of living has fallen from $9.13 to $8.02 per month, a decline of more than 13 per cent. In the Middle States the conditions were reversed, the ruling monthly pay of the farm laborer being $19.69, a decline of 7 per cent, while the average cost of living had declined only 4 per cent. In New York alone farm laborers receive 8¾ per cent less than they did a year earlier, and pay 10 per cent less for their living. The South Atlantic States reduced labor 15 per cent and subsistence 16 per cent, and in the Gulf States labor fell 5 per cent and subsistence only 3 per cent, the average pay in the former being $11 19, and in the latter $14 80 per month. In the nine inland States east of the Mississippi, the monthly pay varies from $15.50 per month south of the Ohio, to $20.90 in the north, the rate of decline in wages being a fraction less than that of the cost of living; while in the six States west of the Mississippi the present average pay for farm labor is $23.81 per month, a slight increase over that of a year earlier, and the price of subsistence falls off about 2 per cent.

West of the Mississippi the increase in the rate of wages is chiefly due to the extension of mining operations. In this region a large number of artisans have appropriated public lands and seek to pay for their claims by working a part of the time at their trades. Quite a number of farm laborers have done likewise, and they work part of the time for wages on the farms of others. The large immigration has enlarged the stock of labor, but it is to a great extent somewhat inefficient in character. All who desire work can get it. No surplus is reported from any county in Colorado. In the two Pacific States the average monthly pay of farm laborers is $38.22 against $36.62 one year earlier, an increase of 4⅕ per cent, while the cost of living has increased fully 18 per cent. In New Mexico, Dakota, and Washington Territory there is a demand for skilled and unskilled American labor at remunerative wages. In Utah laborers receive $28.87 per month, a decline of 7 per cent during the year, and a surplus of labor is reported.

In the New England and Middle States there seems to be a surplus of labor in certain localities and a deficiency in others, which should render the average demand about equal to the supply. The general rate of pay for skilled labor—shoemakers, blacksmiths, carpenters, etc.—is slowly rising, and is believed to mark the return of better times for the farm laborers.

A statement of the average rate of wages paid to agricultural labor in several countries in Europe will be of interest as affording a basis of comparison between the condition of the American and the European farm laborer. From the tables prepared for the report of Secretary Evarts upon this subject the following information is gathered, the figures referring to the year 1878: Agricultural laborers in England receive, without board or lodging, an average per month of $15.60; in Ireland, $14.73; in Scotland, $19.42; in Normandy, $12.44; in Italy, $15.19, in Spain, $14.95; in France, $13.65.

Wages and Prices in France.

In an official review of the consular reports from France, Secretary Evarts says that "the French working people have, more truly than any other working people, illustrated that commendable phase of political economy—getting the greatest possible result out of the most limited means. They look squarely and sensibly at their capital, and then limit their requirements within that capital; make the most and best of their lot, and fling a halo of sentiment about their lives of toil. For these reasons the work-people of France, with as little remuneration and as scanty fare as those of almost any other country—much less than many of their neighbors—are the happiest and most contented labor population in Europe." Agriculture is the greatest industry of France. There are 10,000,000 land-owners, and 18,000,000 persons are engaged in that pursuit. The weekly wages paid to agricultural laborers throughout the republic are set down as follows: Men, without board or lodging, $3.15; with board and lodging, $1.36; women, without board or lodging, $1.10. Notwithstanding these low wages, it is stated that the French farm laborer not only supports himself and family upon them, but in many cases saves enough to become a landed proprietor. The Consul at Bordeaux writes that "farm laborers are frequently economical to avariciousness, and many of them, in the course of time, become quite wealthy proprietors." The Consul at La Rochelle, where the French peasant still preserves his primitive manners and rural virtues, says: "Upon these wages the agricultural laborer not only supports himself and family, but saves money. The country is free from tramps. The laborer thrown out of employment, yet always willing to work, at once starts out, with his loaf of bread under his arm and his gourd of sour wine swung over his shoulder, confident of finding employment promptly." The Consul at Lyons writes "I regard the condition of the agricultural classes of the United States as much superior to that of those in France, yet from the systematic and economic habits of the farmers of France, as a general rule, the French farmer, small as well as large, is better off than his brother agriculturist in the United States." In many districts in France the laborers supplement their agricultural earnings by secondary employment, such as weaving, wood-cutting, sawing, wooden shoe-making, etc. The Consul at Lyons says that from 8 to 10 per cent of the agricultural laborers in his district are engaged in these secondary employments, which yield to each laborer about $40 per annum. Not only must the husband labor for the support of his family, but the wife and children must also labor for the general fund in order to make ends meet. The married farm laborer, who supports and lodges himself, may earn in the Lyons district $150 per annum, divided as follows: husband's wages, $80; wife's wages, $30; children's wages, $40. The cost of living to such a family, per annum, is calculated as follows:

Rent	$10 50	Milk	$5 25
Bread	55 00	Clothing	25 00
Meat	10 00	Groceries	10 00
Vegetables	8 25	Fuel	8 00
Wine, beer, and cider	7 00	Taxes	2 00
Total			$141 00

In view of the facts shown by the foregoing figures, viz., that the French farm laborer, when assisted by his wife and children, can earn only $150 per year, while the cost of his living expenses is $141, the Consul at Lyons makes a large demand upon American credulity in asking Americans to believe that "the French farmer, small as well as large, is better off than his brother agriculturist in the United States."

Wages and Prices in Belgium.

The review, by Secretary Evarts, of the consular reports received from Belgium, shows that the working people of that country are happy and contented, notwithstanding their lives are continual struggles for a meager subsistence; that they are frugal and industrious, and live within their means; and that a feeling of reciprocity exists between the employer and the employed. It is thought that this reciprocity of feeling is made necessary in order to enable Belgium to compete with English, French, and German manufacturers in foreign markets, and thus secure employment for their own working men. A few years of misunderstandings between capitalists and laborers, such as periodically convulse England, would paralyze Belgium and ruin both employers and employes. Such is the reciprocity of feeling between capitalist and labor, that manufactories or workshops are scarcely ever closed; the employers, in the dullest of times, preferring to run them even at a loss rather than throw their employes out of work, and the latter, under such circumstances, cheerfully complying with a reduction in hours and wages, cutting down their already bare necessaries of life to tide over the dark hour, confident that when better times return the full time and wages will be again restored. Were it not for this reciprocal feeling which unites labor and capital, Belgium would be scarcely known as a commercial or manufacturing country. The following table will show the weekly wages paid in Belgium, compared with those paid in New York.

	Brussels.	New York.
Bricklayers	$6.00	$12 to $15
Masons	6.00	12 to 18
Carpenters and joiners	5.40	9 to 12
Gas-fitters	5.40	10 to 14
Painters	4.20	10 to 16
Plasterers	5.40	10 to 15
Plumbers	6.00	12 to 18
Blacksmiths	4.40	10 to 14
Bakers	4.40	5 to 8
Cabinet-makers	4.80	9 to 13
Saddlers and harness-makers	4.80	12 to 15
Tinsmiths	4.80	10 to 14
Laborers	3.00	6 to 9

Following are the prices of the necessaries of life:

	Brussels. Per pound. Cents.	New York. Per pound. Cents.
Bread	4 to 5	4½
Beef	16 to 20	8 to 16
Veal	16 to 20	8 to 24
Mutton	16 to 20	9 to 16
Pork	16 to 20	8 to 16
Lard	20	10 to 12
Butter	20 to 50	25 to 32
Cheese	20 to 25	12 to 15
Coffee	30 to 40	20 to 30
Sugar	15 to 20	8 to 10

The consul at Ghent says the rates of wages paid to agricultural laborers are from 17 to 20 cents per day to men, and from 15 to 17 cents per day to women, and their food. When hired as servants, with food and lodging, they are paid $1.75 to $2.00 per month. The consul at Brussels calls attention to the fact that during the years 1874 and 1875 over 12,992,611 francs value of United States gold coin was demonetized and converted at the Mint at Brussels into Belgian coin. How much of our money was thus converted into Belgian money previous to 1874 the consul had no means of knowing; how much, if any, has been so converted since 1875 the consul does not say.

Blushing and Blanching.

Blushing is occasioned by sudden dilatation of the small bloodvessels, which form a fine network beneath the skin, and when they admit an increased volume of red blood cause the surface to appear suffused with color. Blanching is the opposite state, in which the vessels contract and squeeze out their blood, so that the skin is seen of its bloodless hue. The change effected in the size of the vessels is brought about by an instantaneous action of the nervous system. This action may be induced by a thought, or, unconsciously, by the operation of impressions producing the phenomenon habitually. In a word, blushing may become a *habit*, and it is then beyond the control of the will, except in so far as the will can generally, if not always, conquer any habit. It is almost always useless, and certainly seldom worth while, to strive to cure a habit of this class *directly*.

The most promising course is to try to establish a new habit, which shall destroy the one it is desired to remedy. For example, if blushing is, as generally happens, associated with *self*-consciousness, we must establish the sway of the will over that part of the nervous system which controls the size of the vessels, by calling up a feeling opposed to *self*-consciousness. It is through the mind these nerves are influenced. Then influence them in a contrary direction by antagonizing the emotion associated with blanching. Thus, if the feeling which causes the blushing be expressible by the thought, "Here am *I* in a false and humiliating position," oppose, or still better, anticipate and prevent, that thought by thinking, "There are *you* daring to pity or feel contempt for another." Avoid going on to think who that "other" is, because the aim must be to eliminate self. Constitute yourself the champion of some one, any one, and everybody, who may be pitied, and the ever-zealous and indignant foe of those who presume to pity. Most persons who blush with self-consciousness blanch with anger, and this artificial state of mock anger will soon blanch the face enough to prevent the blush. It only requires practice in the control of the emotions and the production of particular states at will—the sort of expertness acquired by actors and actresses—to secure control of these surface phenomena. Blushing and blanching are antagonistic states, and may be employed to counteract each other, control of the physical state of the bloodvessels being obtained through the emotions with which they are associated.—*Lancet*.

Practical Co-operation.

A Swiss colony settled on Cumberland Mountain, Tennessee, in 1873. This colony of 115 families, about 700 people, purchased 10,000 acres of mountain land at $1 per acre, and now, after four years each head of a family has a comfortable home, an orchard, and garden with a profusion of mountain flowers. There is a large store that is managed for the colony, members of which get goods at wholesale cost; the colony has its own school, church, doctors, etc., and their own candidates govern. The colonists already have dairies and cheese factories in successful operation, and their products find ready sale at fancy prices. They have splendid herds of cattle, and their barns are built as carefully as their houses. There is also a colony of Swiss near Greenville, S. C., about as large as the Tennessee colony, and it is prospering finely.

A Specific for the Coffee Pest.

A correspondent of the London *Times*, writing from Colombo, Ceylon, announces the discovery of a certain cure for that most destructive pest, *Hemeleia vastatrix*. The discovery was made by the assistant director of the botanical gardens at Colombo, Mr. Morris, and consists in a mixture of sulphur and lime applied in a state of powder to the leaves and branches of the trees. One application suffices to destroy the filaments and spores in a few hours, and it now only remains for planters to resort to this most effectual remedy on an extensive scale, as the materials are to be had in abundance and the cost of application is trifling.

The Adirondack Survey.

Mr. Verplanck Colvin, Superintendent of the Adirondack Survey, began the survey of the Raquette River district at Potsdam, St. Lawrence Co., early in August. Arrangements had been made to occupy an astronomical station at that place, and to set up a substantial monument there recording the exact geographical position. It was proposed also to locate accurately all the important land lines, township corners, etc., in the Raquette River district, and mark them by stone monuments carrying nickel plated copper bolts.

Antiseptic Action of Acids.

According to Sieber a relatively small proportion of acid, 0·5 per cent, prevents putrefaction. This property is conspicuous in the mineral acid, and in acetic acid. Lactic and boric acids are much less effective.—*Journ. Prakt. Chemie.*

MR. FRIEDRICH WEGMANN, of Zurich, has recently patented in Germany the "application in roller mills of rollers whose coating shall consist of a homogeneous mass of porcelain, china, or glass, containing as much silica as shall be requisite to obtain the necessary degree of hardness for the process of grinding."

Snowballing in July.

A very novel spectacle was witnessed in New York city, last month, at Morrisania, where people were snowballing each other with genuine fresh snow, pressing it into big round balls, pelting each other with it, and slapping their half-frozen fingers on their thighs to restore circulation to the benumbed members. It was, of course, artificial snow, and made by the working of an ice machine just set going in J. & L. F. Kuntz's brewery.

The machinery, as usual in all ice machines of this class, consists of three parts—a compressing pump, a condenser, and a refrigerator. Aqua ammonia of the highest procurable strength, is poured into a small still and heated until the ammoniacal gas is all driven off into the condenser. There, by the compressing pump, it is liquefied, at a pressure of six and a half atmospheres in a temperature of 50° Fah. The liquid gas is passed thence, through small tubing, into the refrigerator, which is a separate close chamber about 14 feet square; this chamber is the freezing box for the whole brewery. The refrigerator itself is a voluminous machine, consisting of eight coils, each 300 feet in length of continuous welded pipe, the whole forming a large cylinder 9½ feet in diameter. In these coils of pipe the gas, liquefied under pressure, reassumes its gaseous form, and in so doing takes up all heat about it. The cylinder is kept whirling swiftly, partly to promote the spread and expansion of the liquid, but more to enable a lot of huge brushes to sweep off constantly the snow which is continually forming from the atmosphere upon these pipes. A cart load of snow is thus swept off every day. But it is not nice snow. It is good enough for snowballs, but there its use stops, for the air from which it has been formed has been sucked up by a powerful draught from the depths of the lowest cellars, and every sour smell or taint in the atmosphere is transferred to this snow. The air driven down to replace that thus drawn up is not only freezingly cold, but is dry and pure, so that through all the vaults the atmosphere seems like that of the country on a winter's morning. After going through this great mass of tubing, the gas returns to the outer chamber, bearing with it all the heat it has taken up; and to get rid of this it is sent through 1,200 feet of piping, upon which water falls in a spray, and a great fan keeps up a constant cooling current of air. After that it is fit to pass into the condenser, and so around again. None is wasted; none escapes. Yet it maintains a temperature of 3° Reaumur (say about 38° Fah.) throughout three vaults, each 80 by 50 feet, with an average height of 11 feet, and even greater cold could readily be obtained were it desirable. The use of this apparatus enables the actual storage at one time of 50,000 barrels of beer.

It is claimed for the invention that it will save brewers a vast sum by diminishing the consumption of ice, and doing away with the necessity of constructing underground vaults of large dimensions.—*Manufacturer and Builder.*

LACE FAN.

The fan shown on this page is of French manufacture. The face is made of the finest lace, the pattern being designed and worked expressly for this purpose. Nothing more delicate and fairy-like could be imagined, nor could the most capricious beauty demand anything more exquisite.

Ozokerite, or Mineral Wax.

We make the following extracts from a letter, which appeared in the *Foxbury Gazette*, written by Mr. E. M. Grant, who has recently returned from a visit to the various oil-fields of Europe:

The production of oil in the Eastern Galicia oil fields is very limited at present in amount. The wells are mostly situated near Boryslaw, though there is one well south of Boryslaw about 45 miles, that is doing 8 to 10 barrels per day of nice green oil.

The wax fields of Eastern Galicia attract the most attention. This earth wax, or ozokerite, as it is called, is neither more nor less than oil that has been evaporated, leaving the residuum in a solid state, so that it is dug out with picks and shovels, and is about the consistency of common clay. It is very valuable, being worth from 7 to 8 cents a pound.

The shafts are from 350 to 600 feet deep and very close together, so close that, on the piece of land where this wax is found at Boryslaw, containing not over fifty acres, there are 10,000 shafts.

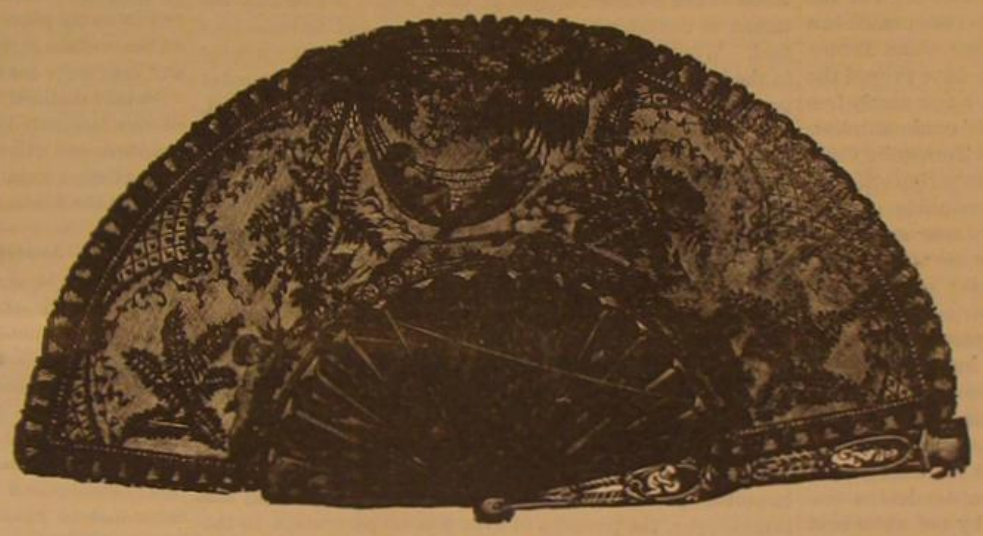
The walls of these shafts are curbed with timbers, but at the depth to which they go they are very thin, so that scarcely a day passes but the walls cave in, breaking the timbers like pipe stems, and burying several human beings beneath the great mass of earth. This thing occurs so frequently, that from four to six persons per week are killed in this manner.

Great fortunes have been accumulated by a few of the Jews who owned the land where the wax was found. The vein is about 16 inches thick, and the wax is carried out in buckets. Twelve thousand men live on that fifty acres of land, how, nobody knows. The wax is refined and made into candles. This being a great Catholic country, and a holiday occurring nearly every other day, candles are in great demand. Our party, consisting of Jas. H. Clark, John Huntington, James Carrigan, and Worthy Clark, of Cleveland, and Wm. L. Lay, of Oil City, took breakfast with a Polish gentleman at Boboka, and the conversation turning on earth wax, Mr. Lay said that there was a mountain of it in Utah, at which the old Polish gentleman exclaimed, "My God! the Lord is with America again! He gives Poland sixteen inches of earth wax, but He gave America a whole mountain." They all like America and Americans, most of them being republicans at heart. The wax field is fully developed and nearly exhausted, unless they should find something new.

In Hungary there is no oil of any account being produced, but there are surface shows all along the range of mountains on the Hungarian side, and some day it will be developed. The government will assist any one who really means business and desires to develop the country.

ENGINEERING INVENTIONS.

Mr. Cyrus B. Cook, of Cynthiana, Ky., has invented an improved combined governor and self-adjusting cut-off, which combines the governor and slide valve of an engine so as to cause the governor to automatically adjust the range of movement of the valve, and thus shorten or lengthen the cut-off automatically. The invention consists in connecting the valve and the governor by a hollow rock shaft, having a second central shaft within. The two shafts are coupled for independent movement, and are combined with an adjustable crank mechanism and a trip mechanism, operated directly by the governor, so that the governor sets in operation the trip mechanism, and allows the engine to act through the independent shafts to alter the throw of the valve rod.



EXQUISITE LACE FAN.

An improvement in water works has been patented by Mr. Paul B. Perkins, of Geneseo, Ill. The object of this invention is to supply water for domestic, manufacturing, and other purposes in cities and towns, and at the same time to furnish the requisite quantity of water under any desired pressure for extinguishing fires wherever the distribution pipes may be extended, by means of stationary pumping machinery discharging the water from its supply source into and through an air tight compression storage reservoir that is provided with the necessary pipes, valves, and fire hydrants, all connected with the town or city mains.

Mr. McWilliam F. Margach, of Meadville, Pa., has devised an improved balance valve, the object of which is to relieve the balancing device from contact with the top of the steam chest as soon as the steam is shut off, and to prevent the formation of a vacuum in the cylinder. It consists of a disk placed on top of the slide valve, and encircled by a ring, which, by the pressure of the steam underneath it, is forced up against the under side of the top of the steam chest, so as to shut off from the pressure of the steam the area on the upper side of the valve inclosed by it, but which is adapted to fall back from contact with the top as soon as the steam is shut off.

Messrs. Adam Moessinger and William Heathcote, of Glen Rock, Pa., have patented an improved gate for turbine water wheels. The invention consists in an arrangement of a circular or conical cap with slotted flanges operated by a rack and pinion, the flange covering the upper openings of the water course, and of a slotted cylindrical ring operated by an eccentric, which covers the lower openings of the water course.

An improved rotary valve and seat has been patented by Mr. Edward L. Watkins, of San Antonio, Texas. The invention consists in combining, with a valve seat having four ports, a rotary valve having a curved opening and recess. When the valve is driven at a uniform speed, the steam will be cut off at about half stroke, but, if desired, it may be so geared as to be driven at a variable speed, and arranged to cut off steam at any desired point of the stroke.

An improved oil well packing, having tapering split clamps and sleeves or thimbles fitting over them, for the purpose of holding an elastic packing, has been patented by Messrs Isaac La Foy and Jesse Siglin, of Bradford, Pa.

Hollway's Process.—The Use of Sulphides as Fuel in Metallurgy.

Mr. John Hollway has prepared the following summarized account of his process for the benefit of those who might not have had time or inclination to read the longer and more technical account given in Mr. Hollway's paper read before the Society of Arts, February 12, 1879.

This process has for its object the utilization of the heat generated by the rapid oxidation of certain mineral substances, which have not hitherto been used as sources of heat for smelting operations. The heat thus obtained is employed in the reduction of the furnace charge, which may be composed partly of sulphides and partly of silicious ores. A current of air is forced through molten sulphides, by which means they are very rapidly oxidized. Great heat is thus developed, rendering the process of smelting a self-supporting operation; therefore no extraneous fuel is required, excepting that employed in raising steam for the blowing engines; where, however, water power is available steam can be dispensed with, in which case all the carbonaceous fuel necessary for the operation is a little coke to start the furnaces, which stands in the same relative position to the ores as wood does to coal in the lighting of an ordinary fire.

It is well known that pyritous minerals are readily combustible, but the best means of utilizing the heat producing property of metallic sulphides is not so apparent as would at first sight appear. Of these sulphides only iron pyrites is sufficiently combustible at a low temperature to burn in the open air, the mass being raised to the temperature at which the oxidation takes place solely by the union of sulphur and iron with atmospheric oxygen. In Spain there are numerous deposits of poor cuprous pyrites, and the Rio Tinto and Tharsis Companies annually treat, at their mines, about one million tons for the extraction of copper only, which does not average 2 per cent. The process employed consists essentially in roasting the pyrites in heaps in the open air, dissolving out the copper from the roasted material, and precipitating it from the solution by means of iron. These operations extend over several months, any gold or silver contained in the ore is lost, and the iron and sulphur are also wasted. The sulphur passes into the air as an obnoxious and annoying gas, desolating the country for miles around the works.

From the earliest ages carbon has been considered a necessity in all metallurgical operations. The first reduction of metal by means of carbon forms a connecting link between the age of stone and the commencement of civilized art. It is well known that carbon burns at widely varying temperatures, as, for example, in our bodies, in a common coal fire, or in a furnace. A great deal of thought has been devoted to the subject of economizing carbonaceous fuel, and great advances have been made in this direction, yet the expenditure of coal or coke necessary say, to melt a given quantity of metal still far exceeds the theoretical limit. The main causes of this discrepancy may be accounted for as follows:

1. Only part of the oxygen of the air passing into a furnace, acts on the material to be burnt.

2. The oxygen is not brought in contact with the combustible matter with sufficient rapidity to obtain the necessary temperature for the operation.

3. Gases pass off hot and unburnt. These are now, however, frequently utilized.

There is one metallurgical operation in which the first two sources of loss are avoided, viz., "Bessemer's," where, by blowing air through molten crude iron a very high temperature is attained by the combustion of small quantities of carbon and silicon contained in the crude iron; this is, however, not the case in the process of puddling, where the oxidation is spread over a considerable period of time, although the same constituents are frequently burnt in similar proportions. But even in the Bessemer process the carbon is only half burned, and a large amount of heat escapes with the carbonic oxide and nitrogen.

When, however, thin streams of air are forced through molten sulphide of iron lying on a tuyere hearth, a high temperature is produced by the perfect combustion which ensues in the midst of the sulphides, and no unburnt gases, excepting nitrogen and sulphur vapor, escape from the surface of the molten mass. The hot nitrogen and sulphurous acid may be caused to act upon iron pyrites and other mineral matter, and when pyrites are thus heated an atom of sulphur held in feeble combination is in great part expelled, and thus is obtained molten protosulphide of iron, which is subsequently burnt by the oxygen of the air driven in at the lower part of the furnace, thereby producing the heat necessary for continuing the operation. The process may be defined as a system of fractional oxidation, in which the numerous constituents of a complex furnace charge can be separated from each other and concentrated in different parts of the apparatus, the heat necessary for the operation being obtained by the combustion of a portion of the less valuable constituents.

The principal ores of all our ordinary heavy metals, except manganese and tin, are sulphides. Iron, although largely occurring in an oxidized form, is abundantly found in combination with sulphur; and bi-sulphide of iron, or iron

pyrites, is an example of sulphurous and combustible minerals. Associated with the iron and sulphur in iron pyrites are invariably found small quantities of other metals, notably cobalt, nickel, copper, silver, gold, lead, zinc, and arsenic. Of these, zinc is almost as combustible as iron itself, while lead and arsenic readily volatilize as sulphides, and cobalt, nickel, and copper are distinctly less readily oxidizable than iron, while silver and gold do not oxidize under these conditions; hence, in supplying air to such material, the iron is the first of the elements to suffer oxidation, so that if the oxidation be arrested before the whole of the iron has been burnt, the cobalt, nickel, copper, silver, and gold present will be found in the unburnt portion. This principle finds a parallel in the Bessemer process of treating pig iron for the manufacture of steel, where a current of air is caused to bubble up through a bath of molten crude iron; the silicon is first oxidized, and is closely followed and to a great extent accompanied by the carbon, and no large amount of iron suffers oxidation, until the whole of the silicon and carbon have been burnt out of the molten material.

The experiments made at Messrs. Cammell's works, at Penistone, in a Bessemer converter, have proved that by blowing air through molten sulphide of iron, the iron and a portion of the sulphur are oxidized, and if the oxidation is arrested before the combustion of the iron is complete, a heavy matte or regulus is obtained, which contains but a small proportion of the iron of the ore, but practically the whole or the greater part of the copper and other less oxidizable metals. In one of these experiments the molten sulphides were run into the converter from a cupola, in which they had been previously melted, and the temperature was kept up until the operation was discontinued, viz., for a period of ten hours, without the use of any carbonaceous fuel, the heat being entirely derived from the oxidation of the iron and a portion of the sulphur of the lumps of pyrites, which were continuously thrown into the mouth of the converter. A Bessemer converter being unsuited for the collection of the gaseous products, the latter experiments have been made in a series of cupola furnaces belonging to Messrs. John Brown & Company, Limited. These experiments have proved the possibility of obtaining a valuable regulus, a slag nearly free from copper, and a considerable quantity of crude sulphur. M. Pourcel, the well known chemist of the Terrenoire Company, has also made some very interesting experiments, having treated by this method a cupriferous sulphide of antimony containing lead and zinc, using heavy spar and silica as fluxes; he obtained a regulus containing the whole of the copper in the form of sulphide, a slag of light specific gravity, and the lead, zinc, and antimony as two separate sublimates, which were condensed in different parts of the apparatus, owing to the superior volatility of sulphide of lead over the oxides of antimony and zinc. In the experiments at Penistone and at Sheffield a cold blast of air was employed, and the gases which passed from the converter or furnace into the open air, carried away with them a large amount of heat. In practice, however, it would be economical to employ a hot blast, which could be heated by the waste heat from the escaping gases. It is remarkable that the least valuable metals, viz., iron and zinc, generate by their combustion the largest quantities of heat.

The process may be employed for the reduction of even the more volatile metals, for example, Mr A. H. Allen, of Sheffield, has thus obtained metallic antimony simply by the oxidation of sulphide of antimony. It is well known that sulphide of lead reacts upon oxide of lead with the production of metallic lead and sulphurous acid. If, therefore, a limited amount of air is blown into molten sulphide of lead, the oxide thus formed in the lower part of the furnace will, in passing upward, come in contact with the hot sulphide of lead, and metallic lead will result with the evolution of sulphurous acid. The furnace having a quiescent hearth below the tuyeres, the metallic lead will collect there, and can be from time to time withdrawn. A limited amount of air must be employed, because if it is driven in too quickly the sulphide of lead would rapidly distill off. In thus treating argentiferous lead ores the silver (and gold if present) would be found with the first metallic lead reduced. When thus treating galena the furnace should have a basic lining.

The process is peculiarly suitable:

1. For the treatment of metalliferous substances which cannot be advantageously treated by other processes. For the extraction of sulphur by distillation, and simultaneously for the concentration and separation of cobalt, nickel, copper, silver, and gold from minerals in the form of metallic regulus; while lead, zinc, antimony, arsenic, etc., accrue in the sublimates.

2. For the treatment of complex ores, for example, gray antimonial copper ores, such as those experimented upon by M. Pourcel. Ores similar to those worked at the well known Bottino Mines, Seravezza, in the Italian Apennines, which contain thirteen or fourteen heavy metals, including silver and lead, for which latter alone they have been worked for centuries. The blende of lead mines, in Derbyshire termed "muck," usually thrown away by the miners, because the large quantity of lead with which it is associated renders the zinc obtained from it worthless.

3. For the treatment of auriferous and argentiferous pyrites. It is well known that in practice it is not possible to obtain the whole of the gold from pyrites by amalgamation with quicksilver, because the presence of sulphur and arsenic sickens and flours the mercury, whereas by fusion the whole of the silver and gold present is obtained.

4. For the treatment of pyrites containing even only small percentages of cobalt, nickel, and copper, which are thus concentrated into a rich regulus, whereas this result is now only obtained by very tedious processes of alternate roasting and reduction. Such ores containing 10 per cent and even 12 per cent of copper exist in South America and many other parts of the world, but are not at present capable of economic treatment, owing to the difficulty of obtaining a sufficient supply of cheap fuel. The process can also be advantageously applied to the treatment of richer ores of copper such as are at present smelted at Swansea.

5. For the treatment of poor lead ores. If such ores are added to a furnace charge of cuprous pyrites, the silica they contain will be utilized and combine with the resulting oxide of iron to form a slag, the galena will be volatilized and be recovered as a sublimate, while any silver present will enrich the regulus. At present, by a costly process of crushing and washing these ores, the galena is concentrated, although a large proportion is left with the *débris*, and passes with the water into the streams, rendering the existence of fish in such waters impossible. The water power now used for washing the ore could, in many cases, be employed for producing the blast.

When thus treating cupriferous iron pyrites, four products are obtained:

1. A matte or regulus containing from 30 to 50 per cent of copper, any trace of cobalt, nickel, silver, or gold the ore may contain, the rest of it being iron and sulphur, it has a specific gravity of 4½ to 5.

2. A slag consisting of silicate of iron from the resulting oxide of iron combined with the silicious matters contained in the ore and the fluxes added.

3. Sublimed sulphur, more or less mixed with volatile compounds of lead, zinc, and arsenic.

4. Sulphurous gases, consisting mainly of sulphurous acid and nitrogen.

The regulus closely resembles, and will replace, the coarse metal of the Swansea copper process, which is now only obtained at considerable cost of labor, time, and carbonaceous fuel. When, however, sulphides of iron and copper present in the bath are treated continuously by a blast of air a point is at length arrived at when the whole of the iron is oxidized, and the regulus in the bath consists of sub-sulphide of copper. If, now, a limited supply of air is introduced, the copper is reduced to the metallic state with the evolution of sulphurous acid.

The slag obtained in the Penistone experiments was essentially silicate of iron containing about 50 per cent of iron and 29 per cent of silica. It had density of about 3·8 to 4, and was in composition somewhat allied to the copper-smelter's ore furnace slag and to the tap-cinder of the iron puddler. By the addition of the calcareous materials, the specific gravity of the slag is so reduced as to cause it to separate readily from the regulus which collects below it. In one of the later experiments, when lime was used, the proportion of copper lost in the slag was very small. This is, of course, a most important point, for when dealing with ores containing but little copper, the presence of even a small percentage in the slag means the loss of a considerable proportion of the copper present. These slags can be utilized for the manufacture of steel, being practically silicious iron ores free from phosphorus, and their reduction in a blast furnace can be profitably effected, as the proportion of iron present is high as compared with the weight of the material, indeed, it may be possible to reduce them while in a molten state.

By resubliming the crude sulphur it can be freed from all impurities except arsenic, and at the works of Messrs. John Hutchinson & Co., Widnes, this is eliminated by means of polysulphide of calcium.

As a certain proportion of the sulphur of the minerals suffers combustion, the resulting sulphurous gases contain from 14 to 15 per cent of sulphurous acid, and hence the proportion of sulphurous acid to nitrogen is nearly identical with that of the gases produced by roasting pyrites in the kilns employed by vitriol manufacturers, and can, therefore, be used with equal advantage for the production of vitriol in leaden chambers. This appears to be the simplest solution of the great problem how to smelt copper without causing a nuisance to the surrounding neighborhood, although a similar result might be obtained by collecting and liquefying the sulphurous acid.

The more incombustible materials it is found practicable to employ without too great a loss of temperature, the wider will become the application for the process; for there are many ores, including silicates and carbonates, containing metals in the form of oxides, which might be conveniently smelted by mixing them with a sufficient proportion of pyritous ores to effect their reduction; in fact, one of the chief practical questions connected with this process is how far it may be trusted to effect the smelting of ores or furnace charges containing comparatively moderate proportions of sulphides.

It is evident that it will almost entirely obviate the necessity for using carbonaceous fuel, at least as far as the production of a regulus is concerned, and consequently the localities in which smelting operations may be advantageously carried on are thus greatly multiplied. One of its chief merits is that it is equally applicable, with comparatively little extra cost in the working, to very poor and very rich ores, for however small the resulting regulus, it will contain nearly the whole of the cobalt, nickel, copper, silver, and gold present in the furnace charge, while any lead, zinc, antimony, and arsenic will be obtained as sublimates.—*Journal of the Society of Arts.*

Yellow Fever.

Dr. Stanford E. Chaillé, chairman of the Havana Commission, has investigated the facts relative to the prevalence of the disease upon the island of Cuba, and finds that "more than twenty years ago out of thirty-six towns only two insignificant ones were free from it; every seaport town had it." He claims that the first authenticated epidemic occurred in 1761 instead of 1762, and that it has continued endemic in Havana ever since the former period.

From Dr. D. M. Burgess the following facts were obtained by Dr. Chaillé relative to the steamer Niagara:

"The steamer Niagara, of the line of Ward & Co., is a first-class iron passenger steamer, and made her first trip June, 1876. Notwithstanding due cleanliness, etc., she went into New York with yellow fever on board on her fourth trip, about September, 1876, and has had cases on board every season since that time. These facts were obtained from the captain, and are attributed by him and Dr. Burgess to faulty structure and continued infection, which both gentlemen deem remediable. The result of this faulty structure is that some two inches of bilge water cannot be pumped out. Dr. Vanderpoel, of New York, has been notified of the chief facts. Two cases developed upon her last trip from New York prior to her entering the harbor of Havana."

Flour Mixed with Mineral Substances.

The author's method for detecting the tenth of a milligramme of alum, magnesia, chalk, gypsum, arsenious acid, etc., added to 10 grammes of flour, depends on the insolubility of the flour of wheat, rye, barley, etc., in chloroform; on their specific gravity, which is less than that of chloroform, and on the specific gravity of the mineral matters, which exceeds that of chloroform. He takes a perfectly dry glass tube 20 centimeters in height, and 2 to 3 in diameter; 10 grammes of the flour are introduced, the tube is nearly filled with chloroform, corked, and shaken for a minute. It is then let stand in an upright position, and in a cool place for some time. The flour which floats on the surface is removed, the chloroform is decanted off and may serve for new operations, and the deposit is treated with cold distilled water, which dissolves alum. The substances insoluble in water are collected on a filter, dried, weighed, and examined physically and chemically. Mineral salts existing naturally in the flour are not deposited, but remain in the floating layer.—*C. Cailletet.*

American Institute Exhibition.

It will not be the fault of this paper if the coming Exhibition of this Institute should prove to be a chaotic mass of half arranged merchandise on the opening day, September 17, for we have so often given notice of the fact that an exhibition is to be held, and have as repeatedly given notice of the time; nor will it be the fault of the officers of the Institute, for the building is always ready in time, but will, we presume, be the fault of the exhibitor, who, as a general rule, procrastinates and is often many days behind. We should think that an exhibitor would desire that his exhibit should be arranged upon the opening day, and not a week or ten days later. For information address General Superintendent, Room 22, Cooper Union Building, New York.

The Effect of Great Pressure upon Powdered Substances.

Mr. Spring, a member of the Belgian Academy of Science, has made several very interesting experiments on the above subject with the following results, as reported in the *Chemiker Zeitung:*

In a hollow steel bar, the sides of which were $\frac{64}{100}$ of an inch thick, he subjected several powdered substances to a pressure of 20,000 atmospheres (133 tons per square inch). Molten and powdered saltpeter was pressed into a solid hard mass like porcelain. Powdered popiar wood was pressed into a block of much greater hardness than that possessed by the wood itself. The specific weight of the powder was 0·389, and that of the compressed block, 1·328. A powdered grindstone was transformed into a new stone of the same hardness as the original one. The same was the case with chalk.

Uralium, a New Metal.

As far back as 1869 the author discovered this metal in commercial platinum obtained from Russian ores. Next to silver it is the whitest metal known; its malleability is as great as that of the purest platinum, but its ductility is much greater, and it is almost as soft as lead. Its melting point lies near to that of platinum, and it is not volatile. Its specific gravity =20·25, and its molecular volume, like those of osmium, platinum, and palladium, is 6·25. Its atomic weight has been found 187·25. In its chemical properties it is difficult to distinguish from platinum.—*A. Guyard.*

The International Dairy Fair.

At a meeting of the Board of Managers of the International Dairy Fair, August 12, it was resolved to hold the fair during the second and third weeks of December next, at the American Institute Rink. The president, Mr. Thurber, was about to sail for Europe, and was empowered by the association to invite all the agricultural societies of England and the Continent to send butter and cheese to the fair for exhibition and competition with American products. Letters from cattle raisers in various parts of the country encourage the managers of the fair to believe that they will have a much larger number of blooded bulls and cows on exhibition this year than they did last.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

Golden Healing Ointment. See adv., page 157.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Patent Reports for sale.—1855 to 1871, 46 vols., 1874 to 1877, 8 vols.; perfect. J. S. Moody, Saco, Me.

For Steam Launches, Engines, Boilers, and Propeller Wheels, address W. J. Sanderson, 21 Church St., Syracuse, N. Y.

Cut Gears for Models, etc. (list free). Models, working machinery, experimental work, tools, etc., to order. D. Gilbert & Son, 212 Chester St., Philadelphia, Pa.

Steam Yacht for sale. G. F. Shedd, Waltham, Mass.

Wanted.—A first-class Machinist or Millwright familiar with hard wood working machinery; one who has had charge of men preferred. Give age, nativity, and experience. Address, with reference, Cincinnati Cooperage Company, Cincinnati, O.

Notice—To Builders of Stationary and Portable Steam Engines, Machinists' Tools, Sugar Plantation Machinery, Pumps, etc., etc., a situation as superintendent or foreman. Address, for two weeks, P. O. Box 340, Beverly, Mass.

Patent for sale of the easiest, most convenient, and useful Monkey Wrench ever invented. W. D., Box 81, Rockland, Mass.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Magnets, Insulated Wire, etc. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Inexhaustible Beds of Kaolin or Clay.—Wanted experienced pottery men to take an interest in the white, pink, and yellow kaolin beds. Digging and shipping on cars will cost 50 cents per ton. M. J. Dobschutz, Belleville, Ill., Agent.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Eclipse Portable Engine. See illustrated adv., p. 157.

Bradley's cushioned helve hammers. See illus. ad. p. 142.

Band Saws a specialty. P. H. Clement, Rochester, N.Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Yacht Engines. F. C. & A. E. Rowland, N. Haven, Ct.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

New 8½ foot Boring and Turning Mill for sale cheap. A first class tool. Hilles & Jones, Wilmington, Del.

Wanted.—Responsible party to build and introduce Thomas' Patent Steam Wheel. Monopoly to right party. Write for description and particulars, to J. C. Thomas, Carlinville, Ill.

Cooper Manufacturing Company, Mt. Vernon, Ohio, Manuf's of Stationary, Portable, and Traction Engines, Saw Mills, Grist Mills, Mill Machinery, etc. Engineers and Contractors. Circular free.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Rubber Belting, Packing, Hose, and all kinds of manufacturers' supplies. Greene, Tweed & Co., 18 Park Pl., N.Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Solid and Opening Die Bolt Cutters, Screw Plates, and Taps. The Pratt & Whitney Co., Hartford, Conn.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Having enlarged our capacity to 96 crucibles 100 lb. each, we are prepared to make castings of 4 tons weight. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 78.

Steam and Gas Fitters' Tools a specialty. Send for circulars. D. Saunders' Sons, Yonkers, N. Y.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Walrus Leather, Solid Walrus Wheels; Wood Wheels covered with walrus leather for polishing. Greene, Tweed & Co. 18 Park Place, New York.

NEW BOOKS AND PUBLICATIONS.

THE THEORY OF SHIPBUILDING (Theorie des Schiffes). By Victor Lutschaunig. Trieste, Austria: F. H. Schimpff. 1879.

The author of this work is the professor of shipbuilding at the Royal Commercial and Nautical Academy in Trieste, and has arranged the same to conform with the course of lectures he delivers at the above institution. All the formulas and results are computed by means of differential and integral calculus and analytical geometry, and only the theoretical part of shipbuilding has been regarded. The first chapter treats of the formulas, with their derivation, for the calculation of the center of displacement, the immersed section, and the entire displacement of a ship in or out of equilibrium. The second chapter treats of the meta center and the dynamical stability. The succeeding four chapters treat of the waves and their action upon the ship, the oscillations of ships in still water, and the resistance produced by the waves. The seventh and last chapter treats of the strength of the ship and the forces that tend to destroy the same. Formulas for obtaining the moment of inertia for different sections are annexed, and will be found of great use to every scientific shipbuilder.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. H. asks for the process of bluing steel without heat. A. Mix finely powdered Prussian blue with rather thin shellac varnish; gently heat the steel, and apply the varnish.

(2) D. H. asks: What chemical difference is there between red and white arsenic? We use considerable red arsenic; the color makes no difference to us; would prefer white, on the score of economy, if the properties were the same as in the red. A. The red arsenic you refer to is probably realgar or orpiment—sulphides of arsenic. White arsenic is arsenious acid and contains no sulphur. They are both poisonous, but in other respects are quite different.

(3) J. P. L. asks how fast it is safe to run a ¼ inch power punch punching iron 3-32 inch thick, or how many holes ought it to punch per minute. A. It will be determined by the rapidity with which you can move and set the plate and clear the punch. Probably 18 to 20 per minute.

(4) J. L. P. asks: How many pounds of resisting air pressure would there be to the square foot, going at the rate of 20 miles an hour, at 30, at 40? A. At 20 miles per hour, 2 lb. per square foot; at 30 miles per hour, 4½ lb. per square foot; at 40 miles per hour, 8 lb. per square foot.

(5) B. G. V. writes: 1. We have a Bell telephone here which we sometimes use in connection with an Edison some eighteen miles distant. There is a continual crackling noise during the whole time they are connected. What is the cause and remedy for it? A. If your telephone line runs parallel with and near a telegraph line the crackling noise is probably due to currents induced by the telegraph line. The remedy will be to use an induction balance, or to shift your line to another set of poles. 2. In the quartz mill at this place there is a large rubber belt running on wooden pulleys, on which there is a large amount of electricity generated. Can it be used to run an electric pen such as described in the SCIENTIFIC AMERICAN? A. No; frictional electricity is not adapted to the propulsion of machinery. 3. Will it answer the purpose of a battery and induction coil? A. It might possibly be used with a voltaic pencil, but it would not replace a battery and induction coil.

(6) W. R. writes: 1. I am to put a pump (the cylinder 2 inches in diameter) into a well 100 feet deep. Which should I use, 1 inch or 1¼ pipe? A. 1¼ inch pipe. 2. Will the additional weight or increase in the size of the column of water make any difference in the working of the pump, provided that it is operated in both cases at the same rate of speed? A. No. 3. Would it be preferable to locate the cylinder in the water (near bottom of well)? A. Locate pump within 16 to 18 feet of the water. 4. In case the larger pipe is used, it is necessary to lift a larger amount of water, and consequently an additional amount of power would necessarily have to be expended in operating the pump? A. No more power required.

(7) T. L. M. asks: How many pounds weight can be raised with a line 1¼ inches in diameter rove through a double and triple block and a snatch? A. For working strain, 1,800 lb. safely; maximum breaking weight, 9,000 lb.

(8) L. F. B. asks if an upright engine should be balanced by the drive wheel so that it will stop with the piston crank in any position. A. Yes, especially if it is run at a high velocity.

(9) D. M. S. writes: 1. I think of building a small steamboat, length 60 feet, 10 feet wide inside of hull, height of cabin about 7 feet at sides. She is to be of sharp build in front. Wish to take several families West in it; and supposing we went up the Missouri River as far as Montana, which would be best: side wheels, stern wheel, or a screw? What size screw propeller should it have? What horse power engine will I need? A. A stern wheel boat, 60 feet by 12 to 14 feet beam, and 3½ feet deep, 2 engines, 8 inch cylinder by 2½ feet stroke. 2. Would it be safe to undertake such a trip with such sized boat as this? A. We think, if properly built, she would be safe for the trip proposed.

(10) W. H. P. writes: I am thinking of building a canoe such as is described by "Paddlefast" in SUPPLEMENT, No. 39, page 618. There are some things about it that I do not understand. 1. Ought the stern post to be perpendicular to the keel (like Fig. 36, page 471, No. 30), or curved like the stern (same fig.)? A. Yes, perpendicular, or nearly so. 2. Would it not be just as well to plank it with ¼ inch cedar as ⅛ inch? A. ¼ inch thick would spring under every strain and be likely to leak, and it will not hold fastenings so well as ⅛ inch. 3. Could you beat to windward with full sail (2 sails) and a leeboard? A. Yes, if properly modeled. 4. How fast would the boat probably sail before a fair wind? A. Depends upon spread of sail and force of wind.

(11) W. F. asks which part of a wheel (that is, the outside) turns the fastest when the wheel revolves: if one portion travels through a greater space than another, please state why. A. On the periphery all points have the same speed.

(12) G. M. A. writes: Here, in latitude 40° north, in summer, about June 21, the sun apparently rises in the extreme northeast and sets in extreme northwest, while at noon it is south of us. Please explain. A. The effect is due mainly to the curvature of the earth.

(13) F. J. N. asks how to make a cheap grade of Babbitt metal. A. Melt separately 4 lb. copper, 12 lb. tin, 8 lb. regulus of antimony. Pour the antimony into the tin, then mix with the copper, away from the fire, in a separate pot, and add 12 lb. more tin.

(14) F. C. asks how to bleach straw: the process by sulphur, that by chloride of lime and sulphuric acid, also any other processes with which you may be acquainted. Does the straw require any preparation for the before named processes; and if so, what? Among straw bleachers, what is the cheapest and most speedy method of obtaining a satisfactory result? A. Straw goods are bleached by submitting them to the action of the vapor of burning sulphur—or better, to the vapor of burning bisulphide of carbon. The straw, which must be perfectly clean, must be well moistened with pure soft water before submitting to the sulphuric oxide. The bleaching is carried on in tight wooden sheds. Straw may be bleached by chlorinated lime, but the fiber is liable to be somewhat injured thereby. Moisten the goods thoroughly in a strong aqueous solution of the bleaching powder (defecated), and then pass them through a bath of sulphuric acid diluted with about 20 parts of soft water. Repeat if necessary, and finally rinse thoroughly in water containing a small quantity of sulphur or hyposulphite of soda.

(15) J. M. W. asks (1) how sugar is made from corn. A. The starch is separated from the mashed meal by a process of washing. Good corn yields about 25 lb. of starch per bushel of corn. The starch is boiled with dilute sulphuric acid, which gradually converts it into glucose or starch sugar. When the conversion is completed a sufficient quantity of chalk or marble dust is added to neutralize and precipitate the acid, and after defecation and filtration the saccharine liquid is boiled down and crystallized. 2. How much will one hundred lb. of corn make? A. About 45 lb. dry sugar. 3. What is the expense per lb.? A. The cost of manufacture depends somewhat upon the scale on which the business is conducted. Starch sugar is produced at a cost much below that of cane sugar.

(16) Z. C. M. writes: I wish to make a composition for making the ornaments on stove patterns. I have tried camphor, whiting, and sulphate of potash, but did not succeed. I have seen the kind they use, and it smells very strongly of camphor; to use it they simply steam it, and press it into the mould. A. The following composition is commonly used: Soften 12 lb. of good glue in water enough to cover it, then heat until the glue is dissolved. Melt 7 lb. of resin, ½ lb. of pitch, and 2½ pints of linseed oil together. Stir the hot glue solution into this and add enough whiting to thicken. It should be mixed in small quantities and used at once; otherwise it will require steaming before it can be used.

(17) R. M. writes: I would like a book on poisons and their antidotes; can you recommend one? A. You may consult "Horsely on Poisons." 2. What can I put in my water barrels to purify the water? It has to stand a few days stagnant until it is used. I carry it from the hydrant some distance off, and it gets bad in three or four days. A. Try a charcoal filter. 3. Will chickens or domestic fowl eat ordinary poisons, such as strychnine, arsenic, phosphorus, or poisonous acids, mixed with feed? A. Yes.

(18) H. R. L. asks: 1. Can you recommend a standard work on butter and cheese making, and the breeding and selection of profitable stock? A. Willard's "Practical Butter Book," Willard's "Practical Dairy Husbandry," and "Youatt and Martin on Cattle." 2. Can you give an antiseptic to prevent milk from souring within a reasonable time without impairing it for family use? A. The double borate of potassium and sodium has been recommended for this purpose.

(19) C. H. G. asks: What preparation of varnish or shellac will do to put on a celluloid comb and brush which I have painted in water colors? I want something to give a glaze to the decoration, and that will not injure the celluloid, at the same time to make the painting durable and handsome, as the set is a very fine one. A. The ordinary pale amber or picture varnish will doubtless answer your purpose admirably. The "negative varnish" used by photographers may be used instead.

(20) G. W. asks: 1. What form of carbon other than simple powdered charcoal is best for a water filter? A. Crushed willow charcoal, well and recently burned, is preferable. 2. Can a carbon filter be cleaned or renewed without taking apart, that is, by reversing the current of water through it? A. Yes, in a measure, but it is better to renew the charge. 3. How long can iron scraps be used in a filter before requiring renewal? A. The iron should be replaced when it becomes badly oxidized. 4. Does the carbon (animal or vegetable) remove organic matter from water? A. The carbon alone cannot be depended on to remove all of the organic matters, especially if the filtration is permitted to proceed rapidly.

(21) M. H. T. asks: 1. What is the best metal for a pan for galvanizing? A. Cast iron is generally employed. 2. Does a cast iron pan make more dross than a wrought? How would cast steel do? A. The difference is slightly in favor of wrought iron.

(22) R. B. R. asks: Would it be wrong in any way or dangerous to run a lightning rod vertically through the center of a chimney smoke flue, and embed the ground end under bottom of chimney in lieu of running it along the angles of roofs and siding outside? Flue is 30 feet high and 20 inches by 8 inches section. Also, would it, if proper, be necessary to connect stove pipes, registers, or other iron or metal attachments? A. The object of arranging the rod on the roof angles is to afford conduction in case the lightning strikes at the roof. You can safely run the rod down the chimney as you propose, and also connect stove pipes and iron work therewith. But remember that no lightning rod can be considered as a protection unless its bottom end connects with a large extent of conducting material placed underground. For example, if there is a metallic water pipe or gas pipe, connect the bottom of the rod to it by soldered joint. If there are no such pipes, then extend your rod, say fifty feet, underground, in a trench leading away from your house; and carefully embed the rod in coal dust or charcoal, placed in the trench. The deeper you can conveniently make the trench the better. Coal dust, hard or soft, or charcoal, all are good conductors of electricity.

(23) L. K., Jr., writes: The water that we are using to supply the boilers of our engine is very hard and produces a very thick scale of lime which is very hard to remove with a pick. About a day before stopping to clean boilers we have used about one pound of refined catechu by putting it in the heater and pumping it into the boilers with the feed water; it is effectual in loosening all the scale, and there is very little labor in cleaning boilers. Will it be injurious to the iron to continue the use of the same? A. Used in moderation no injury will result. Catechu or cutch is very frequently used for this purpose.

COMMUNICATIONS RECEIVED.

What is Light? By Dr. G.
Boiler Explosion. By A. O. G.
On the Steam Engine. By J. N. W. S. D.

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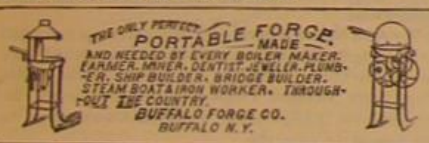

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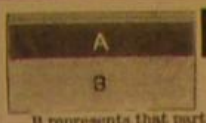

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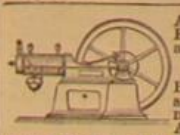

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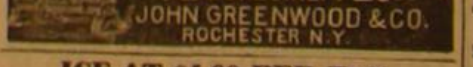

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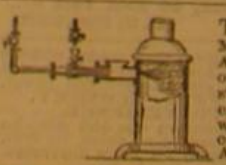

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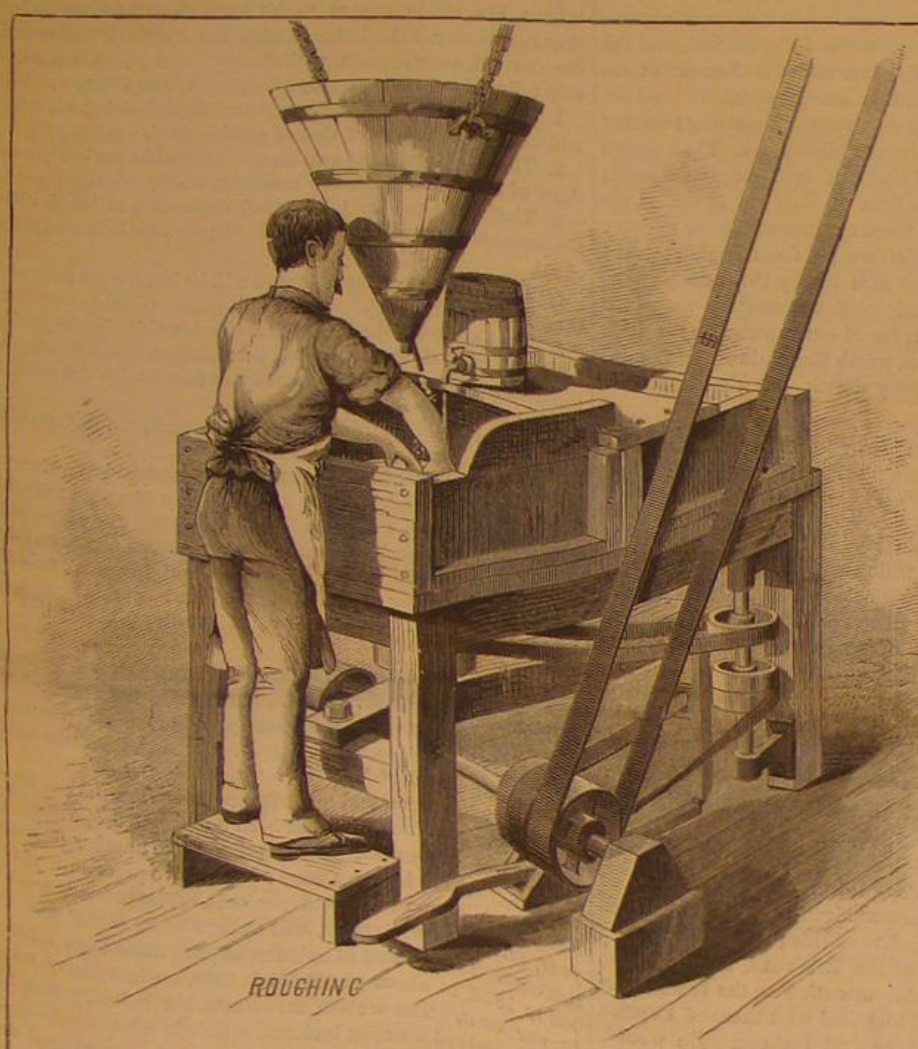

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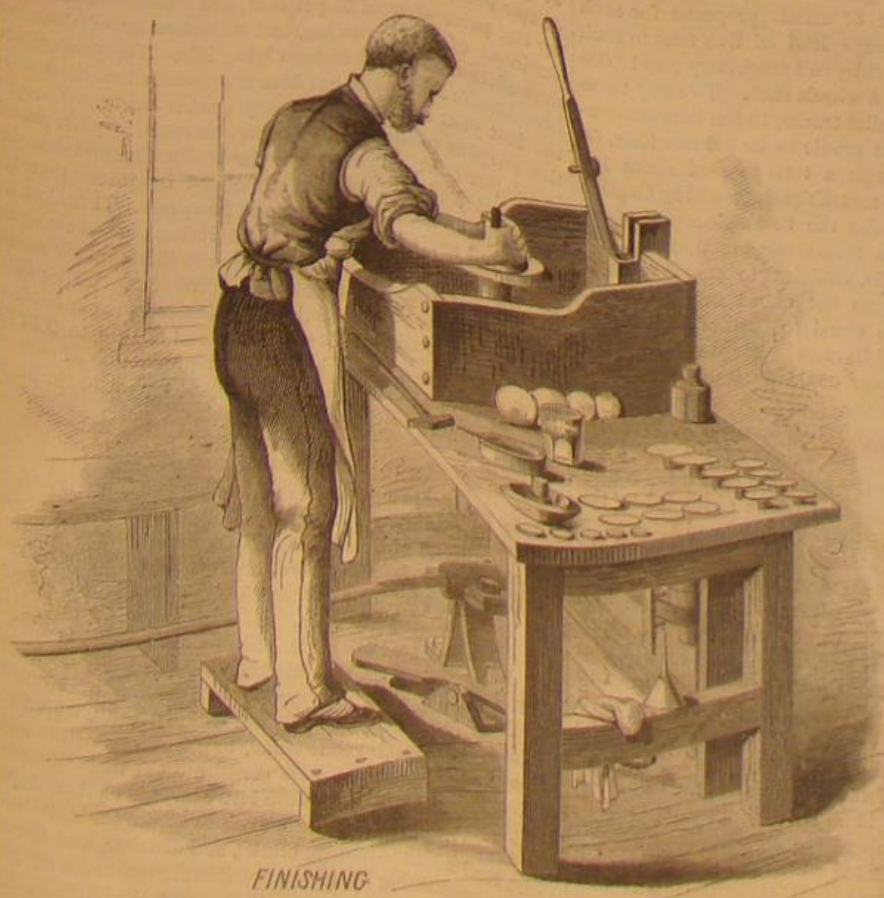

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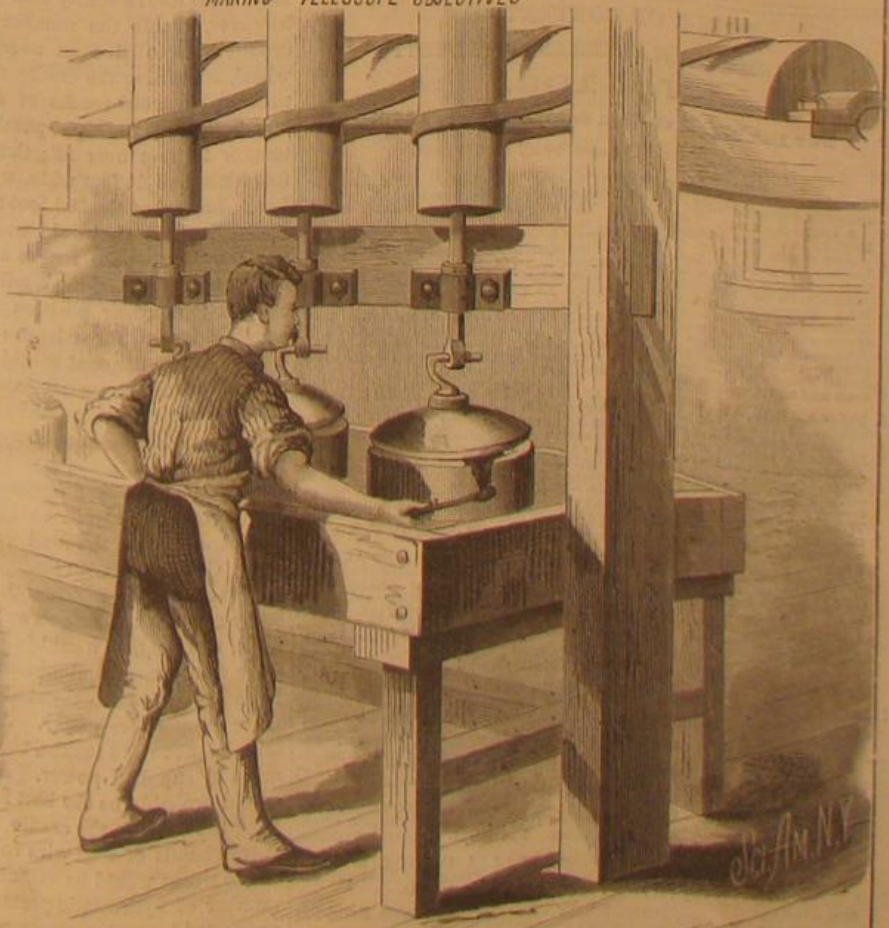

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THE AMERICAN WAY.

One of the secrets of the variety and success of American manufactures is the readiness with which the manufacturers receive suggestions from their customers. If a buyer from a distance says that an article would better meet the wants of his locality if certain alterations were made, the American maker hastens to supply him with the thing he wants. Not unfrequently he will send a competent man to study the conditions of the distant region, that the required adaptation may be more certain and efficient, or an entirely new contrivance invented to supply the need.

In English and other European shops the man who wants something new constructed, or an alteration made in some standard article, is very apt to be snubbed. They have no time to waste on such experiments; and even if the new device should prove a slight improvement, they think it wouldn't pay to alter patterns and machinery to make it.

The result is, American manufacturers are not only monopolizing the home trade by the superior quality and fitness of their products to meet home wants, but by the same tactics they are gaining a permanent footing in foreign markets.

A characteristic illustration is furnished by a correspondent of the London *Times*, writing from Sydney, New South Wales. He says:

"It is a great thing to get control of the market, and the first thing is to get a good footing, and the Americans are certainly pushing for that with an energy which at least deserves success. Our railway department is putting together three large new locomotives from Philadelphia. Their design is the result of close personal observation of our precise wants by one of the partners in the firm of Baldwin & Co. I am not prepared to say whether these engines will prove in every respect better than those which we get from England, but I do not remember any English firm taking the same pains to study what we want to deal most successfully with—the steep gradients and sharp curves of our railway on the Blue Mountains. Perhaps it is not worth the while of the English makers to attend to such petty details, but the Americans think differently."

And, we may add, American manufacturers do not consider such details "petty." Tools and machinery are somewhat like animals and plants, in needing to be thoroughly adapted to their environment. The difference between an organism which thrives in England but will not in Australia, and one of the same genus which will thrive in Australia, may be inappreciable to the unskilled observer; but it is vital, and outweighs all the points of resemblance. So a machine, perfect from the standpoint of England or America, might fail utterly to meet the different needs of another region, though the alteration required to adapt it to the new conditions might be comparatively slight and easily perceived by an expert on the spot.

THE PROPOSED PANAMA SHIP-RAILWAY.

The St. Louis *Exporter and Importer* has taken pains to get from several engineers of high standing an opinion as to the feasibility of the ship-railway project for the Isthmus of Darien, set forth in the communication of Captain Eads already placed before the readers of this paper.

Chief Engineer Chanute, of the Erie road, writes that he had already given considerable attention to the scheme, arriving at conclusions almost identical with those of Captain Eads as to its feasibility and general features. He would, however, double the number of wheels proposed for each cradle, so as to give an average load of five tons to each wheel, sustaining the cradle, ship, and machinery (say 10,000 tons in all) on 500 trucks of 4 wheels each. To carry these wheels he proposes eight parallel tracks, 13 feet between centers, or 96 feet over all; the cradle to be 500 feet long, 50 feet high, and 44 feet wide, with a total base of about 110 feet. Instead of the 500 foot turntables suggested by Captain Eads, Mr Chanute would make the turntable a part of the cradle by giving the trucks a transversing motion, at right angles to the axis of the cradle, sufficient to enable them to assume the proper position on the chord subtending the curves adopted, for a length equal to that of the cradle. Grades of one per cent would have to be adopted, and with a railway 60 miles long a steamer could be transferred from ocean to ocean in 12 hours by the employment of about 8,000 horse power. The cost of working should not be over one fourth of a cent a ton a mile, the weight of the vessel and cradle being included, or three fourths of a cent a ton a mile on its contents. Even at half the traffic estimated by the canal commission the road would pay handsomely.

Mr. C. Shaler Smith thought the only question in doubt was one of finance. Though a grand undertaking it would be by no means a difficult one, and the estimate of Captain Eads, $50,000,000, would fully cover the outlay. The enterprise would most undoubtedly pay. The tidal variation at Panama—20 to 25 feet—would make the handling of shipping there comparatively easy. At Aspinwall, with a tidal variation of about 18 inches, the entire lift would have to be made by supplied power. A caisson on an inclined plane would probably be the best form of lifting dock. He would hang the ship in the cradle in flexible slings composed of woven bands of steel wire rope, 5 feet wide and 1 inch thick. These slings would be connected with the cross heads of a number of hydrostatic presses placed along the cradle and connected by a pipe common to all, so that the ship would be always carried on an even keel, the same as though floating in a caisson. Ten parallel tracks, of 3 feet gauge, rails not less than 6 inches high, and tracks 10 feet apart, would be needed. This would give a total wheel base of 93 feet by, say, 460 feet for the largest cradle. Assuming a maximum load of 9,500 tons, 432 trucks, or 1,728 wheels, would be needed—a result substantially in accordance with that arrived at by Mr. Chanute.

As a method of supplying power for the transportation of the cradle, Mr. Smith suggests the Belgium wire rope towage system. If possible, level grades should be carried up to the base of the summit hills, and then by concentrating all the grades at one point the cradles could be moved over the summit by powerful stationary engines. If the summit can be passed, however, with a maximum grade of 20 feet per mile, then movable engines, drawing the cradles and themselves by steel wire towlines, laid in the middle of each track, and passing over and grasped by "Fowler clip pulleys" attached to each engine, will be the most economical method of locomotion in all probability. The power needed to transport the greatest load, with curves of 12,000 feet radius and grades of 20 feet per mile, would be 200,000 pounds, requiring steel ropes of 1½ inch diameter each. However, as these would form a costly part of the outfit, the relative economy between this system and that of the locomotive engine, for this peculiar service, can only be determined by exact calculations.

Mr. Henry Flad, C.E., writes that he has taken pains to inform himself in regard to the surveys and estimates for ship canals across the Isthmus, and has carefully estimated the cost of construction, maintenance, and operation of a ship railroad. Briefly stated, his opinion is as follows:

1. That the first cost of the construction of a ship railroad will not be one fourth of that of a ship canal.

2. That a ship railroad can be constructed in probably one third of the time required to construct a ship canal.

3. That ships can be transferred on such a railroad with absolute safety, and with the same dispatch as through a ship canal.

4. That the cost of maintenance will be less for the railroad than for the canal.

5. That although the cost of transferring ships by ship railroad will exceed that of passing them through a ship canal, the difference will be insignificant compared with the saving of interest on the first cost.

6. That the ship railroad will therefore offer a better and safer investment for capital.

The unanimity of these experienced and able engineers with regard to the feasibility and economy of a ship railway for the Isthmus is, to say the least, noteworthy and encouraging. Like all grand undertakings it presents an almost inexhaustible field for engineering skill and inventive talent; and it is gratifying to see that American engineers are so prompt to grapple with the novel difficulties presented.

RECENT INDUSTRIAL PROGRESS.

Speaking of the revival of industry that has taken place since preparations for the resumption of specie payment were begun in the spring of 1877, Secretary Sherman said, in a recent speech:

In the production and manufacture of cotton the progress during the past four years has been unexampled, showing an increase of 30 per cent. The increase in the number of bales taken within the last two years over the two preceding years is 417,517, or more than 14 per cent. The present cotton year, ending in September, will show a more rapid rate of increase. The number of spindles has increased from 7,114,000 in 1870, to about 10,500,000 in 1878, an increase of over 47 per cent. The woolen manufacturing industry has recently received a strong impetus, which in a few weeks sent up the price of wool 20 per cent, and greatly encouraged the business of wool growing, and started many of the woolen manufactories that had been lying idle. The production of breadstuffs and meats has been enormously increased within the last year or two, and a ready market has been found for the surplus production. The net increase in pork packing is 38 per cent. The increase in beef production has been constant and progressive, stimulated by prices that have scarcely declined during the past two years. There has been a marked revival in the iron trade during the last two years. In 1873 the production of pig iron in this country reached its maximum, amounting to 2,868,278 tons. Under the influence of the panic it fell off to 2,093,236 tons in 1876. In 1877 it increased to 2,314,585 tons, and in 1878 to 2,577,361 tons. This year, it is believed, the production of iron will be as great as that of the most prosperous year in the history of this product.

The Yellow Fever.

The steady progress of the epidemic in Memphis has been less startling than last year, but for all that, sure and fatal. From 20 to 30 new cases daily, in a town so depopulated as Memphis now is, and where of those that remain so many are protected by previous attacks, is indicative of a potent and concentrated infection. Of other towns, Corinth, Miss., has had one or two cases. Mayersville, Miss., is also reported as suffering. It has been very properly decided to continue perfecting the system of isolation of Memphis, under the rules of the National Board of Health, which have already given such good results, to use every possible means to induce the negroes, who constitute the main source of danger in Memphis, to move into camps, and thus deprive the fever of material to work on; to secure the isolation of cases and affected houses, blocks, and districts, and to effect this by combining as far as possible the resources of local, State, and national boards with those of the Howard Association and of the taxing district and county authorities, and thus limit the spread of the disease.

Dr. W. L. Coleman, of San Antonio, Texas, who was ordered by the National Board of Health to investigate the origin of the yellow fever prevailing in Memphis, has been at work for a month past, and his investigations convince him that the germs were imported direct from the West Indies, and that they passed the New Orleans quarantine unchallenged, and arrived in Memphis some time in June.

THE COMMISSIONER OF PATENTS IN A DILEMMA.

It will be remembered that in 1877 the roof of the Patent Office building was destroyed by fire, and a great number of models were burnt and broken. Since then a great deal of discussion has arisen as to what improvements should be included in the repairs, and considerable time consumed in getting the necessary appropriation allowed by Congress before the work could proceed. But finally a plan was decided upon and an appropriation granted, and the work has progressed quite rapidly during the summer.

The iron work for the support of the roof and the new gallery is already nearly completed and in place, and the whole building is expected to be roofed in by the middle of October. But owing to the breaking up of the old roof to allow the ironwork to be placed in position, considerable inconvenience has been experienced from the rain. A correspondent of the Philadelphia *Bulletin* relates the observation of a gentleman who had business with the Commissioner of Patents, and called upon that official during one of the days of the late severe rainstorm, and found him sitting in a corner of his office, having moved his desk away from the usual place in the center of the room, in order to escape the rain which was trickling down through the roof and the floors above. A colored messenger, having collected all the available spittoons, was engaged in moving them about from place to place in the Commissioner's room wherever he saw signs of a new leak, in order to protect the carpet from the rain. Several of the adjoining rooms occupied by the Deputy Commissioner and clerks of the Patent Office and a portion of the hall of the main floor were in a still worse plight. Beyond the temporary inconvenience of the officials no damage was done, as the records and files of the Patent Office were kept in better sheltered quarters.

THE RED SPIDER ON ROSES.

H. M. Hill, Clancey, Montana, sends us specimens of his roses, the leaves of which are seared and yellow, and asks the cause and cure.

A careful examination shows that the plants have suffered from what is commonly known as the red spider (*Tetranychus telarius*). It is a true mite and not a spider, though belonging to the same subclass.

Among the mites we find many species, some beneficial to man, others noxious. In a list of the former we may mention the locust mite (*Trombidium locustarium*, Riley), which preys upon both the locust and its eggs. It is an important auxiliary in checking the multiplication of the Rocky Mountain locust. Another species (*Uropoda Americana*, Riley) preys upon the Colorado potato beetle; while still another (*Trombidium muscarum*, Riley) infests, in the larva state, the common house fly.

Among the noxious species are the itch mite, the cheese mite, the jigger or harvest mite of the more Southern States (*Leptus Americanus*, Riley), and the one at present under consideration, the red spider.

A curious fact in the life history of these tiny creatures is that they are born with but six legs, though in the adult state they have eight.

The red spider, which is such a pest to the florist, thoroughly dislikes water. It cannot thrive in a humid atmosphere nor on plants often drenched with water. On the other hand it multiplies rapidly in a dry air, so that some florists consider it a certain evidence that their plants are not receiving sufficient water when the spider appears.

Drench the leaves of infested plants often with water in which is a little whale oil soap. See that every leaf is thoroughly moistened, and repeat the sprinkling frequently according as the weather is hot and dry, and the pest will soon disappear. It is bad on vines and shade trees only in the hot, dry weather of midsummer, and needs most watching then.

RAPID PHOTOGRAPHING.

Mr. Muybridge's method of photographing horses in rapid motion has lately been applied in San Francisco to the study of human action, particularly that of athletes while performing their various feats. In order to display as completely as possible the movements of the actor's muscles, they wore brief trunks only while performing, and thus all the intricate movements of boxing, wrestling, fencing, jumping, and tumbling were instantaneously and exactly pictured.

The first experiment was in photographing an athlete while turning a back somersault. He stood in front of the camera motionless, and at a signal sprang in the air, turned backward, and in a second was again in his original position, and in his very tracks. Short as was the time consumed in making the turn, fourteen negatives were clearly taken, showing him in as many different positions.

The same man was also taken while making a running high jump. The jumping gauge was placed at the four foot notch, in order to give an easy jump, as in making it fourteen stout hempen strings had to be broken, as in photographing trotting horses. From the camera to a point beyond the line on which the jump was made, a number of strings were stretched. The two base lines were only a few inches above the ground, and from them to the apex the strings were placed an equal distance apart. In jumping, seven of the strings were broken in ascending and seven in descending. The strings were tautly drawn, and so connected with the camera that as each one parted a negative was produced.

Other pictures were taken of men raising heavy dumbbells, and the various movements of boxing, fencing, and the like.

CURING BEEF BY INJECTING BRINE.

The infiltration system of salting beef, by filling the bloodvessels with brine, is attracting considerable attention in Australia. In some recent experiments at Brisbane, bullocks were treated as follows: At the instant of killing the animal's heart was laid bare, and incisions were made in both ventricles. Into the orifice of the left ventricle a pipe was inserted, and a stream of weak brine was forced through the bloodvessels, washing out all the blood. Pressure was obtained by having the brine in an elevated tank. After the expulsion of the blood the right ventricle was closed by a clamp, and stronger brine was forced in until all the bloodvessels were full. In this way the distribution of the brine through every part of the meat is said to be complete and the curing perfect. It is proposed to send to the Sydney Exhibition a whole bullock thus preserved.

LIFT LOCKS AND LOCKING-TIME.

At the Paris Canal Congress one of the chief objections urged against a ship canal with locks was the alleged great delay incident to locking. It was said that from one to two hours would be consumed in entering a ship, closing the gates, filling the lock, opening the gates, and leaving. The eminent English engineer, Sir John Hawkshaw, said that fifteen minutes would suffice for all these operations. Admiral Ammen says that this estimate is still further reduced by General Weitzel, U. S. Engineer, to eleven minutes. General Weitzel has for many years been engaged in building and operating locks, and in July next will have completed, at Sault Sainte Marie, Michigan, the largest lift lock on the globe. Its dimensions are: Length, 515 feet; breadth, 80 feet; lift, 18 feet; gates to admit vessels of 60 feet beam.

The Mississippi River Commission.

The first session of the Mississippi River Improvement Commission was held in Washington, August 20. A committee was appointed, composed of General Harrison, of Indianapolis; Professor Mitchell, of the United States Coast Survey, and Major Suter, of the Engineer Corps, to submit recommendations as to the best method of obtaining and compiling statistics of the trade, commerce, etc., of the Mississippi Valley, and such other data as may be required for the use of the commission. Another committee was appointed, consisting of General Comstock, of the Engineer Corps; Professor Mitchell, of the Coast Survey; Major Suter, of the Engineer Corps; and Major Harrod, of New Orleans, to prepare a plan for the future work of the commission, and to make such recommendations as they deem necessary with regard to the use and expenditure of the existing appropriation of $175,000.

St. Louis has been selected as the permanent headquarters of the commission, and the office there will be under the immediate charge of the permanent secretary, who will be the executive officer of the commission, and act under the direction of a committee to be selected from among the members who reside in the West.

Sir Rowland Hill.

Sir Rowland Hill, to whom the world is so largely indebted for cheap postage, died at his home in Hampstead, England, August 27, at the age of eighty-four years. Sir Rowland was born in Yorkshire, December 3, 1795. His first occupation was as mathematical tutor in a school near Birmingham. As secretary of the South Australian Commission, he aided, in 1835, the founding of the colony of South Australia. It was about this time that he first turned his attention to the defects in postal organization, and in 1837 he published a pamphlet on the much needed postal reform. His exertions resulted, in 1838, in the appointment of a special committee of the House of Commons, and in August of the same year the commission reported in favor of adopting the plan of a uniform low rate of postage, as recommended by Mr. Hill, the evidence having proved that injurious effects resulted from the old state of affairs to the commerce and industry of the country, and to the social habits and moral condition of the people. In 1839 more than two thousand petitions were presented to Parliament in favor of the scheme, and in 1840 it was carried out.

The labors of Mr. Hill in putting the scheme into execution were protracted and severe. For many years he held the office of Secretary to the Postmaster General. He was knighted in 1860, and retired from office in 1864, on account of failing health.

Henry J. Rogers.

Henry J. Rogers, who assisted in the erection of the first telegraph line between Baltimore and Washington, died at his residence in Baltimore, August 20, aged sixty-nine years. He was subsequently superintendent of the North American Telegraph Company, and was the author of the code of marine signals now in use at all the ports of the country.

THE AMERICAN SCIENCE ASSOCIATION.

The annual session of the American Association for the Advancement of Science began, August 27, at Saratoga, New York, with an unusually full attendance of members. Considerable preliminary business was transacted, but no papers were read.

The address of President Barker was the principal feature of the morning session. In the course of his remarks, the object of the association was declared to be the advancement of science not only by the discovery of new truth, but also by the diffusion of that already known. To this end it extends a cordial recognition to all organizations of what ever sort whose objects are akin to its own. Being itself national in character—for science knows no country and no section of country—it gives its indorsement to all local enterprises, and stands ready to assist them in any legitimate way. Whether it be a State, geological, or topographical survey, an academy of science, or association or individual seeking to unravel nature's secrets, the association desires to strengthen their bonds and to uphold them in the communities where they are located. Its province is to awaken an interest in pure science; or, where such interest already exists, to develop it to the full. It invites all interested in science to its membership, and opens its sessions to all comers. That its periodical and migratory meetings, in the words of the constitution, have actually done what they were intended to do, have promoted intercourse between those who are cultivating science in different parts of America, have given a stronger and more general impulse and a more systematic direction to scientific research, and have procured for the labors of scientific men increased facilities and a wider usefulness, no one who has watched its history can doubt.

Less perfect acceptance, we fancy, will be accorded Mr. Barker's subsequent remarks, in which he excludes inventors from the ranks of original investigators and discoverers. It is true that in very many instances the discoverer has not been an inventor, and that discovery has usually been the real mother of invention; true, also, that original research is the storehouse out of which comes invention. But it will not do to assume, as Mr. Barker appears to, that discoveries are made only or generally by men who "patiently investigate truth for its own sake," and "deny" themselves "the good things of this life to obtain it." There is rising up among us a generation of inventors, who are also explorers and discoverers of the most energetic and successful type; and they push the work of investigation and invention with no intention of denying themselves the good things of life. Their inventions pay; but their discoveries are none the less scientific and honorable.

On the second day the proceedings of the association assumed their regular scientific character. A number of interesting papers were read and discussed, and in the evening the retiring president, Prof. O. C. Marsh, delivered the customary address, reviewing the "History and Methods of Palæontological Discovery." It will be found in full, commencing in the current issue of THE SCIENTIFIC AMERICAN SUPPLEMENT.

In Section A, the address of Prof. Ira Remsen, Chairman of the Sub-Section of Chemistry, was read, in the absence of the author. It was devoted to the chemistry of the organic compounds, a department sadly neglected in American colleges. This paper was followed by one on the "Experimental Determination of the Velocity of Light," by Albert A. Michelson, U.S.N., specially describing and illustrating the experiments lately conducted at the Naval Academy at Annapolis. This valuable paper also appears in full, with numerous illustrations, in this week's SUPPLEMENT. The result obtained—186,305 miles a second, with a probable error of 3 miles—falls nearly midway between those of Foucault and Cornu. Prof. Newcomb, who has been conducting a series of similar investigations, expressed the belief that Mr. Michelson's results are probably within $\frac{1}{1000}$ of correctness.

In Section B, the first paper was by Prof. Warren Upham, of the Geological Survey of New Hampshire, on the "Succession of Glacial Deposits in New England." It was read by Prof. C. H. Hitchcock, and discussed by Profs. Martin, Lislie, Gardner, S. H. Cook, W. H. Niles, Worthen, and Hall. The conflict of opinion showed how far the subject is from being thoroughly and satisfactorily worked out.

The second paper was by Prof. J. M. Safford, of Nashville, on "The Thinning Out and Absence of Upper Silurian and Devonian Formations in Tennessee."

It was followed by a discussion, after which the recently discovered copper veins at Blue Hill, Me., were described by Professor C. H. Hitchcock, of Dartmouth College, who exhibited specimens of ore containing 34 per cent of copper. Evidences of silver and even of some gold have been discovered, and probably the silver will be ultimately worked with success. Major Powell spoke of the work done on the eastern flanks of the Rocky Mountains and on the eastern side of the Sierra Nevada.

Among the remaining papers of the day, that by Dr. Clarence J. Blake, on the "Consonantal Expression of Emotion," was the most interesting. A number of linguists and ethnologists took part in the discussion which followed, bringing out many curious and amusing peculiarities in the pronunciation of foreign, cultivated, and savage languages.

A PNEUMATIC DISPATCH TUBE.—Shavings from a planing mill in Chicago are, by an air-blast, blown 700 feet, through a 15 inch sheet iron pipe, to a distillery, where they are burned for fuel.

LENSES.

[*Continued from first page.*]

classed according to the use to which they are applied. The flint glass for telescope objectives is more dense than that used for the achromatic lenses of photographic cameras.

The disks are cut to the required size, either by means of a diamond or by a revolving iron hoop supplied with sharp sand and water; they are then roughened into shape in the machine shown in one of the upper views in the large engraving on our front page. The hopper suspended from the ceiling contains sharp sand and water, which are allowed to flow out upon the form or tool on the upper end of the vertical spindle. This form, or tool as it is called, has the same curvature as the lens to be made. It is convex for a concave lens, and concave for a convex lens. A disk of glass held upon this tool, charged with wet sharp sand and water, soon assumes the desired curvature, and is ready for the next step, which consists in grinding the lens in another machine with three different grades of emery on as many different tools.

The emery ranges from No. 90 to No. 150, the last grade leaving a surface sufficiently fine to be at once polished with rouge. To the back of each disk of glass a hub is cemented with pitch. In the center of this hub there is a conical hole of sufficient depth and size to receive the point that projects from the lever by which the disk is held down upon the finishing tool. When small lenses are ground, an ordinary handle, having a steel point, is used, instead of the lever, as shown in the lower left hand view. When lenses are ground in this way the tool is much larger in diameter than the disk, and the latter is held eccentrically in relation to the axial line of the tool, so that as the tool revolves the disk is also made to revolve, thus continually changing the relation of the surfaces in contact, thereby insuring greater accuracy in the form of the lens.

Between the applications of the several grades of emery the disk is thoroughly washed, and great care is exercised to prevent any particles of the coarser emery from becoming mixed with the finer.

After the application of the finest grade of emery the glass disk and the tool are both thoroughly washed, and the face of the tool is covered with fine woolen cloth similar to broadcloth, which is made to adhere by a thin coating of melted pitch applied to the face of the tool before putting on the cloth. The tool thus prepared is wet by blowing on water from the mouth in a thin spray as represented in the engraving, and the workman applies to the cloth surface a ball of fine rouge, forming on the face of the cloth a thick paste of rouge and water. The lens, if large, is held upon the tool with the lever in the same manner as in grinding. If small, it is held by the steel-pointed handle. A gentle pressure is applied, and, should the tool become too dry before the required polish is secured, water is blown over it with the mouth, as before described. After having finished one side of the lens the other is proceeded with in precisely the same way. The treatment is the same for both convex and concave lenses. In grinding the best quality of telescopic objectives the operation is wholly performed by hand. This is done in the manner shown in the upper right hand figure of the engraving. The tool is supported by the post, and the disk is moved in a series of small circles, and at the same time turned as the operator moves slowly around the post. In the case of telescope lenses, the final finish is secured by a pitch surface formed on the tool, and traversed by grooves running across it in different directions.

Very small lenses are formed from pieces of glass cemented to the end of a stick. The roughing is done upon a common grindstone. The grinding is done in much the same way as already described; the polishing, however, is somewhat different; the tool being covered with a mixture of rouge and beeswax, the amount of rouge being sufficient to render the beeswax quite hard. The form is given to the wax surface by pressing the unpolished lens into it. A thin paste of rouge and water is applied to the tool occasionally.

Ordinary spectacle lenses are ground in quantities in the manner represented in the lower left hand view in the front page engraving. Here a great number of pieces of glass are cemented to a form with pitch, and the tool is moved over it by a short crank on the lower end of the vertical spindle. The workman dashes emery and water or rouge and water over the form; and the upper tool, in addition to receiving an oscillatory movement, is slowly rotated by the action of the crank in the socket at the back of the tool. Generally a series of forms are operated in a single bench and attended by one man. The steps in the operation of grinding spectacle lenses are about the same as when single lenses are ground. After they are ground and polished upon one side they are removed from the form and turned over, cemented to the form, and ground and polished upon the other side.

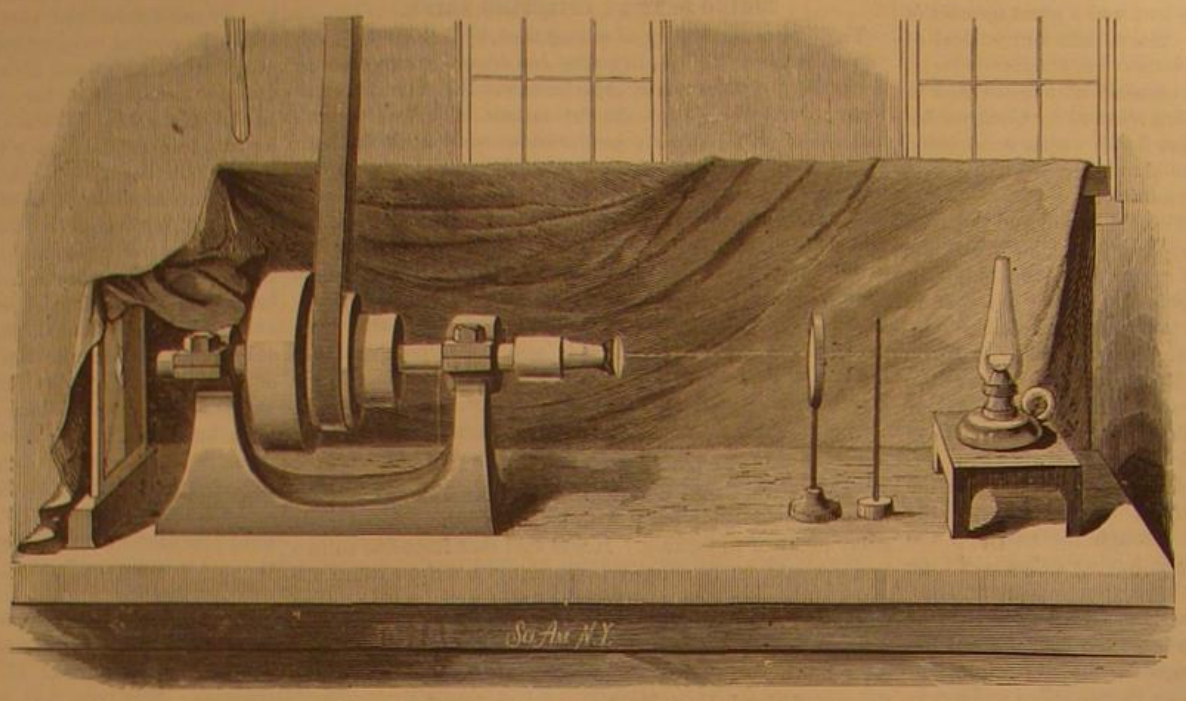
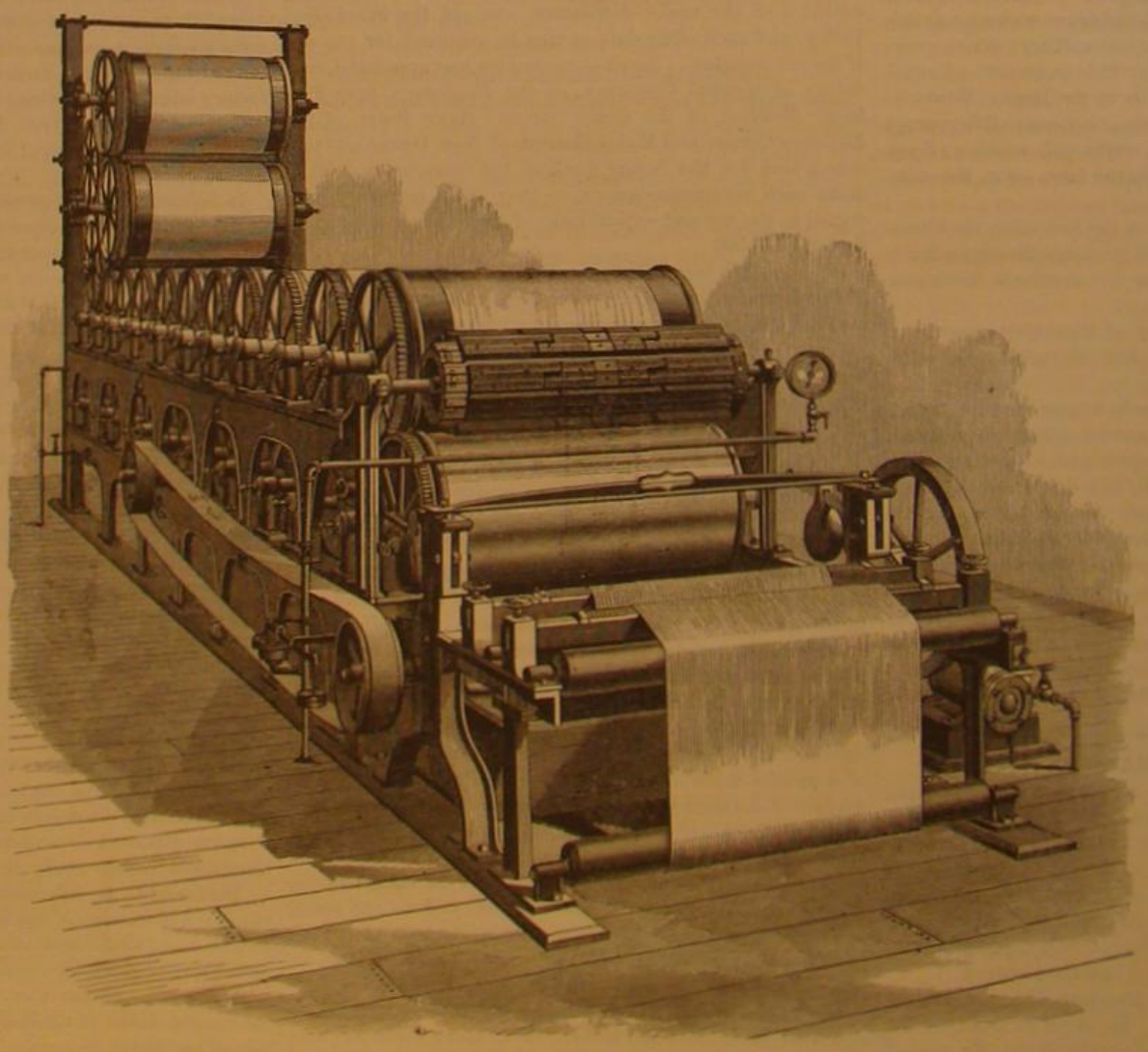


Fig. 2.—CENTERING LENSES.

For many purposes it makes little or no difference whether the axis of a lens corresponds with its geometrical center, but for telescopes, opera glasses, photographic cameras, and other instruments of accuracy, their optical and geometrical centers must correspond. The manner of testing lenses to ascertain if the optical center and the geometrical center coincide, is illustrated in Fig. 2. The lens is cemented to a chuck upon one end of a hollow lathe mandrel; near the opposite end there is a ground glass surface, and in front of the lens being tested there is another lens supported on a standard, beyond which there is a small vertical rod and a lamp. These different pieces are all in line with the axial line of the mandrel, and an image of the rod is cast upon the ground glass screen. If the image remains stationary while the lathe revolves, the optical center of the lens coincides with the center of rotation, but if the image moves, the optical center is out, and the lens must be centered while the cement which supports it is still warm and soft. This is easily done by holding the hands against the edge and sides of the lens as it revolves. When the lens is optically centered, if its periphery is out it must be ground down. This is readily done by placing under it a piece of sheet iron bent into semicircular shape, and forced upward against the edge of the lens by means of a screw passing through a board that supports it. The sheet iron is charged with sand or emery and water, and as the lathe revolves the lens rapidly assumes a circular form.

The matter of testing the different qualities of glass used in the manufacture of fine achromatic lenses has been omitted on account of the abstruseness of the subject and the amount of space required to properly treat it.

For many of the points given above we are indebted to Mr. Chas. F. Usner, a practical optician of this city, from whose factory, at 128 and 130 Fulton street, we have taken the majority of our sketches.



H. W. BUTTERWORTH & SONS' DRYING MACHINE.

DRYING MACHINES.

The lower engraving on this page represents one of Messrs. H. W. Butterworth & Sons' drying machines, such as are used for printworks, bleacheries, and for drying cotton warps and finishing tickings, osnaburgs, etc. This machine is arranged with twenty-four cylinders, supported by a framing, eighteen of them being on a horizontal and six on a vertical frame. The grouping of these cylinders in a horizontal, vertical, or other direction may be modified to suit special requirements; and where the floor space is contracted, the vertical arrangement is preferred.

The frames of the machine are made of cast iron, being quite heavy in their construction, with broad planed surfaces; and hollow passages are cast in them for the transmission of the steam used in heating the cylinders and the return of the condensation, thus dispensing with outside pipes and connections. The steam passes into each cylinder and leaves it again by means of branch passages cast on to the frames and connecting with journals in which the axes of the cylinders run. The stuffing boxes for the journals are packed from the front by an arrangement introduced by this firm in 1867, this packing, however, forming no part of the bearing. The advantages derived from this method consist in the easy access given to the packing, which also lasts longer than in the ordinary arrangement; in an allowance of greater freedom for expansion of the cylinders than can be attained in any other way, and in furnishing an abundant length of bearing for the axles. This firm formerly packed the stuffing

boxes on the inner side, but this rendered them much more difficult of access, and at the same time there was a greater tendency for them to blow out with the steam pressure. The length of bearing also obtainable for the axles was much less. In drying machines as usually constructed, the practice has been to introduce the steam to the cylinder by means of a steam pipe connecting from the exterior through the end of the journal by a countersunk joint. This arrangement did not allow of free expansion and contraction of the cylinder, and caused the end of the journal to press against the end of the steam pipe with more or less force, depending on the temperature to which it was raised, producing consequently more or less friction.

Motion is communicated from one cylinder to another by cast iron gearing, seen very distinctly in the engraving. The cylinders are carefully made, but no special balancing is required, such as is necessary in drying machines for paper making, the material to be dried in the present case being of much stronger texture.

In machines with wide cylinders, where more than one width of material is dried at the same time, the steam is so applied that each width is dried uniformly. A uniformity of temperature is maintained throughout the machine by allowing the steam to enter the top cylinder at one end, and the corresponding bottom cylinder at the other. The working pressure of the steam is usually from five to ten pounds per square inch, and it is controlled by an efficient regulator. The water of condensation is removed from the opposite end of the cylinder to that at which the steam enters, by means of Collins' patent trough, a device very extensively used in England, and quite effective in its operation, causing the water to pass out through the journal in a similar way to that by which the steam enters at the other end. The material to be dried, before entering around the cylinders, passes first through a "stretcher," made of brass, which prevents the edges from turning down, and smooths out all wrinkles, delivering it perfectly even and regular. The tension of the fabric is controlled by passing it between three rectangular bars, alternating above and below them, one after the other, and around a roller; or in another way by means of a strap and weight attached to the roller, from which it moves on to the drier.

ENGINEERING INVENTIONS.

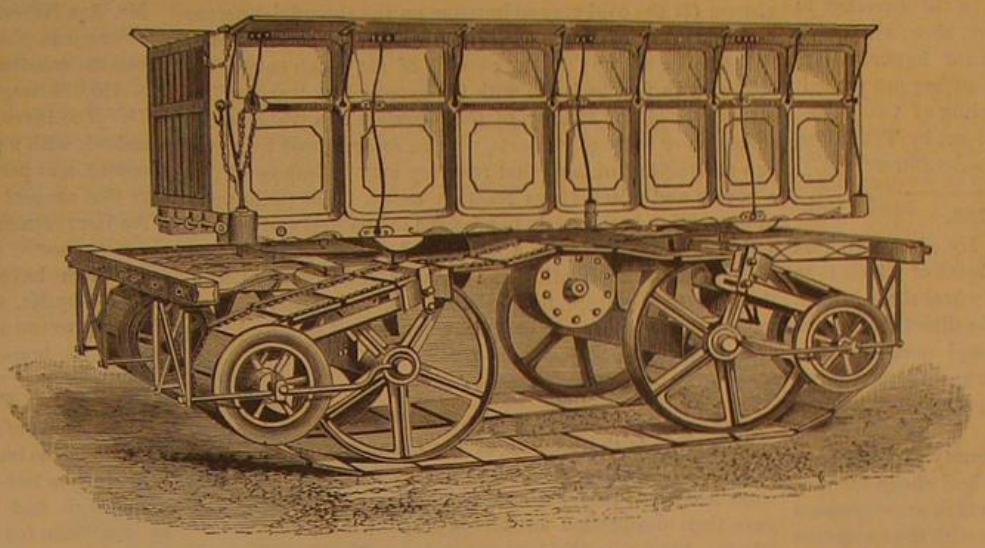
An improved aerial ship has been patented by Mr. Watson F. Quinby, of Wilmington, Del. The peculiar construction of this machine cannot be described without an engraving. The upward as well as the lateral movements are made by winged wheels of novel construction.

An improvement in permanent ways for tramways has been patented by Mr. Silas Nicholls, of St. Clement Danes, County of Middlesex, England. The object of this invention is to construct a tramway capable of resisting for a lengthened period the damaging effects of rain, frost, and snow, and in which the tram rails and the paving of the road on either side of them are kept firm and (so far as the durability of the road materials will admit) of uniform surface level. The invention enables the rails (when the road paving is fairly worn below their level) to be lowered until they are again flush with the surface of the road without taking up the whole of the paving between the rails.

Mr. George W. Dixon, of Spring Lake, Mich., has patented an improvement in valves for steam pumps, the object of which is to simplify the construction of valves for direct acting steam pumps, and thereby reduce the first cost of such pumps and the expense of repairs. The improvement consists in a double seated slide valve, similar to the ordinary slide valve fitted within a case in the steam chest, in which the valve slides, the space at the ends forming steam chambers, into which the steam is admitted alternately to move the slide valve. The admission of steam to the chambers is effected by means of an auxiliary valve in the steam chest, which is operated by means of shifting levers that are acted upon by the piston head in the engine cylinder.

An improvement in railroad frogs has been patented by Mr. Michael McAleenan, of Peoria, Ill. This invention relates to the joint or intersection of the rails of railroad frogs. It is designed to strengthen the joint and prevent dislocation. The improvement consists in prolonging the web and base of one rail in the form of a tongue, that extends toward the point of the frog in the space between the head and base of the other rail.

An improvement in gates for railroad crossings has been patented by Mr. Thomas Meehan, of Brooklyn, E. D., N. Y., and Mr. Colin McLean, of Jamaica, N. Y. The invention consists in the combination of a vertical frame provided with the side posts, and the two trusses for supporting suspended railroad gates and their operating mechanism. Two sets of chains or ropes, and two sets of pulleys, two weights, and four pairs of bevel gear wheels, are employed in moving the gates and retaining them in the required position.



SELF-LAYING TRAMWAY.

Mr. Harrison Gillett, of Lake City, Minn., has patented an improvement in steam generators fitted for burning straw or hay. The object of the invention is to provide a regular and uniform feed of the material without requiring the fire-doors to be opened, to prevent ashes and sparks entering the boiler flues, and to effect the removal of ashes as fast as they accumulate. The inventor makes use of a cylindrical boiler fitted with an inner cylindrical fire space, smoke box, and return flues through the water space. The fire doors at the front are fitted with adjustable feed rollers driven by gearing and a feed table. At the rear of the fire box ash and spark arresters are fitted, and the smoke and ash box is fitted with a pipe from the boiler for wetting down the ashes, and with a spiral conveyer for delivering the ashes to the outside.

New Brake.

A novel form of railway brake has been invented by Mr. W. Wiseman, of the East Indian Government Railway Department. In the specification it is stated that sand is placed in a chamber fitted with valves, which when opened allow the sand to pass into a second chamber, in which revolve blades attached to the axle of the vehicle. The motion of these blades is arrested by the rush of sand impinging and clogging. The above suggests the idea that a small steam turbine or rotary engine might be attached to each car axle, and by letting on steam from the locomotive, turn the wheels backward, and so stop the train.

SELF-LAYING TRAMWAY.

The vehicle shown in the engraving is fitted with a continuous self-laying and self-adjusting tramway. It was among the novelties of a recent Royal Agricultural Show, being exhibited by Mr. W. C. Pellatt, of Red Lion street, Clerkenwell, England. As will be seen by the annexed engraving, the tramway is composed of plates of hard wood, faced and strengthened with metal, and attached to two parallel endless chains, which pass round revolving guides or drums at the ends of the vehicle, and both over and under the wheels. The chief points in which this arrangement differs from others of a similar character are the gain of a fixed rail without loss of power by friction, the endless chain of plates resting on the top of the van wheels, and being carried forward by them. In this way a free and noiseless action is secured. The under carriages, constructed on the bogie principle, lock simultaneously, thus causing the front and hind wheels to run in the same track, and also enabling the vehicle to turn a very sharp corner. The shafts, however, can be fixed at either end, so as to avoid the necessity for turning in narrow or inconvenient places.

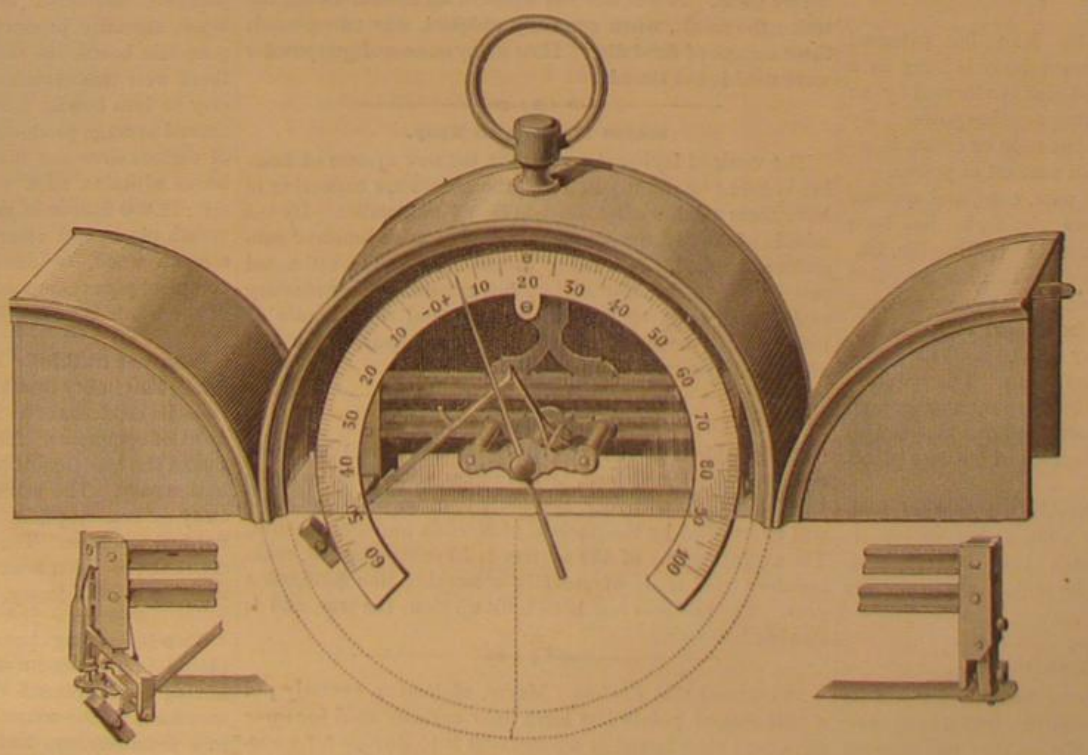
The body of the vehicle projects over the wheels, thus giving an increased capacity of over thirty per cent. A light four-wheeled van, fitted with this apparatus, and loaded up to 1 ton weight, may easily be drawn by one man; and over very heavy or plowed land, the gain is proportionately greater. In this latter case the plates of the endless chains are constructed of a sufficient width to well cover furrows or ruts.

The first two vehicles that were constructed under this patent were a farm wagon capable of carrying from seven to eight tons, and a vehicle for goods or passengers, suitable for high speed.

A NEW METALLIC THERMOMETER.

M. Tremischini's object in the construction of this thermometer, in which the expansion of one metal alone gives the measure of atmospheric temperatures, was to do away with the two inconveniences inherent to the nature of glass —its radiating and absorbing power. It was these inconveniences that the illustrious Tyndall had in view when he remarked that a glass thermometer suspended in the air does not give the temperature of the latter.

But in selecting a metal as an indicator of temperature, the inventor has not been unmindful of the fruitless experiments of those who have preceded him in this field. So, in this new thermometer, there is no system of coupling together two or more strips of unequally expansible metals, no curves especially, of any nature whatever. The metallic strip is made of very hard laminated copper, slightly platinized to prevent oxidation; or it may be of silver. Its thickness is only one hundredth and a half of a millimeter, so that it may possess the highest degree of sensitiveness. The dial of the instrument, on which the temperatures are marked by means of an index needle, rests on a frame which is deserving of a special description.



A NEW METALLIC THERMOMETER.

This frame is composed of two parallel metallic bars, one of steel and the other of copper, connected at their ends by metallic cross pieces. They are represented at the right and left of the accompanying figure. The upper horizontal cross piece, being fixed solidly to the two bars, maintains them at a constant right angle with it; while the lower cross piece, being fastened by two carefully adjusted pins, allows the two other angles of the quadrilateral to become modified under the influence of the unequal elongation of the bars. Taken as a whole, then, the frame forms a rectangular trapezium, one of whose sides (the lower one) may assume different inclinations. This movable side is prolonged beyond the trapezium, and to this prolongation, at a point previously determined by calculation, is fixed the sensitive strip of metal. As for the opposite side of the frame, it ends in a forked appendage, the two branches of which contain an M shaped mortise, and in this rests a movable blade. It is to one of the surfaces of the latter that is attached the other extremity of the sensitive strip. As a result of this arrangement the two points of the frame, to which are fixed on the one hand the oscillating blade and on the other the sensitive strip, are

at an invariable distance apart, whatever be the variation of the temperature.

The expansion of the sensitive strip causes the oscillation of the blade, which, at its lower part, carries a lever. This lever transmits motion to the index needle through an intervening system, whose results are of a remarkable importance, since there is neither chain nor rack, nor especially any antagonistic spiral. To the bottom of the lever is fitted a very small V shaped piece of steel, the apex of which points toward the axis of the index needle The axis contains two diverging grooves corresponding exactly with the two branches of the lever, and the latter are maintained constantly in place in the groove by means of another small piece fitted also to the bottom of the lever. It is now easy to understand that, every time that the lever receives an impulse from the sensitive strip, its V shaped appendage will necessarily transmit this motion, and that too, *without any loss of time*, to the axis of the needle, whatever be the degree of the impulse received, and whatever be the direction in which it takes place. In this thermometer, then, are united all the conditions that are indispensable for important observations; since, in its construction, the author has made it his object to avoid curves and the coupling of two strips, and to obviate the inconveniences pointed out by Tyndall as attending the use of glass thermometers.—*La Nature.*

MECHANICAL INVENTIONS.

Mr. Joseph V. Morton, of Winchester, Ky., has patented an improvement in balance wheels, the object of which is to connect the balance wheel with the band wheel shaft in such a way that when the wheel is moved in the direction for operating the machine the shaft is engaged, and communicates the motion through the belt wheel; but when the motion of the wheel is reversed the shaft is released, remaining stationary

Mr. Edward Wilkinson, of Sheffield, County of Yorkshire, England, has patented an improved light and cheap form of shears, the blades, shanks, and bows of which are composed of flat steel, the whole being in one plane with the exception of the bow, which is curved sidewise, either in one regular or irregular curve, for the purpose of giving elasticity to it.

Mr. Richard J. Skinner, of Oswego, N. Y., has patented an improvement in middlings separators, which is quite simple, and will, it is said, do its work rapidly and thoroughly. The invention cannot be described without diagrams.

Mr. Wilson N. Fort, of Lewisville, Ark., has patented an improved gate composed of parallel bars, one fixed between side posts, and the remainder pivoted in lazy-tongs, on either side, which depend from the fixed bar. The upper pivoted bar is connected with a chain running over a pulley sustained on a rod connecting the two upper ends of the lazy-tongs, by pulling which the lazy-tongs are folded up or contracted and the gateway opened.

An improved tellurian has been patented by Mr. Stephen D Engle, of Hazleton, Pa. This improvement relates to apparatus for the use of schools in teaching the science of astronomy; the object is to furnish a simple and inexpensive apparatus for presenting in a manner that may be readily understood by the pupil the various phenomena connected with the movements of the earth and moon in relation to each other and around the sun, such as the recurrence of day and night, the changes of the seasons, the eclipses, the elliptic orbit of the earth, and the passage of the sun through the signs of the zodiac, etc.

Mr. William M. Myers, of Asherville, Kan., has patented an improved churn, in which the churn body is hung as a weight on the end of a pendulum rod that is vibrated by an escapement and wheel driven by spring or other power. By this means the required agitation of the milk or cream is secured with the expenditure of a small amount of power.

An improved machine which will pare, core, and quarter apples without removing them from the fork, has been patented by Mr. Thomas G. McConnell, of Collinsville, Ill.

Mr. William C. Hooker, of Abingdon, Ill., has invented a trap for catching small animals, such as rats, gophers, and minks, by setting the trap in the holes and runways frequented by such animals; and it may also be used for larger animals by making it of suitable dimensions. The trap consists of a wire shaped to form a loop, spur, spring, and bow, with a trigger having an abutment and an extension up into the bow, the entire trap being formed of but two pieces of wire.

Messrs. Charles S. Moseley and Abraham Bitner, of Lancaster, Pa., have patented a safety pinion that moves its arbor in one direction by a spring catch of peculiar construction, and permits free movement of the pinion in the opposite direction without effect upon the arbor.

American Institute Exhibition.

The marked improvement in general business has had its effect upon the Exhibition of this Institute, which is to open on the 17th of September. Since 1870 no year has equaled the present in the demand for space, or in the superior character of the exhibits. Should this notice meet the eye of any person intending to make an exhibit, no time should be lost in applying for space. Applicants should address the General Superintendent, American Institute, New York.

THE large number of coal oil tanks and refineries struck by lightning shows some peculiar susceptibility of these structures or their contents for attracting electricity. There would seem to be a good field in this direction for scientific investigation and a remedy.

Catching Cold.

This pertinent question is just now engaging attention. There is another question which should be answered first, namely, What is cold? The old idea of a "chill" is, perhaps, nearer the truth than the modern notion of a "cold." The hypothesis would seem to be that a 'cold" is something more than a cold, because, it is said, "You do not catch cold unless you are cold." The fact is there are probably as many diverse occurrences grouped and confounded under the generic title of cold-catching as diseases covered by that popular term fever, which is made to comprise every state in which the pulse is quickened and the temperature raised. By a parallel process of reasoning, "cold" ought to be limited to cases in which the phenomena are those of a "chill." When a person "catches cold," either of several morbid accidents may occur: (1) He may have such a chill of the surface as shall drive the blood in on the internal organs and hamper some weak, or disorder and influence some diseased viscus; (2) the cold may so impinge on the superficial nerves that serious disturbance of the system will ensue and a morbid state be set up; (3) the current of air which causes the cold may in fact be laden with the propagating "germs" of disease; or (4) the vitality of the organism as a whole, or of some one or more of its parts, may be so depressed by a sudden abstraction of heat that recovery may be impossible, or a severe and mischievous reaction ensue. The philosophy of prevention is obviously to preserve the natural and healthy action of the organism as a whole, and of the surface in particular, while habituating the skin to bear severe alternations of temperature by judicious exposure, and natural stimulation by pure air and clean water, and orderly habits of hygiene and health.—*Lancet.*

Immigration Statistics.

According to the records of the Commissioners of Emigration 3,772,707 aliens landed at the port of New York, from August 1, 1855, to January 1, 1879. Of these 1,521,566 gave their destination as New York, and 354,803 went to Illinois, 195,607 to Ohio, 81,955 to Iowa, 69,369 to Missouri, 51,863 to California, 47,687 to Indiana, 38,792 to Utah, 21,738 to Kansas and 19,728 to Nebraska. The destination of the remainder is unknown.

At a conference of delegates representing 200,000 English miners, held in Manchester recently, a resolution was unanimously passed in favor of emigration to the United States.

Similar action has been taken by the Amalgamated Engineers Society, whose headquarters are in London. The engineers on strike in Bradford have been urgently invited to come to this country, with promise of immediate employment and better wages than they can ever hope to get in England. It is said that some 300 Bradford engineers are prepared to emigrate, with assistance furnished by the society.

Killing Flies with Gunpowder.

The Pittsburg *Telegraph* tells how a restaurant keeper got rid of the flies that infested his place. The doors and windows were closed and a train of very fine gunpowder was laid in narrow strips over the floor, and the spaces between the strips were carefully painted with molasses. In an incredibly short time all the flies in the room seemed to be on the floor, enjoying the luxurious repast so temptingly set before them. It was but the work of an instant to fire the train: the result, when carefully weighed, was two pounds three ounces of dead flies. How many ounces of gunpowder were used is not stated.

Steam Heating in Troy.

The work of laying the pipes for the new system of heating is going on rapidly in Troy, the contractor expecting to have them all down by the middle of September. By the middle of August the company had over three hundred subscribers booked. According to the *Budget*, the estimated cost of fitting up a three story brick house with necessary piping and radiators was about $200, and the expense of heating such house by steam, using all required, day and night, will not exceed $20 per year.

Virginia's Oyster Trade.

The president of the Norfolk Oyster Packing Association says that 3,000,000 bushels of oysters will be taken from Virginia waters this year, and more than one third of these will be handled by the packers of Norfolk and Portsmouth. The average value of the oysters is 35 cents a bushel, making the oyster trade of Norfolk something like $350,000 a year. The business has been built up since the war, and is steadily increasing.

IT is stated that Professor Mayer, of Boston, recently put a soft-shelled potato bug larva into carbolic acid for three days, and then boxed it up and sent it to Europe for a zoological specimen. Nothing daunted by the 15 days' journey under such discouraging circumstances, when it reached the old country the bug was found able to eat potato vines as cheerfully as ever.

AT a recent session of the Anthropological Society of Paris, a debate took place on the origin of the blonde race of mankind. Some of the speakers considered that the region of Turkestan was their original seat, while others—in particular Madame C. Royer—maintained that they had originated in Europe.

RECENT AGRICULTURAL INVENTIONS.

An improved cultivator, so constructed that the plows may be readily adjusted to work deeper or shallower in the ground, as may be desired, has been patented by Mr. Cager Hardgrave, of Clarksville, Ark. The invention consists in the combination of the upright rods, having collars and set screws, by which the plow beams are supported at any required height. The improvements are covered by two United States patents.

Mr. George W. Carroll, of Union City, Pa., has patented an improved horn tip for cattle, which may be secured to the horns without liability of breaking or otherwise injuring them; and it consists in wooden tips incased in metal sleeves attached to chains on which are elastic rings adapted to fit the tapering horns and yield to their growth. They are connected together between the horns by a loop so that the chains can be taken up or shortened at pleasure, to adapt them to different cattle.

Mr. Asa Newsom, of Valdosta, Ga., has patented an improvement in plows. The object of this invention is to improve the construction of the plow for which letters patent No. 199,736 were granted the same inventor, January 29, 1878. The invention consists in combining a curved slotted standard, with a plow beam secured between upper ends of standard, and provided with an extension having an eye, and bars that connect the standard and handles.

An improvement in the class of cultivators whose beams are so connected as to adapt them for lateral adjustment, and which have pivoted adjustable standards, has been patented by Mr. Columbus Stephens, of Cave Spring, Ga. The improvements relate to the construction and attachment of the braces for the standards.

Progress of Shipbuilding.

The records of the Treasury Department show a decided increase in the building of steam vessels this year. The returns for the last quarter of the fiscal year were not all in, but enough had been received to warrant an estimate of an aggregate for the year of upwards of 88,000 tons. The total tonnage of steam vessels, built the preceding year, was 81,860, and during 1877 only 47,514. A considerable increase is also probable in the number of sailing vessels, barges, and canal boats. Full reports will be submitted in October.

A very considerable impulse to this department of American industry is foreshadowed in a cable press dispatch from London, to the effect that negotiations between a syndicate of American shipbuilders and the Russian Government had culminated in a large order for American built vessels. According to the dispatch, Admiral Lessowsky, Russian Minister of Marine, had signed a contract with these American ship building firms for the construction of a number of ocean corvette cruisers, which will cost about $17,000,000.

Tobacco Pipes in Germany.

An official inquiry into the extent of the tobacco trade in Germany has brought out some interesting statistics with regard to the trade in tobacco pipes.

The chief center of this branch of industry is Ruhla, in Thuringia. In that town and the neighboring villages the annual production for the past few years has averaged 540,000 genuine meerschaum bowls or heads, and 5,400,000 artificial or imitation meerschaum bowls. The number of polished, lacquered, and variously mounted wooden pipe heads annually produced was 4,800,000. Of the common porcelain bowls, the favorite pipes of the German peasantry, there were manufactured every year 9,600,000, and of fine clay or lava bowls, 2,700,000. Further, there has been an annual average production of 15,000,000 pipe stems or tubes, of various sizes and materials; 1,600,000 dozen of miscellaneous adjuncts, such as flexible tubes, chains, tops, tufts, etc.; 12,000 dozens of meerschaum pipe cases, 800,000 dozen mouth pieces and cigar holders of amber or horn and meerschaum wood, or cocoanut shell; and, finally, 15,000,000 complete pipes composed of various materials. The value of the whole is estimated at about $5,000,000.

SOME one truthfully says that the science of mechanics draws its vitality from coal and iron. Coal emancipates iron from its crudeness and furnishes it with power as an instrument of commerce. The union of these two minerals has solved the question of production, and has rendered distribution easy. The world is embarrassed only with the difficulty of consumption. Coal fashions iron and drives the finished machine. The dirty thing is the great vehicle of civilization. Iron is an instrument; coal is a cause. Iron is an agent of industry, and coal is a master power.

Two interesting specimens of the orang-outang have been placed in the Jardin d'Acclimatation, Paris, the older one having been captured with others, at Borneo, after a desperate chase, in the course of which eight natives, the French (not Barnum) say, lost their lives. The animals, according to the account given, were run into an elephant trap, thirty feet deep, and were gradually reduced by hunger to a state of weakness, when they were garroted and shut up in a cage. The oldest one measures about five feet, and is said to be the largest ever brought to Europe,

THE NICARAGUA CANAL.—Rear-Admiral Ammen states that General Grant has telegraphed his willingness to accept the presidency of an American company to construct an interoceanic canal, with a distinct preference for the Nicaragua route.

Correspondence.

A Five Legged Frog.

To the Editor of the Scientific American:

I notice a fine figure of a "three legged woodcock" in the SCIENTIFIC AMERICAN, No. 2, for January 11, 1879, page 23. You remark that "it is rare that monstrosities in nature are ever able to hold their own in the struggle of life." Being handy at drawing, I herewith send you a sketch of a fully matured frog (*Rana palustris*) having five full sized legs, as a counterpart to the woodcock. This was captured in the Conestoga, near the city of Lancaster. I sent a drawing and description to my young friend, John A. Ryder, of the Academy of Natural Sciences, Philadelphia. He wrote the following notice of it, which was published in the *American Naturalist*, vol. xii., p. 751, but not illustrated, which reads.

"A MONSTROUS FROG.—Mr. Jacob Stauffer, the veteran* naturalist of Lancaster, Pa., sends me a drawing of a frog (*Rana palustris*) with a well developed extra hind limb, or what appears from his drawing and description to be, speaking more correctly, a united pair of hind limbs, though occupying an asymmetrical position, and having their true homologies to a certain extent concealed from this cause. A sketch and remark of Mr Stauffer's, however, shows the true nature of this limb to be compound; that is, that it consists of two united halves divided by development from both sides of the body. He remarks: 'The extra leg is of the same color above and below, while the others, or normal legs, are of a dirty yellowish color beneath.' He further says this leg has six instead of five toes, and gives a sketch, which leads me to think that the digital formula of the compound foot must be written in this manner, 5, 4, 3, 3, 4, 5, showing clearly that the limbs are fused together by their inner faces, thus bringing the outer or fourth and fifth toes to the outside, while the prevalence of the superior and outer dark colors, and concealment of the inferior yellow tints, is just what ought to happen in the event of such union."

I quote Mr. Ryder because he presented my ideas in better shape than I had done. I will only add that this frog was alive for five days at Mr. Snyder's saloon, in this city, with a fish hook through the upper jaw. He was made to swim and hop to amuse the crowds of callers. Poor frog, although vigorous and able to use his additional appendage lustily as an oar or leg in his gymnastics, he had just given up his vitality when I laid him out and took an accurate drawing of the creature, which is now preserved in alcohol for inspection. I have heard of a similar frog in one of the Eastern museums.

J. STAUFFER.

Lancaster, Pa.

A FIVE LEGGED FROG.

Crabs of Cape Verde Island.

A rock crab (*Grapsus strigosus cf.*) was very abundant, running about all over the rocks, and making off into clefts on one's approach. I was astonished at the keen and long sight of this crab. I noticed some make off at full pace to their hiding places at the instant that my head showed above a rock 50 yards distant. The crab often makes for the under side of a ledge of rock when escaping from danger, and may then be caught resting in fancied security by the hand brought suddenly over it from above.

The dry rocks were covered with the dung of the crab, which is in the form of small, brittle, white sticks about an inch in length, very puzzling objects at first sight. The cast shells of the crab, which are bright red and very conspicuous, were lying all over the rocks. At Still Bay, on the sandy beach on which, although it is on the leeward side of the island and the sea surface was smooth, a heavy rolling surf was breaking, I encountered a sand crab (*Ocypoda ippeus*) which was walking about, and got between it and its hole in the dry sand above the beach. The crab was a large one, at least 3 inches in breadth of its carapace. In this species of crab the eyestalks are very long. The eyes are on the side of the stalks, which are longer than eyes, and projecting above them are terminated by a tuft of hairs. When the animal is on the alert these long eyestalks are erected, and stand up vertically side by side far above the level of the animal's back.

With its curious, long, column-like eye serect the crab bolted down toward the surf as the only escape, and as it saw a wave rushing up the shelving shore dug itself tight into the sand and held on to prevent the undertow from carrying it down into the sea. As soon as the wave had retreated it made off full speed along the shore. I gave chase, and whenever a wave approached the crab repeated the maneuver. I once touched it with my hand whilst it was buried and blinded by the sandy water, but the surf compelled me to retreat, and I could not snatch hold of it for fear of its powerful claws. At last I chased it, hard pressed, into the surf in a hurry, and being unable to get proper hold in time it was washed down into the sea. The crab evidently dreaded going into the sea.

These sand crabs breathe air through an aperture placed between the bases of the third and fourth pairs of walking legs, and leading to the gill chamber. They soon die when kept for a short time beneath the water, as shown by Fritz Muller's experiments.—*H. N. Moseley's Notes.*

* He means because I am over 70 years of age I am a veteran—as a naturalist.—J. S.

Winding Up a Horse.

The Rev. Dr. Chamberlain, in a letter to the *American Missionary*, from Mudnapilly, India, gives the following singular experience he had with a balky horse:

Nineteen years ago, says the venerable divine, I bought in Madras a peculiar kind of horse. He had to be wound up to make him go. It was not a machine, but a veritable live horse.

When breaking him to go in the carriage he had been injured. An accident occurred in starting him the first time, and he was thrown and hurt and frightened. It made him timid; afraid to start. After he had once started he would never balk, until taken out of the carriage. He would start and stop and go on as many times as you pleased, but it was very difficult to get him started at first each time he was harnessed to the carriage.

He was all right under the saddle, an excellent riding horse, and would carry me long distances in my district work, so that I did not wish to dispose of him; but I could not afford to keep two; whatever I had must go in carriage as well as ride, and I determined that I would conquer.

How I have worked over that horse! At first it sometimes took me an hour to get him started from my door. At last, after trying everything I had ever heard of, I hit upon an expedient that worked.

I took a strong bamboo stick two feet long and over an inch thick. A stout cord loop was passed through a hole two inches from its end. This loop we would slip over his left ear down to the roots, and turn the stick round and round and twist it up.

It is said that a horse can retain but one idea at a time in its small brain. Soon the twisting would begin to hurt. His attention would be abstracted to the pain in his ear. He would forget all about a carriage being hitched to him, bend down his head, and walk off as quiet as a lamb. When he had gone a rod the horse boy would begin to untwist, soon off would come the cord, and the horse would be all right for the day. The remedy never failed.

After having it on two or three times he objected to the operation, and would spring about and rear and twitch and back, anything but start ahead, to keep it from being applied. We would have, two of us, to begin to pat and rub about his neck and head. He would not know which had the key. All at once it would be on his ear and winding up. The moment that it began to tighten he would be quiet, stand and bear it as long as he could, and then off he would go. It never took thirty seconds to get him off with the key. It would take an hour without. After a little he ceased objecting to have it put on. He seemed to say to himself, "I have got to give in, and may as well do it at once," but he would not start without the key. In a few months he got so that, as soon as we got into the carriage, *he would bend down his head to have the key put on*, and one or two turns of the key would be enough.

Then the key became unnecessary. He would bend down his head, tipping his left ear to the horse boy, who would take it in his hand and twist it, and off he would go.

My native neighbors said, "That horse must be wound up or he cannot run." And it did seem to be so.

When he got so that the "winding up" was nothing but a form, I tried to break him of that, but could not succeed. I would pat him and talk to him and give him a little salt or sugar or bread, and then step quietly into the carriage and tell him to go. "No." Coax him. "No." Whip him. "No." Legs braced, every muscle tense for resistance. A genuine balk. Stop and keep quiet for an instant, and he would hold down his head, bend over his ear, and look around for the horse boy appealingly, saying very earnestly by his actions, "Do please wind me up. I *can't* go without, but I'll go gladly if you will." The moment his ear was touched, and one twist given, off he would go as happy and contented as ever horse could be.

Many hearty laughs have we and our friends had over the winding up of that horse. If I were out on a tour for a month or two and he were not hitched to the carriage, or if he stood in the stable with no work for a week or two during the monsoon, a real winding up had to take place the first time he was put in. We kept him six years. The last week I owned him I had to wind him up. I sold the patent to the man that bought the horse, and learned from him that he had to use it as long as the horse lived.

Should City Horses be Turned Out to Pasture?

Grass is the natural food of the horse. In spring and summer the fresh green herbage of the field and mountain springing up among the rocks, along water courses, or in the valleys, seasoned with the twigs of shrubs and trees, and the great variety of other plants which are both pleasant to the eye and good for food, constitute a rather bulky but nutritious and acceptable aliment. This food distends the paunch and gives an outline to the animal, which, as concerns city horses, is, to say the least, unfashionable. Very heavy horses, high bred horses, and even those accustomed from colthood to concentrated food, especially to receiving oats regularly, and whose skins are thin from having had regular grooming, protection from the weather and from the attacks of flies, do not do well as a rule when turned to pasture. It is hard to make city people understand this. This is true—and being true, ought city horses ever to be turned to grass? Certainly not in all cases. If they have a good, deep, dark shed to go under at will, to get away from insects, and to protect them during cold storms; copse and young woody growth in which they may at will take shelter from the flies; running water in the pasture; plenty of good sweet grass, not too close cropped nor yet too rank; and about one third to half their usual feed of grain daily—say four quarts of oats and an equal measure of bran—and access to salt at all times, they would do well—not gain in flesh, probably, but they would come through the summer looking fly bitten, perhaps; but, nevertheless, in such shape that they would soon get into first-rate working order, with a new lease of life from the change. It is quite as important for farmers to understand this as for the city owners of horses—and much hard feeling saved, and perhaps the annoyance of lawsuits may be avoided, by the knowledge. There should always be a proper understanding of exactly what is to be done by the party taking the horses.—*American Agriculturist.*

[After considerable unfortunate experience in turning horses out to recuperate in pastures during the summer, we have come to the conclusion that horses accustomed to city work and care, whose condition is tolerably good, are seldom benefited, but are often injured, and never come back to their work in as good trim as when sent away.—EDS.]

Our Ferry Traps.

The frequent narrow escapes from fearful catastrophes make it necessary that we should again call the attention of steamboat inspectors to their duty in this regard. It is not too much to state that New York has the best as well as the worst managed ferries on the continent. And yet the best are far from being what they may and should be, where the interests involved are of such vast magnitude. It is not uncommon to find 1,000 persons crowded on board one of the boats of the Fulton ferry at certain hours of the day, and more at night. It is hardly within the power of language to describe the horrors which would ensue were a boat thus loaded to sink, from whatever cause, whether from collision caused by fog or by ice. These excessive freights of humanity may be witnessed several times on every working day of the year.

The boats of all our ferries, and especially the one named, should have their vacant space below deck filled with copper bound oil casks, since it has been proven that water tight compartments are a myth. Their upper decks should be covered with life rafts. The life preservers in the cabins of the Fulton ferry boats are beyond the reach of passengers. The outside bulwarks between fenders and rail should be fitted with sectional life rafts, which could be dropped overboard in an instant.—*American Ship.*

Remarkable Electrical Experiments.

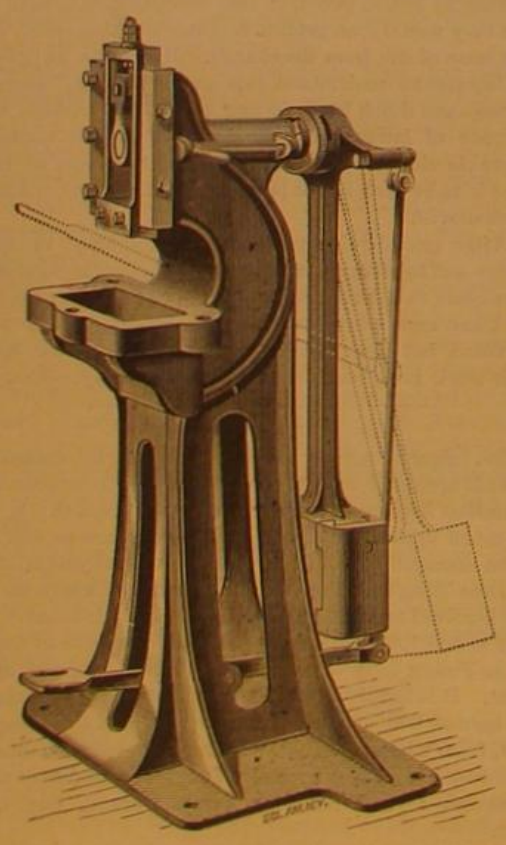
Some twenty years ago, says a writer in *Inter-Ocean*, Mr. Andrew Crosse, of Bloomfield, England, stood foremost in the grandeur of his experiments and investigations in electrical science, and his achievements ranked among the most splendid of his day, while his skill entitled him to high rank among the devoted investigators of scientific truth. Mr. Crosse collected the electricity from the atmosphere by means of a wire with points, supported on poles, fixed to the tallest of the magnificent trees which adorned his grounds. This conducting wire was carried into a room, where it terminated in a large brass ball. Near this was another similar ball, which was connected with a neighboring pond, down in the water, by means of a metal rod, and by means of an adjusting screw and large glass handle the electric discharge was easily directed into the earth by bringing the two balls together when not experimenting, or the charge was not too strong. Mr. Crosse had a Leyden battery, consisting of fifty-one gallon jars, containing seventy-three square feet of coated surface on each side, and with about 1,600 feet of his lightning rod wire, he has frequently collected sufficient lightning to charge and discharge this battery twenty times a minute, with reports as loud as a musket. The battery, when fully charged, would perfectly fuse into red hot drops thirty feet of iron wire in one length, the wire being 1-270 of an inch in diameter. When the battery was connected with 3,000 feet of rod during a thunderstorm, a constant stream of discharges took place between these balls. And if the center of a cloud was vertical over the points, the bursts of thunder and the crash of the accumulated fluid conspired to produce an appalling effect.

A NEW PRESS.

The press shown in the annexed engraving is quite novel in principle, and although a recent invention it is rapidly coming into notice. It is adapted to a great number of uses, such as the punching and shearing of metals and other materials, stamping, embossing, etc., by foot or hand. It accomplishes work that has heretofore been done only by power presses. It performs some astonishing feats; for example, a press like that shown in the engraving will easily shear one-half by two-inch wrought iron, and punch a ¾ inch hole through 5-16 inch iron by foot power alone, and it can do more when operated by hand.

This astonishing result is obtained by the employment of a weighted pendulum, swinging back and forth or describing a complete circle if necessary. The pendulum is used in connection with an automatic clutch, a shaft, and a slide. The pendulum is easily set in motion by the pressure of the foot upon the treadle; this revolves the shaft with the same results and performs the work with the same speed as in ordinary power presses.

The weight of the pendulum may be varied to suit the work in hand, a supplemental weight being fitted to each side of the pendulum, to be attached or removed as occasion may require. The press is provided with a foot pedal, which yields to upward pressure, preventing accidents to the feet of the workman, and also avoiding breakage in case an unyielding body should accidentally get under the pedal. When required the press is furnished with a hand lever, as indicated in dotted lines. It is thus capable of rapidly



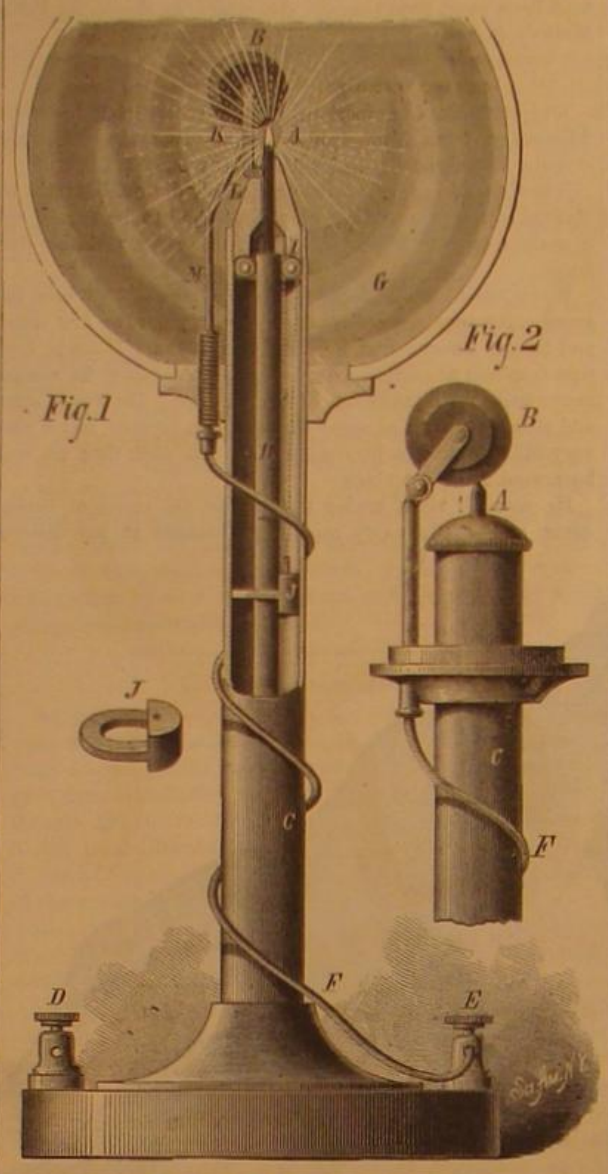
PEERLESS PUNCH AND SHEAR PRESS.

punching 1 inch holes through 5-16 iron. An ingenious stop is shown at the side of the press by which the punch may be brought into action at every oscillation of the pendulum or whenever required.

This press, and other styles on the same plan which we may hereafter describe, are made by the Peerless Punch and Shear Company, of 52 Dey street, New York city.

NEW FORM OF ELECTRIC LAMP.

The accompanying engraving represents an electric lamp (Reynier's system) designed by G. Cromé for domestic use. It is said that this lamp gives very good results when operated by six Bunsen elements. When a series of lamps is used the current should be supplied by a dynamo-electric machine. The carbons are inclosed either by a simple globe



IMPROVED ELECTRIC LAMP.

or by a bell filled with nitrogen or rarefied air, and the lamp may be used with safety in powder mills, in mines, and under water.

The carbon pencil, A, is a little less than $\frac{5}{16}$ inch in diameter. It is guided by the tube, H, and is pressed upward against the edge of the disk, B, by the weight, J, attached to a cord passing over the pulley, I. The carbon is in electrical communication with the binding post, D, and the carbon disk, B, is connected with the other binding post, E, by means of the wire, F.

The globe, G, rests upon the collar attached to the main standard of the lamp, and is entire throughout, except at the bottom. This globe may be replaced by a glass bell filled with nitrogen, which will retard the combustion of the carbons.

The disk, B, is supported by a lever, K, that is pivoted in the insulated standard, M. The lower end of this lever is bent at right angles, and is made to exert a slight lateral pressure on the carbon when the point of the carbon presses against the disk, B. The upward movement of the carbon causes the disk, B, to turn slightly, thus presenting a new surface to the action of the current.

The device shown in Fig. 2 is similar to that already described, the difference being that the regulating lever is omitted.

A Steam Rammer for Paving Streets.

The Philadelphia papers contain descriptions of a new and successful invention in use in that city for laying street pavements. According to the statements of our contemporaries it pounds granite blocks and cobble stones into place, making the surface, one paper says, as smooth as a billiard table, and promises to do away with the old style of paving the streets. The rammer, which looks like a locomotive at a distance, is operated on the same principle as a trip hammer, and can be so regulated as to make a stroke of one pound weight or 1,500 lb. This enables the operator to produce a level surface on every portion of the street it passes over, while the most expert man power cannot strike over two hundred pounds. Durability and solidity are the important features of paved streets, and while hand power can only force the stone into the earth three inches, the steam rammer sends them six inches with ease; thus making the stones compact and solid. It is claimed that the streets paved with this new invention will last until the stone is worn out. The machine weighs six and a half tons, and even that makes no rut or impression on the street which it has rammed. In repaving streets paved with cobble stones under the old system it is necessary to relay them, while, with the steam rammer, they can be driven to a level with perfect ease. It requires the services only of an engineer and a man to guide the rammer to work the machine. It consumes one fourth of a ton of coal per day. A number of streets in West Philadelphia bear splendid specimens of its work.

The Melodiograph.

Several contrivances have been invented to record the notes of melodies played on a piano, organ, or other key instrument, but were all more or less useless on account of their complexity, imperfectness, or expense.

Zigliani's melodiograph is very simple, usable, and cheap. A double flat spring placed under each key is connected with a battery and with a recording apparatus, which consists of a comb provided with insulated teeth gently resting on a copper cylinder. A strip of ruled and chemically prepared paper is drawn over this roller by a clock work, and receives the impressions or marks of the teeth of the comb. This clockwork can be regulated so as to cause the paper to move in conformity with the time kept by a person playing the instrument. Every time a key is depressed the circuit is closed, and the electricity, passing through one of the teeth of the comb, makes a mark corresponding to the key that has been depressed.

The Phosphorescence of the Sea.

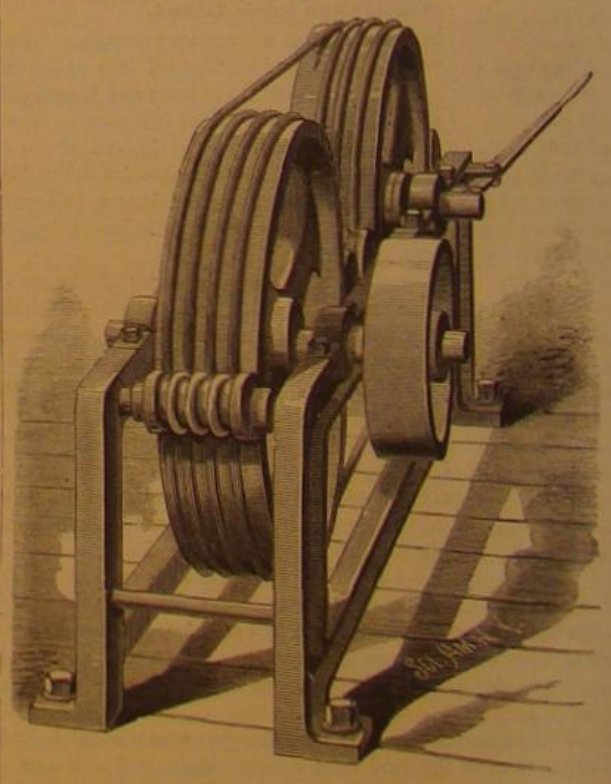
The illumination or phosphorescence of sea water at night, observable in this latitude in the summer, and at all times in tropical regions, is largely due to *Noctiluca miliaris*. It is a gelatinous little speck of a fellow, in shape like a peach, but only $\frac{1}{32}$ of an inch in diameter. The light, which is of a greenish hue, arises from scores of minute points. A glass of water taken where these creatures are present may contain myriads of them. Nets and ropes drawn through the sea pick up millions of Noctiluca; and the ropes and meshes are made luminous by them until they become dry.

NOVEL DEVICE FOR TRANSMITTING MOTION.

We give herewith an engraving of a new device for transmitting motion, invented by Messrs. Dennis, Samper & Valenzuela, of Bogota, United States of Colombia, South America. This device is intended for the transmission of power from one shaft to another, and it may be employed in transmitting continuous rotary motion or a reciprocating rotary motion.

It consists, as will be seen, by reference to the engraving, of two pulleys placed, one upon the driving shaft, the other upon the driven shaft, and connected by a belt, rope, or chain which passes several times around each pulley. When a continuous rotary motion is to be communicated from one shaft to the other the belt is endless, but when the motion is alternating the belt need not be endless; it may be wound several times upon the pulleys and have its ends attached to the pulley rims.

The belt is prevented from moving along laterally on the pulleys by the small grooved rollers journaled on diametrically opposite sides of the pulleys, and embracing the several convolutions of the belt. It is stated that the slight side pressure required to keep the coils of the belt in position on the pulleys amounts to nothing compared with the saving of power by avoiding the slipping of the belt.



DEVICE FOR TRANSMITTING MOTION.

The applications of this device are numerous. It may be used in transmitting power in place of the ordinary belt, and in most cases in place of cog gearing. It may be applied to hoisting machinery and to the transmission of power by wire ropes.

Further particulars may be obtained from Mr. Silvestre Samper, 362 President St., Brooklyn, N. Y.

Poisoned by Revenue Stamps.

Ex-Mayor Butler, Binghamton, N. Y., has been seriously poisoned about his face and hands by handling government revenue stamps used on cigar boxes. While the weather was very hot and he was perspiring freely, he stamped and canceled the stamps on a large number of cigar boxes. Green dust flew from the stamps and covered his hands and wrists, and a handkerchief used by him for wiping his face and neck also became filled with the dust. The result was a severe and deep poisoning wherever the dust touched. There was evidence of poison breaking out on one ankle, showing that it was spreading through his system. Ex-Alderman Jackson, of the revenue office in Binghamton, has been troubled for about a year with a skin disease resembling closely the poisoned surface of Mr. Butler.

THE GREENLAND WHALE AND THE GRAMPUS.

The annexed engraving represents a combat between the Greenland whale (*Balæna mysticus*) and the grampus (*Delphinus grampus*), the most voracious of the inhabitants of the ocean. It does not devour one third of the animals it kills. It is the greatest enemy of the whale, and dead bodies of whales have frequently been found having large pieces of flesh torn from the body, and the lips mutilated or destroyed. As soon as the whale opens its mouth to defend itself the grampus darts at its large soft tongue, tears it off, and causes the death of the animal.

It is said that the grampuses are fond of amusing themselves by mobbing the Greenland whale, and that they persecute it by leaping out of the water and striking it sharply with their tails as they descend. In consequence of this it has been called the thrasher or killer. The swordfish is reported to join the thrasher in this amusement, and to attack the whale from below to prevent it from diving. Whatever may be said of the latter part of the story, the former is certainly true, and is corroborated by Capt. Scott, who has often seen this strange sight.

The grampus is from twenty to thirty feet in length and from ten to twelve feet in girth. It has forty-four conical, strongly made, and slightly curved teeth. Its color is black on the upper part of the body, suddenly changing to white on the abdomen and part of the sides, and there is generally a white patch of considerable size behind the eyelid.

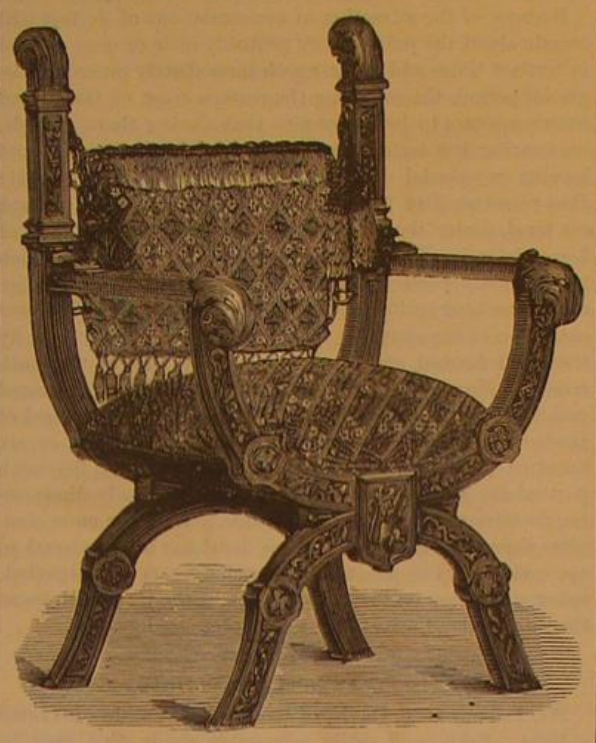
Although it sometimes wanders to more southern regions, its favored home is in the northern seas that wash the coast of Greenland and Spitzbergen, where it congregates in small herds.

The Greenland whale, northern whale, or right whale, as it is indifferently termed, is an inhabitant of the northern seas. It is, when full grown, about sixty or seventy feet in length, and its girth about thirty or forty feet. Its color is velvety black upon the upper part of the body, the fins, and the tail; gray upon the junction of the tail with the body and at the base of the fins, and white upon the abdomen and fore part of the lower jaw. The velvety aspect of the body is caused by the oil which exudes from the epidermis, and aids in destroying the friction of the water. The jaw opens very far back, and in a large whale is about sixteen feet in length, seven feet wide, and ten or twelve feet in height. The most curious part of the jaw and its structure is the remarkable substance that is popularly known as whalebone, which is found in a series of plates, thick and solid at the insertion into the jaw, and splitting at the extremity into a multitude of hair-like fringes. On each side of the jaw there are more than three hundred of these plates, which, in a fine specimen, are about ten or twelve feet long and eleven inches wide at the base. A large whale furnishes about one ton of whalebone. These masses of whalebone are placed along the sides of the mouth for the purpose of aiding the whale in procuring food and separating it from the water.

COMBAT BETWEEN THE GREENLAND WHALE AND GRAMPUSES.

The Human Voice a Corner Stone Memento.

A great many novel articles have been placed under corner stones of public buildings and other structures about being erected. But the most novel article we have known to be thus deposited was in laying the corner stone of an academy in Massachusetts the other day. It was nothing less than a strip of the human voice imprinted on tin foil by the phonographic process. There is no comprehending the curiosity this bit of tin foil will be to the people of a couple of hundred years hence, when the corner stone shall be opened and the voice taken out, and found to articulate the words and sentiments of one long since dead and forgotten.



ARMCHAIR DESIGNED BY SCHMIDT & SUGG, VIENNA.

Artificial Formation of Felspars—Nepheline and Leucite.

F. Fouqué and A. Michel Levy have recently prepared the minerals above mentioned. Nepheline is formed when a mixture of silicic acid, alumina, and sodium carbonate, in such proportions that the oxygen of protoxide, sesquioxide, and acid are as 1 : 3 : 4, are heated together; white silk-like crystals are obtained which, under the microscope, are seen to be small hexagonal prisms (they are 0·12 min. long and 0·06 min. broad), which accord in every respect with natural crystals of nepheline. If somewhat more silicic acid be taken, like that corresponding to the proportion 1 : 3 : 4½, a completely crystalline mass is obtained, which bears in its optical characters the same resemblance to hexagonal nepheline as chalcedony does to quartz. By melting together one tenth pyroxene and nine tenths nepheline a mixture of four different minerals was obtained: nepheline, pale green spinel, garnet in brown-yellow octahedra, and microlite. Leucite was also found in the fused product, and resembled both in form and optical characters the natural mineral.—*Comptes Rendus.*

Volcanic Oil Well.

An oil well on Kendall Creek, near Tarport, Cattaraugus county, N. Y., having ceased to yield oil, the operators recently pulled up the tubing, and as no obstruction was found in that, it was decided to torpedo the well. Before arrangements were completed for the operation, a sound like that of steam escaping from a locomotive valve, and then a rumbling noise, were heard in the well, and a trembling of the earth was felt. Presently a shower of stones, ashes, and dry dust, accompanied by a dense cloud of gray smoke, was thrown in the air. The eruption lasted only a few seconds, and then oil began to flow copiously. The well has since been yielding nearly double its former quantity. The stones thrown up from the well were rough and light, like pumice stone. The ashes were red and gray.

The Grape Rot.

We recently visited the vineyards of Vineland, N. J., to ascertain with what success those were meeting who have been experimenting in protecting their vines as a remedy against the "grape rot," which has been so destructive in Southern New Jersey the past two or three years. In company with E. G. Blaisdell, the courteous and enterprising editor of the *Vineland Weekly*, we made a tour of inspection of several of the vineyards.

In the March 1st issue of the *Farmer* our correspondent from Red Plains, N. C., recommended the use of a board covering over the trellis as a remedy against rot and mildew. The idea was taken up by our Vineland grape growers, and experiments are this year being made in many of the vineyards. The experiments so far are entirely successful.

Some have experimented by using manila paper bags just large enough to hold within it a cluster of grapes. The bag is slipped over the bunch and securely pinned at the opening, and is left on until the grapes are ready for the market. We first visited the vineyard of George Scarborough, Esq., who put on five hundred bags as an experiment. In all cases where we removed the bag we found the cluster perfect, unless where the bag was not put on soon enough. Experiments thus far have shown that they should be put on about ten days after the blossoms appear, for all that were covered at that stage were found perfect. Mr. Scarborough has largely experimented this year with the board covering, and is so well satisfied with the results that next year he will cover all his grapevines with them. In every case where the board protection was used the grapes were found perfect—not a sign of rot could be found, while the next vine, left uncovered, would not be worth picking. Last year, in both his finely cultivated and extensive vineyards but one crate of grapes were picked, when the work was abandoned and given up as not paying for the labor. Last year he found that the "Concord" rotted worse than the "Ives Seedling," and the "Champion" worse than the "Concord."

We next visited the large vineyard of D. Rood, Esq. This gentleman has 30,000 paper bags in use, with results the same as in Mr. Scarborough's vineyard. One man will put on one thousand bags in a day. The extensive vineyards of Colonel Alex. W. Pearson were examined. Here the board covering only has been used, and with gratifying results, as in the other cases. The colonel is pretty well satisfied that the board covering is the remedy against "grape rot," and next year will make a wholesale matter of the covering. From our observations we would pronounce in favor of the board covering. It not only affords protection from the disease, but protects from the early frosts. The first cost is

greater than the paper bag covering, but this is counterbalanced by the length of time it will last.

The fruit prospect about Vineland is certainly of the most encouraging nature. Large orchards of choice pear trees are laden with excellent fruit; we observed many pear trees broken down with the weight of the fruit. An unusually large crop of berries were shipped to the Philadelphia and New York markets from this place, and such a thing as "hard times" seems to be unknown among the thrifty fruit growers of Vineland.—*Ohio Farmer.*

The Entomological Club.

The Club on Entomology, connected with the American Association, held its sessions on the day preceding the general meeting. Prof. J. A. Lintner, of Albany, president, delivered an address, telling of the great advances made in the study of insects and the increasing interest manifested in the subject. At the last session of the club the names of 280 entomologists were reported. Investigation since has increased the list to 835 persons engaged in the study of entomology in the United States.

At the afternoon session many specimens of insects were exhibited, among others some from California of the *Pseudohazis eglanteriana*. Prof. Samuel H. Scudder, of Cambridge, presented specimens and a description of the operations of the *Retina brustiana*, an insect now ravaging the pine trees of Nantucket and other evergreen trees in different places. Prof. Comstock, United States Entomologist, exhibited specimens of the larger species of the same genus.

Prof. August R. Grote, Director of the Museum of the Buffalo Society of Natural Science, stated that he believed the damage done by Paris green was greater than that done by the potato bug. His opinion was based on a careful study of its effects on horses, cattle, sheep, chickens, and even men and women. He referred to the laws in Germany restricting the open and promiscuous sale of such poisons, and thought it the duty of the members of the club to do all in their power toward educating the people up to the bad effect of this and kindred poisons, aniline dyes, etc., with a view to effecting legislation. Prof. Comstock presented specimens of an insect which preys on the eggs of the bark-louse, taken from the maple. Prof. C. V. Riley, of the United States Entomological Commission, gave an account of two species of moths affecting the yucca. Professor Samuel H. Scudder told of a fossil insect of a very singular shape, obtained from tertiary rocks. Prof. W. S. Barnard, of Cornell University, showed specimens of a small bug which kills bees and butterflies much larger than itself. He also gave an account of the pear bug-louse, which causes a certain blight to the pear tree. Prof. William Saunders, editor of the *Canadian Entomologist*, gave an account of insects he had seen caught by the bidens, not heretofore supposed to be a carnivorous plant.

New Theory of Sea Level Changes.

In an interesting article by Warren Upham, in the *American Naturalist*, on the "Formation of Cape Cod," in which he shows that it is due to glacial action, the author presents the following theory of the causes of the changes in sea levels:

The plains of Cape Cod are further like those of Long Island, Martha's Vineyard, and Nantucket, in being indented by narrow arms of the sea, which reach one to two miles inland, filling the lower end of long depressions that continue across the plains to the north, being either dry or occupied by small streams. The plains and valleys which thus generally border the terminal moraines on their south side appear to have been formed by the same floods which deposited the large amounts of modified drift along the edge of the ice sheet. Much of their finer gravel and sand was carried forward by the descending currents, and spread in these gently sloping plains, while the valleys of drainage seem to have been made by the same waters at their lower stages.

The continuation of these valleys below our present sea level calls up one of the most complex but at the same time most important and interesting questions connected with glacial geology. This feature shows plainly that when these valleys were formed the sea did not reach so high upon the land as now; and if we extend our inquiries we find that everywhere around the world the glacial period was marked by most extraordinary changes in the relative heights of land and sea. These remarkable oscillations, which had one extreme at the equator and the other at the poles, appear to have been changes in the level of the ocean. It seems not unlikely that an eighth part of the earth's surface had become covered with ice, and if we consider a slope of one half a degree to be needed to give it motion, an estimate of four miles for its average depth does not seem to be too great. The removal of the water thus taken from the sea and stored up in accumulations of ice would lower the surface of the ocean more than half a mile. At the same time this vast accumulation of ice in high latitudes must draw the sea by gravitation away from the equator toward the poles. This cause appears to have retained the sea level at about its present height near the lower limit of the ice sheet, while in arctic regions it rose much higher than now. Marine shells in the modified drift show that the sea thus stood fifty to two hundred feet above its present height on the coast of New Hampshire and Maine; five hundred feet in the valley of the St. Lawrence, and one thousand to two thousand feet higher than now along the west coast of Greenland. Everywhere in high latitudes, both in the northern and southern hemispheres, we have proof of such a submergence of the land when the drift was accumulated, increasing in amount the nearer we go to the poles. On the other hand, the coral islands of the tropics are witnesses of the depression of the sea in this period, amounting to three thousand feet, or perhaps more, at the equator, while different evidence shows that at the mouths of the Mississippi, Ganges, and Po rivers, it was at least four hundred feet lower than now. If we reflect upon these widespread changes of sea level that marked the glacial period, occurring only where they would be produced by taking water from the sea to form ice sheets and by gravitation through their influence, and if we compare these recent simultaneous changes with the general stability of the continents, we seem compelled to attribute them to movements of the sea rather than of the land.

Because of the attraction of accumulations of ice that still remain about the poles, where probably little or none existed in tertiary times and at the epoch immediately preceding the glacial period, the sea along the eastern coast of the United States appears to be lower now than during those periods, uncovering the tertiary border of the Southern States and leaving pre-glacial deposits with marine shells, apparently Post-pliocene, fifty to two hundred feet above our present sea level, under the terminal moraine and modified drift of Long Island. The entirely unstratified character which marks many portions of the terminal deposits of the ice sheet, reaching quite to the sea shore, and the still lower extension of the channels which appear to have been cut by the floods formed at its melting, indicate that at the south coast of New England the sea was depressed in the glacial period below its present height. The submarine channel of Hudson river shows that after this time it sank five or six hundred feet lower than now, apparently because the south part of the glacial sheet had been melted, greatly diminishing its attractive force at this latitude. With the more complete departure of the ice the sea level has been restored to approximately the same condition as before the glacial period, being still rising on the eastern coast of the United States at the rate of about a foot, or less, in a hundred years.

MISCELLANEOUS INVENTIONS.

Mr. Dabney C. T. Davis, of Greenwood, Va., has invented a light, cheap, and easily adjustable shade, that may be fitted to any style of hat, and removed at pleasure. It is designed for keeping off the rays of the sun and inducing a current of air to pass around outside of the hat and in contact with it in order to keep it cool.

Mr. William C. Egan, of New York City, has invented an improved fastening for ladies' and children's shoes, whereby the trouble and annoyance resulting from the use of buttons, lacings, or other devices may be avoided and the appearance of the shoe improved. The invention consists in providing a shoe with elastic insertion and alternating scalloped edges, provided with studs on the points for receiving a lacing.

A simple, easily adjusted, and efficient device for securing watch stems in the pendant, has been patented by Mr. George F. Dobiecki, of Brooklyn, N. Y. It consists of a pin passed through a hole made in the pendant, through the ears, and through the bushing, and engaging an annular groove or notch in the stem. Freedom of movement is allowed the stem; but it is held in the pendant unless released by withdrawing the pin.

An improvement in the construction of toe weights (or side weights), such as are used attached to horses' feet for inducing an increased tendency of the horse to throw his feet forward and increase his speed in trotting, or otherwise regulating the gait of horses, has been patented by Mr. Hope Redmon, Jr., of Cynthiana, Ky. The invention consists in a grooved weight, wedge shaped in the cross section, and provided with a spring catch, combined with a toothed clamping hook, having a shoulder and toe on its lower end, by which it is secured in a suitable rabbeted slot in the horseshoe.

Mr. Isaac A. Powell, of Elk Falls, Kan., has patented improvements in the construction of apparatus for heating water for steaming feed, scalding hogs, and for laundry purposes. The water chamber is made of wood, and from the bottom over a central opening rises the fire chamber, the sides of which are corrugated to increase the heating surface without increasing its height beyond a safe point, and its top is covered by a concave or inverted conical crown, from which rises the flue pipe, which is carried through the top of the water chamber. The apparatus has a grated fire basket, adapted to fit up into the fire chamber, and it has an opening on one side for supplying fuel to the fire without removing the basket entirely from the fire chamber.

Mr. Lafayette Smith, of Millersburg, Ind., has invented an improved eaves trough hanger, which consists of a flat sheet metal bar, from which depends a perpendicular bar or rod whose lower end embraces a round or flat cross bar set horizontally across the trough and firmly secured thereto with solder.

Mr. Edmund R. Banks, of Cynthiana, Ky., has patented an improvement in coffee and tea pots, in which the construction is such that the coffee and tea can be steeped and the pots placed upon the table without its being necessary to strain the coffee and tea. The invention consists in the wire gauze cup suspended detachably from a hook attached to the cover of the pot.

An improvement in wisp brooms has been patented by Mr. James H. Flynn, of Schenectady, N. Y. This invention consists in fastening the under edge of the cap to the wisp by wrapping it with wire, and then drawing the cap up over the wire and fastening its upper edge by wrapped wire, which is concealed within the lower end of the handle. The handle is made of a paper tube wrapped or covered with velvet or other fabricated material adapted to fit over the wooden stock, to which it is secured by glue or tacks, etc., and a cap piece nailed to the upper end of the stock. It has a loop, the lower end of which is fastened under the lower edge of the handle, and its upper end under the cap piece.

An improved table for playing ball games has been patented by Messrs. Edwin M. Macy and Rufus Russell, of Longview, Texas. It consists of a bed, upon which the balls are rolled, having at the end spaces for the balls to pass through, and behind these a pit communicating with a return ball alley, also an elastic cushion, against which the balls strike.

An improved double-acting lift pump has been patented by Mr. William Loudon, of Superior, Neb. It consists in providing the upper end of the cylinder, on the outside, with a flange, to which the upper head is screwed or otherwise attached. Through this flange are made water ways, through which the water passes upward to enter the cylinder.

The Juice of the Tomato Plant as an Insecticide.

A writer in the *Deutsche Zeitung* states that he last year had an opportunity of trying a remedy for destroying green fly and other insects which infest plants. It was not his own discovery, but he found it among other recipes in some provincial paper. The stems and leaves of the tomato are well boiled in water, and when the liquor is cold it is syringed over plants attacked by insects. It at once destroys black or green fly, caterpillars, etc.; and it leaves behind a peculiar odor which prevents insects from coming again for a long time. The author states that he found this remedy more effectual than fumigating, washing, etc. Through neglect a house of camellias had become almost hopelessly infested with black lice, but two syringings with tomato plant decoction thoroughly cleansed them.—*Gardener's Chronicle.*

The Sand Box Tree.

On the far side of the island (St. Thomas), says Mr. Moseley, I saw several "sand box trees (*Hura crepitans*). The tree is one of the Euphorbiaceæ, allied to our spurges, and has a poisonous, irritant juice; but its most remarkable peculiarity is its fruit. A number of seed capsules, shaped like the quarters of an orange, are arranged together side by side as in an orange, so as to form a globular fruit. When the fruit has become quite ripe and dry, suddenly all the capsules split up the back, opening with a strong spring, and the whole fruit flies asunder, scattering its seeds for a distance of several yards, and making a noise like the report of a pistol.

The Boomerang.

This curious weapon, peculiar to the native Australian, has often proved a puzzler to men of science. It is a piece of carved wood, nearly in the form of a crescent, from 30 to 40 inches long, pointed at both ends, and the corner quite sharp. The mode of using it is quite as singular as the weapon. Ask a black to throw it so as to fall at his feet, and away it goes full 40 yards before him, skimming along the surface at 3 or 4 feet from the ground, when it will suddenly rise in the air 40 or 60 feet, describing a curve, and finally drop at the feet of the thrower. During its course it revolves with great rapidity, as on a pivot, with a whizzing noise. It is wonderful so barbarous a people should have invented so singular a weapon, which sets laws of progression at defiance. It is very dangerous for a European to try to project it at any object, as it may return and strike himself. In a native's hand it is a formidable weapon, striking without the projector being seen; like the Irishman's gun, shooting round a corner equally as well as straightforward. An engraving of one of these curious implements was published in these columns some time ago.

The Objects of Study.

The duties of the teacher are tersely set forth in the New York *School Journal* as follows:

His business is to develop, discipline, and train the powers by which knowledge is gained; besides, in performing this work he will lodge in a secure and usable form all the useful knowledge possible. He will make as his great leading object the training of the mind; he will next direct the pupil's attention to his own mental processes, to show him when he thinks accurately; this is sometimes called *teaching to think;* he will teach the pupil to arrange and classify his knowledge; he will teach the pupil to give good expression to his knowledge. These being the objects the teacher aims at, he requires study in order that he may secure these objects; they may be set down as the objects of study. And if a person has no teacher, he still needs all of the above effects, and to produce them he uses study. It is plain, then, that study is the indispensable means to be employed to obtain education.

SCIENTIFIC EDUCATION.—It would certainly be a great boon to the world if the general level of scientific education could be raised, so that each young man or young woman, when he or she issues from school doors, should have enough definite knowledge of the great laws of the physical universe to instantly denounce blue glass theories and attempts at perpetual motion, not from the pride of knowledge, but from the feeling that error, credulity, and superstition should be combated with truth.—*Prof. John Trowbridge.*

Huxley on Pluck and Endurance.

At the distribution of prizes for proficiency in intellectual and physical exercises, at University College, London, recently, Professor Huxley spoke to the boys, dwelling especially upon the value of industry and physical capacity for hard work in the competition of every-day life. The chief value of their success in school lay, he said, in the evidence it afforded of the possession of those faculties which would enable them to deal successfully with those life conditions they were about to meet. Asking what sort of fellows were the prize winners, he continued:

Is there, in all the long list which we have gone through to-day, the name of a single boy who is dull, slow, idle, and sickly? I am sorry to say that I have not the pleasure of knowing any of the prize winners this year personally—but I take upon myself to answer, Certainly not. Nay, I will go so far as to affirm that the boys to whom I have had the pleasure of giving prizes to-day, take them altogether, are the sharpest, quickest, most industrious, and strongest boys in the school. But by strongest I do not exactly mean those who can lift the greatest weights or jump furthest—but those who have most endurance. You will observe again that I say take them altogether. I do not doubt that outside the list of prize winners there may be boys of keener intellect than any who are in it, disqualified by lack of industry or lack of health, and there may be highly industrious boys who are unfortunately dull or sickly, and there may be athletes who are still more unfortunately either idle or stupid, or both. Quickness in learning, readiness, and accuracy in reproducing what is learnt, industry, endurance—these are the qualities, mixed in very various proportions, which are found in boys who win prizes. Now there is not the smallest doubt that every one of these qualities is of great value in practical life. Upon whatever career you may enter, intellectual quickness, industry, and the power of bearing fatigue are three great advantages. But I want to impress upon you, and through you upon those who will direct your future course, the conviction which I entertain that, as a general rule, the relative importance of these three qualifications is not rightly estimated, and that there are other qualities of no less value which are not directly tested by school competition. A somewhat varied experience of men has led me, the longer I live, to set the less value upon mere cleverness; to attach more and more importance to industry and to physical endurance. Indeed, I am much disposed to think that endurance is the most valuable quality of all; for industry, as the desire to work hard, does not come to much if a feeble frame is unable to respond to the desire. Everybody who has had to make his way in the world must know that while the occasion for intellectual effort of a high order is rare, it constantly happens that a man's future turns upon his being able to stand a sudden and heavy strain upon his powers of endurance. To a lawyer, a physician, or a merchant it may be everything to be able to work sixteen hours a day for as long as is needful without knocking up. Moreover, the patience, tenacity, and good humor, which are among the most important qualifications for dealing with men, are incompatible with an irritable brain, a weak stomach, or a defective circulation. If any one of you prize-winners were a son of mine (as might have been the case, I am glad to think, on former occasions), and a good fairy were to offer to equip him according to my wishes for the battle of practical life, I should say, "I do not care to trouble you for any more cleverness; put in as much industry as you can instead; and oh, if you please, a broad, deep chest, and a stomach of whose existence he shall never know anything." I should be well content with the prospects of a fellow so endowed. The other point which I wish to impress upon you is, that competitive examination, useful and excellent as it is for some purposes, is only a very partial test of what the winners will be worth in practical life. There are people who are neither very clever nor very industrious, nor very strong, and who would probably be nowhere in an examination, and who yet exert a great influence in virtue of what is called force of character. They may not know much, but they take care that what they do know they know well. They may not be very quick, but the knowledge they acquire sticks. They may not even be particularly industrious or enduring, but they are strong of will and firm of purpose, undaunted by fear of responsibility, single-minded, and trustworthy. In practical life a man of this sort is worth any number of merely clever and learned people. Of course I do not mean to imply for a moment that success in examination is incompatible with the possession of character such as I have just defined it, but failure in examination is no evidence of the want of such character. And this leads me to administer from my point of view the crumb of comfort which on these occasions is ordinarily offered to those whose names do not appear upon the prize list. It is quite true that practical life is a kind of long competitive examination, conducted by that severe pedagogue, Professor Circumstance. But my experience leads me to conclude that his marks are given much more for character than for cleverness. Hence, though I have no doubt that those boys who have received prizes to-day have already given rise to a fair hope that the future may see them prominent, perhaps brilliantly distinguished, members of society, yet neither do I think it at all unlikely that among the undistinguished crowd there may lie the making of some simple soldier whose practical sense and indomitable courage may save an army led by characterless cleverness to the brink of destruction, or some plain man of business, who, by dint of sheer honesty and firmness, may slowly and surely rise to prosperity and honor when his more brilliant compeers, for lack of character, have gone down, with all who trusted them, to hopeless ruin. Such things do happen. Hence, let none of you be discouraged. Those who have won prizes have made a good beginning; those who have not may yet make that good ending which is better than a good beginning. No life is wasted unless it ends in sloth, dishonesty, or cowardice. No success is worthy of the name unless it is won by honest industry and brave breasting of the waves of fortune. Unless at the end of life some exhalation of the dawn still hangs about the palpable and the familiar—unless there is some transformation of the real into the best dreams of youth—depend upon it, whatever outward success may have gathered round a man, he is but an elaborate and a mischievous failure.

Blowing Up River Snags.

Mr. R. R. Hunt describes, in the *Transactions of the New Zealand Institute*, the method practiced on the Waikato River to remove the snags which obstruct the navigation and have repeatedly led to the wrecking of river craft. The Waikato Steam Navigation Company, the main sufferer, determined to use dynamite for clearing away the obstructions. The work, as far as the dynamite was concerned, was of the ordinary character, but two special provisions were adopted in the preliminary operations. First, a boat was secured by double moorings above the site of the snag, so that by paying out the moorings the boat could be suffered to drop down stream exactly over the snag; second, for examining the stump, use was made of what has been called a "hydraulic telescope," viz., a plain wooden tube with a piece of glass at the bottom, and two handles, by which the tube could be held steadily to the eye. By the aid of this instrument the snag could be clearly seen, and the best part for boring the hole could be chosen. This was an important point, as if, in the absence of the power of selection, the hole was accidentally bored into a wrong part of the snag, the dynamite was practically wasted, the due effect being only felt when the hole was made in a sound part of the timber.

The inspection having been made, a hole was bored with a 1½ inch steel auger to a depth of 3½ feet below the summer level of low water. A charge of dynamite, varying from 3 ounces to 24 ounces, was then inserted and exploded by a fuse. As soon as the fuse was lighted the ropes were hauled on and the boat drawn up stream some 50 feet, which was found in all cases sufficient to protect the occupants from injury on the explosion taking place. Then the ropes were paid out to the same length as before, and in this way, with the use of two ropes, the boat was certain to return to the exact spot it had previously occupied. This was an important matter in saving time, as it was difficult to discover through the rippling water the exact site of the snag, which it was necessary to revisit in order to ascertain whether or not the charge had done its work. It was found to be false economy to use too little dynamite, as the explosion then only shattered the stump, and a second operation necessitated double or treble the amount to clear it away entirely. As a rule, half a pound of dynamite was required for a stump 2 feet in diameter; but a snag 4 feet in diameter was only removed by a charge of 1½ pounds. It was remarked that the stumps were invariably cut off at the bottom of the auger hole, leaving a flat surface, as from a cross-cut saw, and it has been suggested that a similar mode of felling large trees would save many serious accidents to the men employed. The cost of blowing up a snag by dynamite is about one third of that required for removing it by sawing. On an average three men will blow up eight snags a day.

Inefficiency of Steel Armor Plates.

A series of experiments were commenced recently at La Spezzia, Italy, in the presence of Herr Krupp, the representatives of the Terre Noire Works, and others, to test the resistance of steel armor plating against a 100-ton Armstrong gun, and the respective merits of the projectiles furnished by Armstrong, Gruson, Whitworth, Terre Noire, and San Vito. Two projectiles were to be fired against each of four Terre Noire plates, 9 feet by 4 feet 8 inches, and 2 feet 4 inches thick, at a distance of 500 feet from the gun. The two best were to be tried against the steel furnished by Saint Chamond. The terrible efficiency of the projectiles first tried thwarted these arrangements.

The first round was fired with a projectile (San Vito) from the government manufactory of Fossano, made of chilled Gregorini cast iron, weighing 2,022 pounds, the charge being 550 pounds of powder. The shell was projected with the velocity of 1,715 feet per second. It struck the target and rebounded, and shivered in pieces, after piercing the plate to a depth of 14 inches and carrying away a third of it. The second round was fired with a Whitworth projectile weighing 2,110 pounds, made of compressed steel, with a hardened point 3 inches long. The steel pierced the plate 22 inches, and carrying away a third of it, passed through the backing, remaining itself almost intact. The third round was fired with an Armstrong projectile weighing 1,946 pounds. The steel penetrated the plate 12 inches, completely shattering and dislodging it, and rendering the target unfit for further practice, but failing to penetrate the backing. Although a government commission on the subject has not reported its opinion, the general conviction is that these experiments fully proved the utter inefficiency of steel plates for defensive purposes.

New Discovery in Connection with Carbolic Acid.

BY JOHN DAY, M.D.

Several important additions have recently been made to our knowledge of the chemistry of carbolic acid, some of which are possessed of great interest to us as medical practitioners. For instance, Städeler has shown that it is a constant constituent of the urine; Brieger has shown that it is a normal constituent of the contents of the bowels; and Baumann has discovered that it is one of the products of the putrefaction of albumen. For an interesting account of these and other discoveries in connection with carbolic acid, I would beg to refer you to an editorial article in the *Medical Times and Gazette*, of October 12, 1878, entitled "The Pathological Excretion of Carbolic Acid." I have myself devoted a good deal of attention to the chemistry of carbolic acid, and in the course of my investigations have found that it is a powerful deoxidizing agent—a property which has not, that I am aware of, been previously recognized.

I will show you a few experiments by way of proving that my view on this point is correct. Guaiacum resin, when oxidized, is changed from its normal color, which is reddish brown, to a deep blue, and this effect can be produced by a number of oxidizing substances. I have chosen, as sufficient for my purpose, solution of permanganate of potash, black oxide of manganese, tincture of iodine, and the vapor of a solution of chlorine. I will now oxidize some guaiacum resin with the different substances I have named, and then deoxidize it and restore it to its normal color by the addition of carbolic acid. That this is simply a process of deoxidation may be shown by the ease with which the guaiacum can be again oxidized. I can offer you another proof of the deoxidizing power of carbolic acid by adding a drop or two to a solution of permanganate of potash, when you will find that it will be instantly reduced and decolorized.

I will show you one more experiment in proof of the deoxidizing properties of carbolic acid, and it is one which I think will interest you, as it is a little suggestive of the action of carbolic acid on the iron in the blood, when it is administered internally. This bottle contains a weak solution of persulphate of iron, and to show you that it does not contain a trace of the protosulphate I will add a few drops of a solution of red prussiate of potash, a salt which has no action on persulphate of iron, but quickly turns the protosulphate blue. By the use of this test we have not, as you may perceive, produced any change of color in the solution; but on the addition of a little carbolic acid you will find that a deep blue reaction will occur, thus showing that the persalt of iron has been reduced to a protosalt.

If you will permit me to trespass on your time for a few minutes longer, I will show you a very curious reaction which carbolic acid is capable of effecting, and it is one which has not yet, I think, been mentioned in any work on chemistry. When carbolic acid is added to tincture of iodine no perceptible change takes place, but when carbolic acid is added to tincture of iodine freely diluted with water, the fluid is almost instantly decolorized, and a compound is formed which is incapable of acting on starch and turning it blue as free iodine does. Now, it has struck me that this combination of carbolic acid and iodine might form a good antiseptic dressing for wounds. Indeed, the main object of my paper has been to excite a discussion on a theory I wish to place before you regarding the action of carbolic acid as an antiseptic.

The investigations of Pasteur, Tyndall, Sanderson, Lister, and others, have clearly shown that putrefactive changes never take place without the presence of bacteria; and, further, that bacteria are dependent on oxygen for their existence. Now, it has occurred to me that the deoxidizing properties of carbolic acid offer a fair explanation of its *modus operandi* in the antiseptic treatment of wounds. During the reading of this paper Dr. Day demonstrated by several experiments the correctness of his conclusions.—*Australian Medical Journal.*

The Music of the Spheres.

Light comes in undulations to the eye, as tones of sound to the ear. Must not light also sing? The lowest tone we can hear is made by 16·5 vibrations of air per second; the highest, so shrill and "fine that nothing lives 'twixt it and silence," is 38,000 vibrations per second. Between these extremes lie eleven octaves; C of the G clef having 258⅞ vibrations to the second, and its octave above 517½. Not that sound vibrations cease at 38,000, but our organs are not fitted to hear beyond those limitations.

If our ears were delicate enough, we could hear even up to the almost infinite vibrations of light. Were our senses fine enough, we could hear the separate keynote of every individual star. Stars differ in glory and in power, and so in the volume and pitch of their song. Were our hearing sensitive enough, we could hear not only the separate keynotes, but the infinite swelling harmony of these myriad stars of the sky, as they pour their mighty tide of united anthems in the ear of God.—*Rev. H. W. Warren, Recreations in Astronomy.*

THE preserving of fruits, vegetables, etc., is an industry of very large proportions in this country, and the processes of manufacture have become so perfected there is but very little material wasted. The skins of the fruit are converted into jellies; the peach stones are sold to druggists; the tomato peelings and the very scrapings of the table go to the catchup makers. The entire process of desiccation occupies about three hours.

AN ASCENT OF THE VOLCANO OF AGUA, CENTRAL AMERICA.

M. P. de Thiersant, *Chargé d'Affaires* of France at Guatemala, communicates to *La Nature* the following narrative of a recent ascent made by him of the celebrated volcano of Agua, which, within the historic period, has emitted only water, but that occasionally with disastrous consequences:

I started from Guatemala on the 16th of February, 1879, with my wife, Mr. Graham, the British *Chargé d'Affaires*, and Captain Gaillardo, aid-de-camp to President Barrios.

After a night's rest we again took up our route, accompanied by an escort of 20 Indians. At half past 11 o'clock we entered the city of Antigua, the unfortunate victim of an earthquake in 1773, and which has never since risen from its ruins. There we found the provisions that we had ordered in advance, as well as a supply of horses and some new traveling companions—a French gentleman, M. Coupé, and a Guatemalian lieutenant. At 2 o'clock we mounted our horses and proceeded toward Santa Maria, following, as far as San Juan del Obispo, the valley of Antigua, which is covered with coffee and corn plantations. We then began the ascent by a road cut out of a mass of ashes and *lapille* (lava gravel), the numerous strata of which marked the ancient eruptions of the volcano. At 4 o'clock we perceived the ranchos of Santa Maria, a large town inhabited entirely by Cokchiquel Indians, who speak the Populuka language. The plain on which they have established themselves is 6,800 feet above the sea level, undulating in character, and covered with volcanic deposits, which are utilized in the culture of coffee, corn, and sugar cane.

As soon as our presence was known a large number of them, men, women, and children, ran to meet us, and accompanied us as far as the door of the *cabildo* (town house), the two halls of which were kindly put at our disposal by the alcade of the place. At half past 3 o'clock in the morning the caravan again moved, preceded by a drummer, a fifer, and a lantern bearer, the 20 Indians bringing up the rear. The night was quite dark, though starlight, and the air was filled with cold mists which covered the plain. After having got beyond the houses of the town we reached the side of the cone, the inclination of which allowed us to make our way easily, although slowly. Then, taking our steed by the bridle, we followed a path which led us to the clearing called *La Cruz* (The Cross), and which we reached at a quarter past 5 o'clock. The thermometer marked 5·80° C. (42° F.); we were at an altitude of 8,500 feet. To preserve us from the effects of the cold, which was quite acutely felt, the Indians lighted a large fire, and seated around this we patiently awaited the dawn of day. At thirty-five minutes past 5 we again took up our march, leaving our horses in charge of some of the Indians, and penetrated the forest by a path inclined at an angle of about 28 to 30 degrees. After walking for an hour we entered the region of conifers, and struck the boundary of the forest, which is at an altitude of about 10,000 feet. From this limit onward the ascent was really painful and difficult. The path ran through the midst of thickly tufted plants, 15 to 20 inches high, which are used by the Indians for covering their ranchos.

Walking was at first quite easy, although the soil was very slippery on account of its clayey nature; as yet the grade was only 30 to 35 degrees, but little by little it became steeper, until it was, if I am not mistaken, fully 45 degrees.

At an altitude of 10,170 feet we turned to the right, and for some time followed the ravine through which rushed the torrent of water that, in 1541, destroyed the city of Ciudad-Vieja. Afterward we turned again to the left, and proceeded directly northward toward the slope of the volcano, which seemed to recede in proportion as we approached it. At an altitude of 10,500 feet we began to meet, at various distances apart, small glaciers, called *neverias*, in the hollows of the mountains, and from which the Indians obtain the ice which they sell to the inhabitants of Antigua. One of the curious facts that we observed was that from the beginning of the forest as far as the volcano the surface of the soil, protected from the rays of the sun, was covered with ice some millimeters thick, and it remains in this state, although the mean temperature of 0° C. (32° F.) occurs at a much higher altitude than this.

Another fact observed was that, in proportion as we ascended, the pines became more stunted and less numerous, all those that we noticed being half charred and bearing the traces of lightning or of fire. The aspect of these blackened and leafless pines, scattered here and there about 30 feet apart, only added to the desolate appearance of the desert through which we were desirous of hastening. Unfortunately, this last part of the ascent was the most toilsome; the rarefaction of the air, added to the steepness of the mountain, obliged us to ascend slowly in order that we might breathe. Finally, after painful efforts, we reached the volcano at half past seven.

FORMER ERUPTIONS OF THE VOLCANO.

The volcano of Agua once destroyed an entire city, not with torrents of fire and lava, but with an avalanche of water which had gathered within its walls. This fearful catastrophe is thus narrated by the historian Juarros:

"The most awful calamity which had as yet afflicted this unfortunate city (Guatemala) took place on the morning of the 11th of September, 1541. During the three days preceding there had been an incessant and violent rain, particularly during the night of the 10th, and the water seemed to fall rather like a cataract than a mere rain. It is impossible to describe the fury of the wind, the perpetual flashes of lightning, and the fearful roar of the thunder. On the morning of the 11th, at 2 o'clock, the quaking of the earth was so violent as to make it impossible for any one to remain standing; and the shocks were accompanied by subterranean noises which caused a general terror. Soon afterward an immense torrent of water was precipitated from the summit of the mountain, carrying along with it enormous quantities of rocks and gigantic trees. It descended exactly upon the unfortunate city, destroying almost all the houses, and burying a large number of the inhabitants beneath the ruins, and among others Doña Beatrice de la Cueba, the widow of Pedro Alvardo, the illustrious conqueror."

PRESENT ASPECT OF THE CRATER.

The crater which contained this volume of water, and which is to-day perfectly dry, is about circular in outline and funnel-shaped, its diameter at the top being 625 to 650 feet, and at the bottom 312 feet. Its depth does not exceed 312 feet. Its sides are composed of solid rock, in some places forming an unbroken wall, and at others piled up in immense blocks; they are inclined at a steep angle, especially at the east and west, and strewn with stunted pines. The bottom of the crater is level and composed of a clayey soil, overgrown with a small grass, along with which are found a few myrtaceous plants of a species which also grows on the sides of the mountain. At the base of the chasm are found, lying pell-mell, large blocks of stone that have fallen from the summit, and upon which are seen several names written, with the dates 1550, 1553, etc. At some parts of the walls and the upper edge are seen manifest traces of an ancient eruptive activity, which, with the enormous deposits of igneous dejections accumulated at the foot of the mountain, indicate that the volcano of Agua was formerly ignivomous, although there now exists neither history nor tradition of such eruptions.

After visiting the bottom of the crater, I ascended and made the tour of its summit. The ascent is quite difficult, and even dangerous. One is obliged to climb over blocks of rocks, and in certain places the passage is so narrow that great care is necessary. The highest point is at an altitude of 12,500 feet. MM. Dolfus and Montferrat made it 12,300, Father Cornet 12,400, and Cervantes 13,800. It took us more than an hour to make the circuit of the edge of the volcano. But what a magnificent panorama we enjoyed from the top of this observatory, placed by nature at a very short distance from the summit line! In its entirety, the view embraced the whole Republic of Guatemala, a portion of that of Salvador, and extended to the Atlantic and Pacific, whose immense blue sheets were confounded with the horizon. As details of this splendid picture, probably unique in the world, we observed on one side the volcano of Fuego, with its immense plume of smoke; on the other, the green plains of Escuintha, whose tints, diminishing by imperceptible degrees, finally disappeared in the billows of the ocean; the great lake of Amatitlan, whose green shade was relieved by the sugar cane plantations which surrounded it; further off, the naked and ragged summits of the provinces of Altos, surrounding the picturesque lake of Aititlas like a crown; and, finally, shut off in the distance by the high mountains of Vera Paz, the laughing valleys of Antigua and Guatemala, with their fields of coffee and maize, and their collections of houses forming villages and cities. In the midst of these marvels of nature the only sad thing is to see that the hand of man has as yet done hardly anything to reap any benefit from them.

Russian Fairs at Nijni-Novgorod.

A cable telegram a few days ago announced that, during the annual fair at Nijni-Novgorod, a fire broke out which consumed several of the booths. Nijni is on the Volga, very near the center of European Russia, and has direct railway connection with Odessa, Moscow, and St. Petersburg, where merchants take an active interest in the annual fairs. The business in furs and skins forms an important part of the transactions at these gatherings. A correspondent writes to the *Shoe and Leather Reporter* as follows respecting the fair and the methods of doing business:

"At Nijni the summer days are generally hot, and the nights seldom darken into anything deeper than a silvery gray twilight. The sun rises early, and by five o'clock all the travelers are up and pouring into the public houses, where they breakfast off tea mixed with spirits, raw ham, cold sausages, and other such light trifles. Then the business of the day commences, to end virtually at eleven o'clock, for by that time all the important sales have been effected, and the rest of the day is given over to napping, dining, and festivities. The booths of Nijni may be counted by the thousand, stretching from the center of the town through all the principal streets in every direction, and out into the suburbs; but for the convenience of traders the different wares are classed together—the jewelers near the Starostat House, close under the eyes of the police; the silks and cloths a little further; then the hardware, and so on. Out into the suburbs, where their fragrancy may blend with that of the country air, are the skinners' stalls, whose goods are of powerful perfume.

"The Russians haggle a good deal over their bargains—not with screams like the Greeks, nor with disdainful shrugs like the Turks, but with fawning and persuasive banter. The graver Russian merchants do their bargaining with a solemn brevity of speech, but they have none the less a reputation for being sly customers. Chroniclers are in doubt as to whether it is the Russian or the Chinese who is hardest to beat in business; at any rate, the Russian is so incredulous of other men's honesty that he mostly keeps his own hidden like a precious coin, only to be exchanged for a full equivalent. There is no such thing as buying a pile of skins at sight and trust in Nijni; every skin must be overhauled, and if the slightest flaw be apparent it must be exchanged for a better one. This system, applied to other goods besides skins, makes business a little slow, and explains the fact that not much money changes hands, though there is much fussing in the booths."

Krupp of Essen.

The cast steel manufactory at Essen has existed since 1810. It has been conducted by the present owner, Herr Alfred Krupp, since 1826, and since 1848 for his sole account. The number of workmen at the close of 1877 amounted to 8,560. There are in these works 1,648 furnaces, 77 steam hammers, the largest of all weighing 50 tons, 18 trains of rolls, and 1,063 machine tools. One of the steam engines at Essen is 1,000 horse power. When all existing facilities are employed the works can produce in 24 hours 2,700 rails, which will lay 11⅞ miles of line, 350 tires, 150 locomotives and car axles, 180 car wheels, 1,000 railroad springs, 1,500 grenades, etc. In one month there can be produced 304 field guns and guns of large caliber. At the various works of Herr Krupp there were also employed 5,300 workmen in addition to those already enumerated. The mines attached to the works embrace 4 coal mines and 562 iron ore mines, including iron mines near Bilbao, in Spain. Four large steamers owned by the works, each of 1,700 tons burden, besides leased steamers, are engaged in the transportation of Spanish ores to Krupp's furnaces on the Rhine. Another steamer, of 1,000 tons burden, is being constructed.

Wheat Raising in the South.

The Macon *Telegraph* announces that for the first time in the history of Georgia the local mills find wheat in sufficient abundance to run them without drawing supplies of wheat from the North. There are, undoubtedly, parts of Central Georgia where wheat can be grown to perfection, for there the soil is a stiff clay loam, and is rich in the elements that wheat requires. But even upon the sandy soils of that State it appears that good wheat crops can be raised by the application of fertilizers, and if care be taken in the tillage. It seems to be a remarkable thing that in such soils wheat should be grown, as the *Telegraph* states, as far south in Georgia as the Florida line. This success has been achieved by the use of the drill. Nor is it only in Georgia that the cultivation of wheat is extending. In Northwestern South Carolina the Germans have demonstrated that excellent crops of both wheat and rye can be raised by deep drilling and manuring with the waste of the barnyard composted with muck and pine shatters.

How to Save Clover Seed.

One of our best clover seed savers is just at our elbow, and he says: "Tell them the second crop is for the seed, and is really fit for no other purpose, as it salivates the stock fed on it; that the best time to cut for seed is a very nice point to determine. It should be cut when a majority of the heads turn brown, and before any begin to shed off the little seed pods, each of which contains a seed. Cut the second crop of clover just as though it were for hay, rake it into windrows, and let it lie and take one or two showers; then put it into very small cocks while damp, about one good pitchforkful in a place, and when it is dry put into stacks and cap with something that will turn water; or what is still better, if you have a shed or barn, put it there and let it remain until you get a huller to take it out for you. There are hullers enough now in the State to hull all the seed needed for home use, and the owners of the hullers are willing and anxious to go to any section where work can be had. Let our farmers save all the clover seed they can, and thus help to make thousands of dollars for the State, now sent out each year for clover seed to sow."—*Rural Sun.*

Staining Pine.

The *Northeastern Lumberman* recommends the following manner of staining pine to represent black walnut: Put pulverized asphaltum into a bowl with about twice its bulk of turpentine and set where it is warm, shaking from time to time until dissolved; then strain and apply with either a cloth or a stiff brush. Try a little first, and if the stain be too dark, thin it with turpentine. If desirable to bring out the grain still more, give a coat of boiled oil and turpentine. When the wood is thoroughly dry, polish with a mixture of two parts shellac varnish and one part boiled oil. Apply by putting a few drops at a time on a cloth and rubbing briskly over the wood.

Pneumatic Cushion for Elevators.

An apparatus has been put into practical use in Chicago by the inventor, Colonel A. C. Ellithorpe, and subjected to serious tests in the Chamber of Commerce, where the elevator car, which itself weighed two tons, was loaded with 5,000 lb. of iron, and, to test the real merits of the invention, a basket of eggs and some glass globes; the car was then dropped from a height of forty feet, and was checked so gradually by the air at the bottom of the shaft that neither an egg nor a globe was broken. This encouraged two men to drop with the car, and they reached the bottom not only in safety, but almost unshaken.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion, about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Wanted—The address of Manufacturers of Friction Clutches. Address Washington Ice Company, 79 Clark St., Chicago, Ill.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Patent Steam Cranes. See illus. adv., page 158.

Wanted—An offer to furnish Paper Tape for printing telegraph instruments in large quantities. Apply by letter to Wm. H. Deane, 196 Fifteenth St., B'klyn, N. Y.

The Secret Key to Health—The Science of Life, or Self-Preservation, 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

A well equipped Machine Shop desire to manufacture special machinery. Address T. H. Muller, care of P. O. Box 532, New York.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2018 Frankford Ave., Phila., Pa.

Cut Gears for Models, etc. (list free). Models, working machinery, experimental work, tools, etc., to order. D. Gilbert & Son, 212 Chester St., Philadelphia, Pa.

Wanted.—A first-class Machinist or Millwright familiar with hard wood working machinery; one who has had charge of men preferred. Give age, nativity, and experience. Address, with reference, Cincinnati Cooperage Company, Cincinnati, O.

Magnets, Insulated Wire, etc. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Inexhaustible Beds of Kaolin or Clay.—Wanted experienced pottery men to take an interest in the white, pink, and yellow kaolin beds. Digging and shipping on cars will cost 50 cents per ton. M. J. Dobschutz, Belleville, Ill., Agent.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Steam Yacht for sale. G. F. Shedd, Waltham, Mass.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

$300 Vertical Engine, 25 H. P. See illus. adv., p. 158.

Eclipse Portable Engine. See illustrated adv., p. 157.

Bradley's cushioned helve hammers. See illus. ad. p. 142.

Band Saws a specialty. F. H. Clement, Rochester, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

New 8½ foot Boring and Turning Mill for sale cheap. A first class tool. Hilles & Jones, Wilmington, Del.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 78.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Fuller & Stillman, Chemical Engineers and Assayers, 40 Broadway, New York.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

The genuine Asbestos Roofing forms the lightest and most economical roof in use. It can be easily applied by any one. H. W. Johns M'f'g Co., 87 Maiden Lane, New York, sole manufacturers.

No gum! No grit! No acid! Anti-Corrosive Cylinder Oil is the best in the world, and the first and only oil that perfectly lubricates a railroad locomotive cylinder, doing it with half the quantity required of best lard or tallow, giving increased power and less wear to machinery, with entire freedom from gum, stain, or corrosion of any sort, and it is equally superior for all steam cylinders or heavy work where body or cooling qualities are indispensable. A fair trial insures its continued use. Address E. H. Kellogg, sole manufacturer, 17 Cedar St., New York.

Vertical and Horizontal Engines M'f'd by Nadig & Bro., Allentown, Pa.

Renshaw's Ratchet (short spindle) uses taper and square shank drills. Pratt & Whitney Co., Hartford, Ct.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

The new "Otto" Silent Gas Engine is simple in construction, easy of management, and the cheapest motor known for intermittent work. Schleicher, Schumm & Co., Philadelphia, Pa.

Machines for cutting and threading wrought iron pipe a specialty. D. Saunders' Sons, Yonkers, N. Y.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 29.

NEW BOOKS AND PUBLICATIONS.

SCIENTIFIC HORSESHOEING. By William Russell, Cincinnati: Robert Clarke & Co. 8vo, pp. 144. Price $1.00.

An unpretending yet superior treatise on this important art, embodying the results of over 40 years of study and intelligent practical working as a horseshoer and manufacturer of horse shoes for general and special use. The anatomy, functions, and proper management of the horse's foot are described in a plain, straightforward manner, with fifty engravings showing the hoof in health and disease, normal and special forms of shoes, and kindred matters of value to farriers and horse owners.

INTEMPERANCE THE GREAT SOURCE OF CRIME. By A. B. Richmond, Esq. Meadville, Pa.: H. M. Richmond. Price $1.50.

These "Leaves from the Diary of an Old Lawyer," as the sub-title describes them, embody an uncommonly cogent argument against the license system. The stories are well told and free from rant. Indeed its manly tone and temperate style are somewhat exceptional in "temperance" literature.

THE SILK GOODS OF AMERICA. By Wm. C. Wyckoff. New York: D. Van Nostrand.

There is no industry that is rising more steadily or more deservedly in popular favor than American silk manufacture. Mr. Wyckoff's brief account of the recent improvements and advances of this art in the United States is well calculated to help on the good work by showing the conditions which have determined the superiority of American silk goods. In addition to a dozen chapters on the manufacture and special characteristics of the several sorts of silk goods, the volume contains the Seventh Annual Report of the Silk Association of America, summarizing the progress made during the past year, and a directory of American silk manufacturers and dealers, and raw silk importers and brokers.

JOURNAL OF THE CINCINNATI SOCIETY OF NATURAL HISTORY. April, 1879.

With the present number, this excellent periodical—the organ of one of our most energetic natural history societies—enters upon its second volume. Its contents, as usual, are of great scientific interest, especial prominence being given, as in former numbers, to the subject of silurian palæontology. Professor A. G. Wetherby remarks at some length on the genus pterotocrinus; Mr. E. O. Ulrich describes three new genera and twenty-eight new species of fossils from the lower silurian about Cincinnati; Mr. S. A. Miller remarks upon the Kaskaskia group, and describes four new species of fossils from Pulaski county, Ky.; and Mr. Joseph F. James gives a catalogue of plants growing in the vicinity of Cincinnati. The latter is rendered doubly valuable from the fact of its containing a reproduction of Lea's list of Cincinnati fungi, which has been long out of print. Considering the number of botanists in the United States who have entered, or are entering, upon the study of mycology, the Cincinnati Society would be doing a great service to science if it would supplement this bare list of fungi by a reprint of the descriptions of new species as given by Mr. Berkeley in the now inaccessible Lea catalogue. We know of but a single copy of the latter rare pamphlet in New York city, and that is buried in a volume with other papers, where it would never be found by a student unless by accident.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. B. C. asks: Is there anything that will remove tincture of iron from clothes? A. Try pure hydrochloric acid diluted with its own volume of water, and rinse with plenty of water afterwards and then with a small quantity of dilute ammonia water.

(2) A. D. E. asks: Do you consider crude petroleum of any benefit in keeping a boiler clean where hard water is used? If good to use, how often and in what quantities and in what manner should it be used? A. In moderate quantity, and when properly used, petroleum has been found useful in preventing the formation of hard incrustations in boilers. See p. 18, current volume, SCIENTIFIC AMERICAN.

(3) S. W. O. asks (1) if there is anything better than camphor for preserving insects, butterflies, and moths. I have been using camphor for three years, and it is collecting on the insects so fast that in another three years they will be white with it. A. See p. 11 (40), Vol. 38, SCIENTIFIC AMERICAN. 2. The brass part of my microscope has become rusty; how can I get it off? A. Remove the lacquer with caustic soda, clean with emery flour, and relacquer. 3. What is the best cement for mending a large china fruit bowl which is broken across the middle? A. Use one of the receipts given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(4) G. C. R. writes: I desire to cement in a brass frame a glass tube through which kerosene oil flows. Can you inform me of a cement which can be used for the purpose, which is impervious to the oil, and which is not affected by it? A. Borax, 1 part; shellac, 4 parts; boiling water, sufficient to form a thin paste. Thicken with whiting and use hot. A small quantity of glue is sometimes added.

(5) C. M. D. asks (1) for a method of separating the copper from the settlings of a gravity battery, I wish to obtain the copper pure. A. Wash the copper in hot water and fuse it in a blacklead crucible. 2. Please give directions for making an electric light suitable to light a room 12x15, and the best battery for the purpose and number of cells needed. A. Use a battery of 30 bichromate cells. There are a number of suitable regulator lamps in the market.

(6) J. H. M. asks (1) how washing bluing (powdered) is prepared. A. There are several wash blues in the market: soluble Prussian blue, aniline blue, ultramarine, and neutralized sulphindigotic acid. See p. 969, No. 61, SCIENTIFIC AMERICAN SUPPLEMENT. 2. How is stove polish made in cakes? A. The best stove blacking consists of pure graphite or plumbago, reduced to a fine powder and rendered cohesive by strong pressure while moist.

(7) J. H. H. asks (1) whether a Holtz electric machine can be used instead of the induction coil in repeating the experiments of Professor Crookes given in SUPPLEMENT No. 189. A. Yes, but the electric discharges are less frequent and less controllable than where the induction coil is used. 2. How large a coil will be necessary for the experiments on a small scale; that is, not before an audience, but in a laboratory? A. A coil that yields from 1 to 1½ inch spark. 3. Is the Sprengel pump figured in Ganot's Physics, eighth English edition, capable of forming a vacuum of the exhaustion required, or are there better methods of creating a vacuum? A. The Sprengel pump, or some modification of it, will produce as perfect a vacuum as can be made.

(8) K. P. M. writes: I have a well and spring water, and analyzed them according to instructions from SCIENTIFIC AMERICAN, and found in the well water a strong trace of chloride of sodium, in fact it turned milky, and it lost its color under permanganate test. The spring water has no trace of chlorides; it keeps its color under permanganate test, but there is considerable sediment in the bottom. Now, is the spring water fit to use? A. Probably, but we cannot judge fairly from your statements.

(9) W. F. J. asks what is applejack, and how is it made. A. A high spirit made chiefly from cider by distillation. A brandy made from apples.

(10) F. F. S. asks how to remove plaster stains from a cherry and maple wood floor. The floor was covered with dry sand, but the mortar from plaster dropped on it struck through. A. Try rubbing the spot with a little dilute hydrochloric acid. Dry thoroughly and oil.

(11) G. W. M. writes: 1. I notice that some of the leather I have used for valves and plungers for wooden pumps, in a year or two grows hard and stiff. What kind of leather should I use that will remain soft and pliable? A. Leather thoroughly saturated with lard oil will retain its flexibility indefinitely under the circumstances. 2. Is there anything not poisonous with which tin pipe may be coated inside that will prevent its rusting for six or eight years? Would soluble glass answer the purpose? A. Try a platinum varnish. Soluble glass will not answer.

(12) C. M. asks how the beautiful blue black color on the guards and heelplates of some guns, particularly those of Colt and Parker, is obtained. We have tried pulverized charcoal and heated sand, but the color is either blue with a reddish cast or a light green. Can it not be done with sulphur somehow? A. It is done by first heating the articles until they become blue and then gray, and then allowing them to cool; they are afterward heated until they again become blue.

(13) T. McD. asks if copper wire (for an induction coil) can be insulated as perfectly by long strips of silk as by the usual way, the silk to be about ½ inch wide and any number of feet long, and to be put on lengthways of course. A. This method of insulation is not practicable, as the ribbon would take a great deal of room and would be troublesome to apply. Better make an apparatus like that shown on p. 124, current volume of SCIENTIFIC AMERICAN, and cover your wire with thread.

(14) S. A. B. writes: 1. Of two similar iron vessels of same capacity, one containing compressed air to 300 lb. per square inch, and the second acting as boiler and generating steam to 75 lb. per square inch, which will explode with the most violent and disastrous results, and under what conditions? Which is the safer? A. Compressed air is safer; it does not scald. When a steam boiler explodes a portion of the water expands into steam, thereby greatly increasing the volume of steam. This accounts for the powerful effects of boiler explosions. 2. How long will the vessel containing compressed air (say capacity=3 cubic feet) supply 30 cubic inches of air at a uniform pressure of 50 lb. per square inch? A. We cannot answer this without knowing pressure of the compressed air. 3. What is the capacity and what pressure do compressed air vessels usually carry? A. Pressure 300 to 400 lb., capacity to suit purpose. 4. At what point in the cylinder will the piston be when engine is at half stroke, that is, crank at right angle with piston rod? A. Depends upon length of connecting rod.

(15) J. S. asks: What is the best way to kill insects, for collections, so that their legs will not contract? A. Dip them in turpentine or chloroform.

(16) H. B. writes: In your issue of 12th instant, page 24, 7th paragraph, speaking of the fossil bones of the moa Mr. Haas says: "The massive limbs, larger than those of the heaviest ox, had evidently been broken to extract the marrow." Query: Do birds have marrow in their bones? A. Some of the bones of birds have large marrowless spaces.

(17) G. L. asks how to make sand paper. A. Crush glass under a runner and sift it into about six sizes. Coat a good quality of manila paper with thin glue and dust the pulverized glass over it. Sometimes two coats of glue and glass are thus applied to the paper.

(18) J. S. B. asks (1) how to find out the quantity of water a pump will furnish, at 40 strokes per minute, in one hour, each stroke 0·22 gallon per stroke. A. 40 strokes per minute is 2,400 per hour, and 22 one hundredths of a gallon per stroke, 2,400×0·22=528 gallons per hour. 2. I copy the 0·22 gallons per stroke from the circular advertising the pump. Does it signify 22-100 of a gallon? A. 0·22 gallon = 22-100 of a gallon.

(19) D. W. M. asks how to arrange an electric bell with a telegraph circuit so that when the circuit is broken it will close a local battery and ring the bell. A. Arrange a relay so that when the armature falls away from the magnet it will close the local circuit.

(20) A. B. P. asks (1) how a current of electricity is generated in the wire around a permanent magnet in the Bell telephone? A. The vibrations of the diaphragm in front of the magnet disturbs the normal condition of the magnet; any change of magnetism in this generates electrical currents in the surrounding helix. 2. Does the wire touch the magnet or membrane? A. No. 3. Is it necessary that the membrane be metal; would it not be better to make it out of thin sheet rubber, with a piece of metal glued to it in the center? A. It should be soft iron. 4. Does it weaken a permanent magnet to revolve an armature close to it? A. No. 5. Can I change the pole of the electro-magnet so that it will attract and then repel? I want to make an electric engine. A. Yes.

(21) C. A. P. writes: 1. We have put up a siphon in our mines to take out the water according to description on page 315, No. 20, Vol. 36 (25), SCIENTIFIC AMERICAN. The length of it is nearly 1,000 feet; about 800 feet runs through a tunnel on a grade of 6 inches to the 100 feet. Diameter of pipe 1¾ inch. We have three pet cocks tapped in the pipe at intervals of 150 feet in the tunnel to let out the air when we prime it. We have also an automatic air valve on the apex and a check valve in the suction end. After we started it, it would run a full stream for a short time, then diminish gradually until it stopped altogether. We tried it several times with no better result. We then fastened a piece of an inch pipe on the discharge end and let it project through the side of a barrel sunk in the ground, so that there is 6 inches of water over the mouth of the pipe. It is running in a continual stream since we made the change, but it will not keep the water low enough in the mines at this rate. How can we remedy it? A. We infer from your description that the head upon the discharge opening or end is so great that, with the length of pipe and friction, the water cannot be supplied fast enough to keep your discharge opening full; probably if you use a 2 inch pipe and put to it a 1¼ in. discharge nozzle you will accomplish your object. 2. The pipe runs from the mouth of the tunnel down a slope on a grade of about 30 degrees; at the bottom the pipe discharges horizontally. Will it work any better by running the pipe on a trestle the same grade as in tunnel, that is, 6 inches to 100 feet, until it will be over the present discharging point, then run the pipe down near the ground so the discharge end will be perpendicular? A. We do not think this proposed change will benefit your present arrangement.

(22) C. T. M. writes: Some time ago, Vol. 37 p. 123 (17), you described a method of making vinegar. Will you please answer the following questions in the SCIENTIFIC AMERICAN? 1. If I use a vinegar barrel as a generator, how far apart should the holes in which the pack thread is inserted be? A. From 2 to 3 inches. 2. How many and what size glass air vents should be placed in the shelf? A. Use 8 ¼-inch tubes. 3. What sized air holes should those near the bottom be? A. From ⅛ to 1 inch. 4. How much of each of alcohol, water, and honey, are used for the mixture? A. 1 part 80 per cent alcohol, 4 to 6 parts of water, and 1-1000 of honey. 5. Please give a recipe for making a self shining liquid shoe polish? A. Soft water, 1 gallon; extract of logwood, 6 oz.; dissolve by aid of heat. Soft water, 1 gallon; borax, 6 oz.; shellac, 1½ oz.; boil, stir, and add bichromate of potash, ½ oz., dissolved in ½ pint of water. Mix all together, warm, and add ammonia water, 3 oz. 6. Please give directions for making a galvanic battery, with directions for plating insects, etc., with gold, silver, etc. A. See p. 91 (10), Vol. 41, and pp. 47, 248, 341, and 380 (39), Vol. 35, SCIENTIFIC AMERICAN.

(23) J. A. C. asks (1) what will remove coal oil from a wool carpet without taking up the carpet. A. Moisten the spot with benzole, cover it with a piece of dry flannel, and pass a hot iron over it. Repeat with clean flannel if necessary. 2. How can I calculate the horse power of a stream, the cross section of stream and velocity being given, also head? Please state rule plainly as possible. A. It will depend upon the quantity of water you deliver at the outlet, and as this will determine the amount of head lost by friction, it becomes an important element in determining the available power. If there is no waste at the outlet, the head there would be equal to 22 feet, but it is evident that the more rapidly the water is drawn at the outlets, the greater must be the difference of head there and at the source, to overcome the friction through the pipe.

(24) J. H. M. asks if there can be made a steel blade or chisel one eighth of an inch thick driven by a wheel and crank which will penetrate a bar of iron without breaking. A. If we understand your query, yes; a power punch is an example.

(25) J C. asks: What is the amount of horse power claimed for the steamer Great Eastern? A. 3,800 horse power nominal.

(26) C. C. D. asks: 1. Can you tell me how to bend spring steel wire 17 size? I find in trying to bend the same that it most always breaks, and cannot get it in the proper shape that I wish. A. If you use a good quality of wire there will be no difficulty in coiling it. Piano wire makes an excellent spring and requires no tempering. 2. After the temper has been taken out how can I retemper it to its former stiffness? A. Springs made of ordinary steel wire are hardened by heating them to a cherry red and plunging them into cold oil. They are tempered by heating them in a flame until the oil blazes. They should be turned constantly to insure an even temper throughout. In some cases it is necessary to "blaze them off" more than once. 3. How to nickel plate the same: will a battery be required? A. See p. 209, Vol. 38, SCIENTIFIC AMERICAN.

(27) H. B. asks (1) how to make a solution for battery of 1 zinc plate 3x4 inches, and 2 carbon plates 3x4½ inches. A. Dissolve two parts of bichromate of potash in twenty parts of warm water. When cool add one part of sulphuric acid. 2. How far apart should the plates be? A. About ⅝ inch.

(28) J. C. H. asks how precipitated chalk is made to adhere to form balls such as druggists keep for sale, for the face. A. By subjecting it to heavy pressure while slightly moist.

(29) J C. writes: In your issue of July 26, page 59, question 26, J. D. asks: [See his question and your answer]: Assuming 306 cubic feet to be discharged under 3⅛ foot head, and 347 feet with same apertures under 4⅛ foot head, flowing on a 13½ foot overshot wheel in both cases, you state the power of the wheel will be 11·8 and 13 4 horse power respectively; if I read the questions and answers correctly is this so? I make it $\frac{306\times62\cdot5\times13\cdot5}{33000}=7\cdot82\times\cdot75=5\cdot70+$ actual H. P. and $\frac{347\times62\cdot5\times13\cdot5}{33000}=8\cdot87\times\cdot75=6\cdot65+$ " "

Assuming the duty of the wheel to be 75 per cent the value of the water. A. You are right. The error, whatever it was, evidently affected proportionately both calculations. 2. Is 306 and 347 horse power the actual discharge under the above conditions (aperture 1½ by 48 inch)? A. Very nearly; in practice probably 5 per cent should be deducted on account of form of opening and friction. 3. What is the best recorded duty of overshot wheels? A. Bresse records 80 per cent, Daubisson, very large wheels, 83 per cent, and Morin claims to have obtained experimentally 90 per cent. 4. What is the average duty of engines and boilers per pound of coal per horse power per hour, in New England woolen and cotton mills, after being in use from 6 to 10 years—approximately? A. We are not aware of any experiments to determine the duty of the class of engines you mention. 5. What is the best coating for a turbine wheel when the water has the effect to rust it and form tubercles on the buckets? A. We think if well painted with brown oxide, ground in pure linseed oil, it would be well protected.

(30) "Operator" asks: 1. How can I make a small, cheap furnace to melt brass, zinc, etc., say from an ounce to one half pound, and what fuel should be used to get heat enough? A. A common cylindrical coal stove connected with a chimney having a good draught, may be used for this purpose. Use anthracite coal for fuel. 2. Can a person make an article (patented) for his own use without infringing; for instance if I should make a pair of Bell telephones for my use, would it be infringing? A. See Rights of Investigators, p. 128, Vol. 39, of SCIENTIFIC AMERICAN.

(31) R. B. N. writes: I have a set of German silver drawing instruments, but from bad management the steel has rusted and the silver dulled; will you please inform me through your "Notes and Queries" how I can make both bright again? A. The only remedy is to repolish by means of emery and crocus wheels or by hand, using fine emery paper and finishing with crocus cloth.

(32) F. G. will probably find the following tonic for the hair as good as any he can use: Take one ounce of sage and steep it in boiling water for ten minutes; strain and add two ounces of glycerine, one quarter ounce of powdered borax, one quarter ounce of lac sulphur, one quarter ounce of tincture of cantharides, bergamot sufficient to perfume. Apply twice a week with the hand, and rub thoroughly in. It will remove dandruff and strengthen the growth. It will also, it is said, prevent gray hairs.

(33) C. S. Y. writes: 1. I wish to make a battery like one described on page 91, current volume of SCIENTIFIC AMERICAN. How is the battery fluid made? A. Dissolve two ounces bichromate of potash in one pint of warm water. When cold, add slowly two ounces sulphuric acid. 2. How can I fasten a wire to the flat surface of the carbon so as not to be eaten off by the acid? A. Drill a small hole in the carbon, taper the end of the wire, and twist it tightly into the hole. Heat the carbon plate so that it will just melt paraffine, and apply a little paraffine to the carbon around the wire. After it has soaked through, allow it to cool, and place a drop of melted paraffine over the lower end of the wire. Care must be taken to avoid saturating too much of the carbon with paraffine, as this renders the carbon useless. 3. How is a Bunsen battery made? A. For full instructions for making batteries of various kinds see SUPPLEMENTS 157, 158, and 159. 4. What is the name of the metal I inclose, and what is it used for? I have a piece the size of a chestnut. It was found in Peru about 22 years ago. A. It is an amalgam of silver and mercury, containing also lead, antimony, copper, and a trace of gold—probably not of natural occurrence.

(34) Q. E. D. asks: 1. Please to tell me how I can make a common electric call bell ring when the circuit is open. I want to connect it with a door, so that when the door is opened the bell will ring. A. A single stroke bell may be made to strike on opening the circuit by employing the magnet to hold the hammer away from the bell, and providing a spring, or its equivalent, to carry the hammer against the bell when released by the magnet. You might operate a vibrating bell by employing a local battery and a relay; but an open circuit battery like the Leclanche or the Fuller would be far better. If such were used, you would need to arrange your door fixtures so that the circuit would be closed on opening the door. 2. How many feet of outdoor wire are there in a pound? A. There are about 22 feet of No. 10 iron wire in a pound. 3. Do old battery zincs that have not been used for some time have to be amalgamated again before they will work? A. If the zincs have not a coating of mercury they should, of course, be re-amalgamated.

(35) C. E. G. asks the proportion of magnesia, zinc, etc., for making imitation meerschaum, and how it is prepared. A. To a hot concentrated sirupy solution of zinc chloride add powdered magnesia to form a thick paste, which should be moulded into form as quickly as possible, and after baking at as high a heat as it will permit without injury, cover it with powdered caustic lime and let it cool slowly.

(36) O. D. writes: 1. I have often seen sumac quoted in the New York market. Is it the kind that grows native in central New York; if so, what portion is used and how is it prepared for shipping? A. Yes; see p. 199, vol. 36, and 204 (07), vol. 37, SCIENTIFIC AMERICAN. 2. What kind of a crucible is required for fusing iron, and where are they to be found? A. Use a blacklead (graphite) crucible. See "Business and Personal" column. 3. I see no advertisement in your columns of minerals. Where can tungsten, silver, nickel, etc., be purchased? A. Any metallurgist or chemist can obtain them for you.

(37) E. I. B. asks for the name of some good book on the assaying of gold and silver ores. Something that is not too expensive and that is practical. A. Consult Rickett's "Notes on Assaying."

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

S. L.—Marcasite—sulphide of iron.—H. M. H.—Sample appears to contain a gold telluride, but the amount available was too small for confirmatory tests.—M. B.—The ore is an argentiferous (silver bearing) galena—lead sulphide. If the sample is a fair representative of the ore body the property is valuable. A series of assays would determine its actual richness.—F. B. F.—It is an impure ferruginous clay or ocher containing a sufficient quantity of iron oxide to, if properly washed and roasted, be used as the basis of a cheap paint for iron work, etc.—M. E. S.—The ore contains nearly 20 p. c. of copper. The value of the property will depend somewhat upon its location.—M. Bros.—The rocks contain shell lime stone and a semi-decomposed feldspathic. The former, if properly kilned, will make a good agricultural lime, and the latter may also be used with advantage as a dressing for some crops.—Correspondents who sent supposed tin ore and antimony please send address.

COMMUNICATIONS RECEIVED.

On Many Ported Slide Valve. By F. G. N.
On the New Optical Delusion. By P. J., W. G. S.
List of Exports from Augsburg to the United States. M. O.
On Compressed Air Theory. M. R. C.
On Local Government. R. P. P.

[OFFICIAL.]

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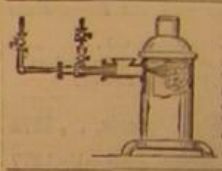

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SCIENTIFIC AMERICAN

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

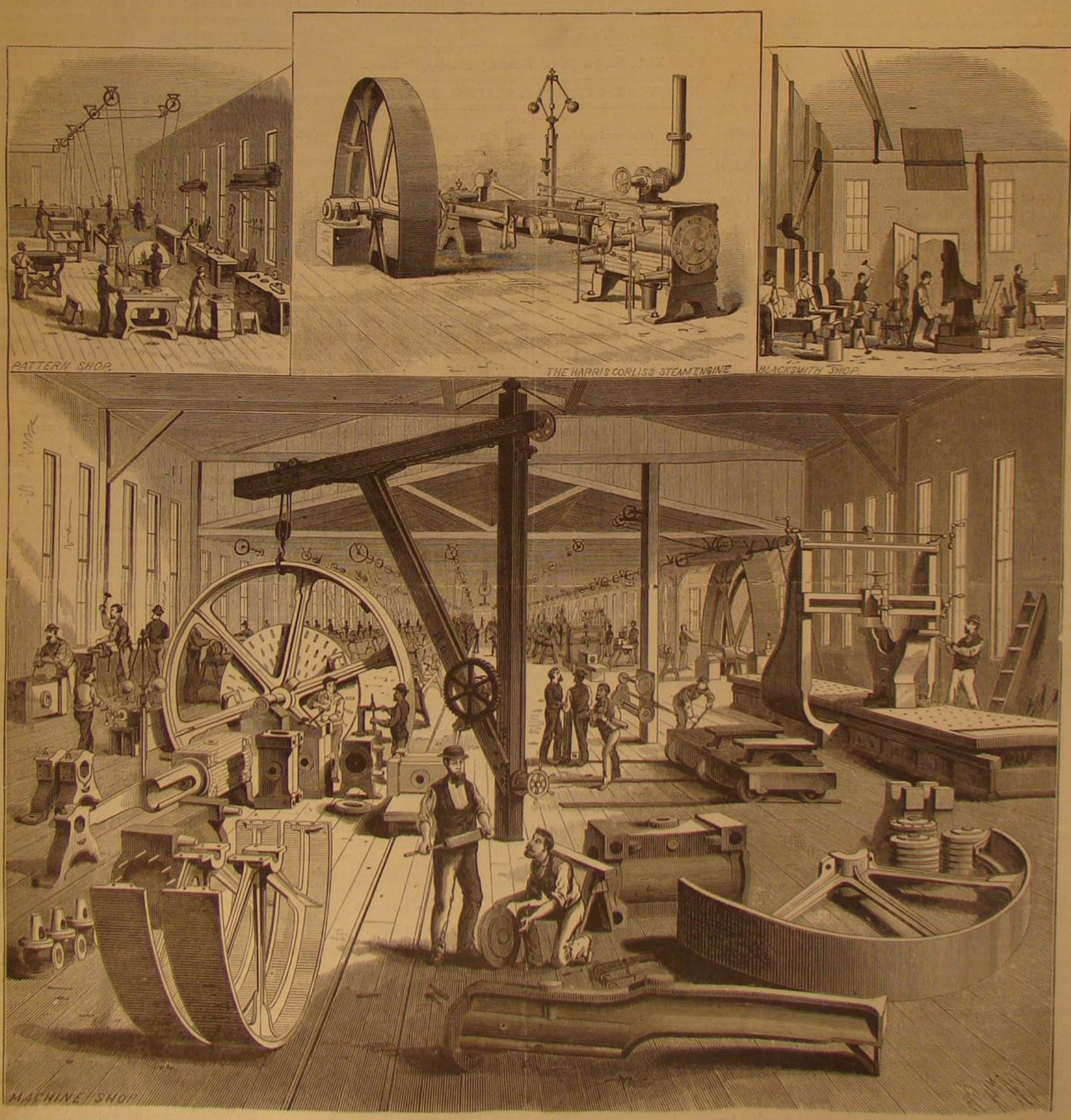
Vol. XLI.—No. 12. [NEW SERIES.] NEW YORK, SEPTEMBER 20, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

THE MANUFACTURE OF THE HARRIS-CORLISS ENGINE.

The details of the construction of the Harris-Corliss engine and the reports of its performances are already familiar to the readers of this journal; for this reason, and because the engine is now so widely and favorably known, it is unnecessary to repeat these items at length. It may be said, however, that this engine up to the present time maintains its superiority, and is to-day regarded as the standard engine.

Mr. William A. Harris, the proprietor of the Harris-Corliss Engine Works, at Providence, R. I., is now 44 years of age, and in the prime of life, an able mechanic and organizer. This, together with his twenty-four years' experience on the Corliss and Harris-Corliss engine, afford an explanation of the great success of this engine and of its enviable reputation. He commenced the business in a small way, and his facilities were limited to the construction of engines of from ten to twenty horse power. The business being very successful and demanding larger quarters, he built new engine works at the corner of Park and Promenade streets, having purchased two acres of land there.

On a recent visit to these works we were impressed with the system and order with which the work is done. Notwithstanding the great amount of labor in hand, the smallest and least important piece is as carefully dealt with as the ponderous castings of the larger engines. Special tools are adopted for a much wider range of work than is usual in establishments of this kind. The design of these tools, their adaptability to their work, the admirable organization of the establishment, together with the improvements which have brought this engine to perfection, are all due to the energy, tact, and talent of the proprietor of these works, and they place him prominent among the advanced mechanics of the day. When engineering ability of such high order is devoted to a single branch of manufacture, it is natural to expect higher results than are reached by those who engage in this, that, or the other—doing a great variety of work, but of poor quality. The works of Mr. Harris are devoted exclusively to the manufacture of his engine.



THE HARRIS-CORLISS ENGINE WORKS.

The new shop is located within six minutes' walk of the railroad depot and within ten minutes' walk of the business center of Providence. At these works there are facilities for manufacturing all sizes of engines, from ten horse power to one thousand horse power. The shop was arranged with reference to the handling of materials and parts of engines with the greatest facility. The lathes, planers, and other machines are placed so that, as the work progresses toward completion, it is moved over as little space as possible, in passing from one machine to another. This complete and careful arrangement of tools results in a great saving of labor and facilitates the work.

The demand for the Harris-Corliss engine is such that one thousand horse power per month in engines of different sizes have been shipped from this establishment for many months consecutively. It is now a common thing to contract for engines of seven hundred and eight hundred horse power, and furnish pulley fly wheels thirty feet in diameter, eight feet face, the wheel alone weighing, when finished, one hundred thousand pounds. These immense wheels are made in sections, fitted and bolted together. They are mounted on a shaft supported in suitable journals, and turned by applying to their spokes toothed segments and driving by means of a pinion.

A good idea of the appearance of the machine shop of this establishment may be had from the lower view in our large engraving on the front page. Here are shown the various parts of the engines and the means of handling them. In one of the upper views is shown the blacksmith shop, in the other the pattern shop.

The accuracy of the work done in this establishment, as well as the excellent quality of the materials used, is attested by every engine sent out.

We found in these works engines in process of construction for all portions of the United States, and we were informed that many of them have been exported for use in foreign countries.

The great success of the Harris-Corliss engine lies chiefly in the simplicity and precise action of the governing elements; the governor is an independent mechanism, saddled with no extraneous load, and free to instantly respond to variations in the angular velocity of rotating parts. (The slightest variation in the angular motion of the shaft or fly-wheel is immediately appreciated by the governor, and a corresponding point of cut-off is instantly indicated.) "An automatic cut-off engine is one in which the volume of steam cut off in the cylinder is exactly proportioned to the steam pressure and imposed load, to automatically regulate the speed of the engine. If the load is increased, the piston stroke to cut off is lengthened; if the steam pressure is increased, the piston stroke to cut off is shortened, and *vice versa*, and the regulation of cut off for any stroke depends upon the conditions existing during that stroke. Thus each stroke of the piston and each semi-revolution of the crank possesses a perfect autonomy."

In the Harris-Corliss engine, when the steam port is opened for admission of steam to the cylinder no obstruction exists to the free flow of steam from the boiler, and when the connecting pipe is of proper size, with few bends and well protected from loss of heat by radiation, the initial pressure in the cylinder is within a pound or two of the pressure in the boiler. When steam flows into the cylinder the piston advances with a velocity proportional to the load on the engine and steam pressure, the motion of the piston is communicated to the crank, and from the shaft to the governor, and a point of cut-off is indicated for that stroke; the nearness of the steam and exhaust valves to the bore of cylinder, the prompt opening and instantaneous closing of steam valves, the rapid opening of exhaust and the tightness of valves under pressure, all contribute to the remarkable performance of this engine. The motion of steam and exhaust valves derived from the wrist plate is peculiar to this engine, and, next to the precise action of the regulator, has much to do with the high economy of performance.

A Large Cog-Wheel.

A cog-wheel, said to be the largest ever made in Paterson, N. J., has lately been finished. It is of iron, 20 feet in diameter, the periphery 10 inches wide, and it weighs 12 tons. It is designed for a sugar factory in Cuba, and is to be used for crushing the sugar cane. It will make only two and a half revolutions per minute.

HUSNIK's plan for causing a chromated gelatine film to adhere to a zinc plate is to coat the zinc plate with a solution of three grammes of chromic acid in one thousand grammes of water; when the acid has acted upon the zinc, wash off the solution and first coat the plate with plain gelatine, and then with the chromated gelatine. Treated in this way the film is said to adhere very firmly to the zinc; but it must be kept dry before being used, otherwise a chemical reaction is apt to set in, by which the printing surface would be spotted.

AN extraordinary statement is made by the Chief Government Engineer of the Province of Liége in his trade report for 1878. He alleges that during last year a good deal of hardware manufactured in Belgium was exported to England, whence it was shipped to British colonies after the Belgian trade marks had been obliterated and replaced by spurious English ones. 1878 was the worst commercial year which Belgium has known since 1830.

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NEW YORK, SATURDAY, SEPTEMBER 20, 1879.

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On Ultramarine. By M. T. MOREL. Methods of testing for brilliancy, firmness, coloring power, resistance to acids, and resistance to alum. How to determine the coloring matter of blue textile fabrics and paper.
Ultramarine. By E. W. BUCHER. Method of preparation.
Separation of Ferric Oxide Alumina from Manganese. A. Classen's method.

V. THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—Saratoga Meeting.
On the Identity of the Laws of Oxygen with Bright Solar Lenses, as shown in photographs taken with increased dispersion. By Professor HENRY DRAPER. History of the discovery of oxygen in the sun, and description of apparatus and methods employed.
History and Methods of Palæontological Discovery. By Prof. O. C. MARSH. (Continued from SUPPLEMENT No. 195). Cuvier. Jean Lamarck. William Smith. James Parkinson. William Buckland. Adolphe Brongniart, and the development of fossil botany—1828 to 1852. The systematic study of invertebrate fossils—1824 to 1856. Louis Agassiz and other students of fossil fish and reptiles. Richard Owen. Results of the third period of palæontology. The fourth period of palæontology. Natural selection. Dominance of the doctrine of evolution. Antiquity of man. Belief in universal laws.
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Homologies in the Lauraceæ. By LESTER F. Ward. Illustrated.

THE AMERICAN ASSOCIATION.

Notice has been taken in other columns of the general proceedings of the American Association at its Saratoga meeting. On the whole it was an enjoyable convention, well attended by members, and well supplied with papers, though no part of the proceedings may be described as of extraordinary interest or importance.

No great scientific discovery or invention, that the readers of the SCIENTIFIC AMERICAN would consider entirely novel, was brought before the meeting. The main results of Mr. Michelson's investigation of the velocity of light had already been made public. The details of his work, however, were known to but few, and his paper was justly regarded as of superior value and merit. Professor Marsh's address was a masterly review of a great subject, crammed with information which will give it permanent value. As a record of the bibliography of palæontology, as well as a history of the development of the science, the printed address has no equal in that field.

Major Powell's treatment of Mythologic Philosophy was not only intensely interesting and suggestive, but singularly original, and freighted with a wealth of information with regard to the mental conditions of American savages. No better evidence could be given of Major Powell's fitness for the great work he is engaged in under the auspices of the Smithsonian Institution.

Mr. Edison's researches in connection with the behavior of highly heated metals in vacuo are certainly promising: possibly they mark the opening up of a new department in the practical treatment of metals, as well as in scientific metallurgy. Whatever may be the issue of Mr. Edison's efforts in the direction of electric lighting, the results of his investigations are certainly important in furnishing valuable contributions to science.

We take great pleasure in laying before the readers of the SCIENTIFIC AMERICAN and the SUPPLEMENT full and exact reports of the papers and addresses mentioned, with others of value.

PATENT YOUR INVENTIONS ABROAD.

In a report to the Department of State on the International Machine Market recently held in Leipsic, Germany, the United States consul to that place calls especial attention to the national and personal loss which results from the too common neglect of our inventors to take out foreign patents. Not only is the direct export of American manufactures to Germany and other European states seriously diminished by such neglect—the manufacturers of those countries flooding the market with cheap and ill-made imitations—but, still worse, such imitations are often exported to neutral markets to compete with or ruin the sale of the genuine articles of American make.

The consul mentions several American inventions whose market in Germany has been spoiled by local imitations after a large trade in the genuine articles had been built up. He also instances one which, thanks to a German patent, has been able to command the field in spite of many local imitations. He says:

"There are twelve manufactories throughout Germany engaged in the manufacture of reapers and mowers, after the model of those constructed by W. A. Wood, of Seneca Falls, N. Y. But the Wood reaper and mower being patented in Germany, the imitators have avoided infringement thereon by a variation from the original. This variation enables Mr. Wood to keep the field in Germany with his machines, notwithstanding the fact that the imitations are offered at 40 per cent less than the original."

The moral is evident. A few years ago it did not matter so much whether the inventor's control of his invention abroad was secured or not. American products were little known in foreign countries and imperfectly appreciated; besides the cost of manufacturing here was so great that any considerable export trade was out of the question. But all that has been changed. Even if the article is one that cannot profitably be exported the right to manufacture it in any European state can be profitably disposed of in the vast majority of cases. The eagerness with which American inventions are snapped up by foreign makers liable to unlimited competition in the production and sale of them is evidence enough, were all other evidence lacking, that the exclusive privilege of manufacturing under a patent would be easily salable at a good price. There is much to be done, it is true, toward organizing, developing, and simplifying the means required for handling to the best advantage American patent rights abroad; but even now the possession of a good patent right in any of the leading European states is a valuable property. And foreign patents are much more easily obtainable than most people imagine. Excepting England and Russia the official fees for patents in Europe are now not very much greater than those in the United States; and when we take into consideration the value of the markets thus to be controlled, the costs become comparatively trifling.

For this reason we are forced to think that Commissioner Paine is misreported in a late dispatch to the *Evening Post*, in which he is charged with saying that American inventors quite generally prefer not to secure patents in Europe in consequence of the high and discriminating fees there exacted.

That American inventors do largely neglect to secure the advantages offered by foreign patent laws is evident enough; but it is not due, we think, to any deliberate balancing of cost and possible profit. More frequently the American in-

ventor utterly fails to appreciate the real value of foreign fields of operation. The opportunities offered at home are large enough to satisfy his ambition; and he does not know what he could do with foreign patents if he had them. The more enlightened of our inventors, however, are finding out the impolicy of such indifference to European markets; and before many years the neglect to take possession of them will form the exception and not the rule.

Our national redress, therefore, against the lawful appropriation of unpatented American inventions abroad, and the consequent loss to our national income, is rather through the enlightenment of our inventors by means of information such as the Leipsic consul sends, than through any attempt at retaliation by the exclusion of foreign inventors, as Commissioner Paine is reported as favoring. The *Post* writer says:

"The only practical measure of redress open to our government would be to adopt a scale of fees for foreigners to correspond with those charged to American inventors. This course, the commissioner thinks, would speadily bring about a desired change, as foreign inventors regard the American market as an exceptionally good one for mechanical devices, and are always anxious to take out American patents."

Possibly it might, but we should be the heaviest losers by the attempt. The expressed object of the American patent system is the advancement of the useful arts—the multiplication and perfection of American industries. To accomplish this end, inventions are encouraged by offering the inventor, for a term of years, the exclusive right to use, make, and sell his invention and its products. The nationality of the inventor has nothing to do with the matter. If his invention is new and useful we want the benefit of it; and we are more likely to reap that benefit by treating him fairly than by trying to exclude him or rob him. The circumstance that certain foreign governments do not show a corresponding willingness to accept the benefits offered them by American inventors is no excuse or reason for our imitating their unwisdom. The moment we look upon inventions in their proper light, as the bases of new industries and the improvement of old ones, all talk of retaliating against foreign shortsightedness in the matter of patent rights, by handicapping foreign inventors, is sheer nonsense. The best way to induce foreign governments to treat American inventors more liberally is to prove to them by our industrial progress the vital advantage of treating liberally all inventors, their own as well as ours.

Be that as it may, the fact remains that most European governments do now offer our inventors privileges that are worth securing, though at a somewhat higher cost than we are accustomed to here, and every year those privileges increase, and rapidly increase in money value.

GELATINE NEGATIVES.

Much success has of late attended the production of photographic negatives in which a substratum of gelatine is used as the vehicle to carry the sensitive silver instead of collodion. It was claimed, among other advantages, that the gelatine was cheaper than the collodion. It seems now to have been ascertained in England that for the damp climate of that country, at least, the gelatine negatives are unstable.

The film expands and contracts, under the varying degrees of atmospheric moisture, to such an extent that the usual varnish soon cracks and the surface is covered with a fine powder, while the surface of the gelatine retains the markings of the cracks, and the negative is spoiled. To prevent this loss of negatives, it is recommended that gelatine negatives be covered with a film of collodion and then varnished. The collodion has a greater expansive quality than the varnish, and does not crack. It perfectly preserves the gelatine negative. But inasmuch as collodion makes first-rate negatives, would it not be better to omit the gelatine altogether?

In the meantime we will suggest that the latest improvement in the production of gelatine plates—formulæ for which we have heretofore published—consists in adding a quarter of a grain of gelatine to the solution of bromide employed in precipitating the silver. This simple little change gives ease and certainty to the production of dry gelatine plates of the highest sensitiveness. This improvement confirms the suggestion of M. De Pitteurs, that the remarkable sensitiveness of gelatine plates is due to a chemical combination between the gelatine and silver which favors the action of light on the bromide of silver.

THE DISSOCIATION OF CHLORINE.

Employing the improved method of determining vapor densities, which he introduced last year, Professor V. Meyer, of Zurich, has lately subjected chlorine to a series of tests which strongly indicate a compound character for that hitherto supposed element. As described in *Nature*, the apparatus employed is also extremely simple, and consists of a cylindrical bulb of about 100 c.c. capacity, sealed to which is a glass tube about 6 mm. in diameter, and 600 mm. long; this tube is widened out at the open end, so as to admit of the introduction of a caoutchouc stopper, and has a side tube, 1 mm. in diameter and 140 mm. long, sealed on to it about 100 mm. below the open end. The side tube is once bent nearly at right angles and the end slightly turned up, so that, when dipped into water, it will deliver gas into a graduated glass vessel inverted over it. For determinations at high temperatures the bulb is constructed of porcelain and is heated in a gas furnace; when operating at lower temperatures the bulb is heated either by means of a vapor bath or in a bath of molten lead. The operation consists in heating the bulb until it acquires a constant temperature, which is indicated by the non-appearance of air bubbles at the orifice of the side tube which is plunged under water; the stopper is then removed, the weighed quantity of substance introduced and allowed to fall into the bulb, the stopper quickly reinserted, and the end of the side tube then brought under the measuring vessel; directly air ceases to issue from the extremity of the tube, the stopper is removed, and the air thus collected is afterward measured in the usual manner. In the case of substances which undergo oxidation when heated in air, the air is first displaced from the apparatus by a current of pure nitrogen. In this manner the volume of vapor, measured at the atmospheric temperature and pressure, generated by a known weight of substance, is ascertained, and the density deduced from these data by a simple calculation.

Experimenting with chlorine the numbers obtained at a temperature about 620° C. agreed with those required on the assumption that the chlorine molecule has the formula Cl_2, which is that generally accepted. At higher temperatures, however, a diminishing density was determined, until at about 1,200° and above, the density was two thirds that obtained at 600°. In this respect the action of chlorine, when heated, is precisely like that of oxygen when passing from the condition of ozone to its ordinary condition. Two explanations are possible. Either what is regarded as the atom of chlorine is (like ozone) a compound of three subatoms, with the formula Cl_3 (instead of Cl_2 as commonly held), or chlorine is not an element, but a compound of at least two elements which are dissociated by heat.

In confirmation of the correctness of the latter supposition, there comes the report from Zurich, printed in the *Chemical News*, that Professor Meyer, in conjunction with Herr C. Meyer, has determined that in all probability oxygen is one of the components of chlorine. Still further, an unconfirmed report has reached *Nature* to the effect that the Messrs. Meyer have actually separated oxygen from chlorine. Should these reports be confirmed, the chemistry of the non-metals will enter at once upon a new era. In the communication to the Berlin Chemical Society, describing the experiments noted, the Messrs. Meyer state that bromine behaves like chlorine; and if chlorine has been dissociated, the rest of the group are likely soon to follow.

THE NORTHWEST PASSAGE SUCCESSFULLY MADE.

The Swedish exploring steamer, Vega, of the Nordenskjöld expedition, arrived at Yokohama, Japan, Sept 2. The Vega was in excellent condition; all on board were well, and there had been no sickness or scurvy on board during the long Arctic winter.

The following report of the entire voyage, as told by Professor Nordenskjöld, was telegraphed to the New York *Herald*. The Professor says:

"We sailed from Gothenburg on July 4, 1878, and a four days' sail brought us to Tromsöe (a Norwegian port on an island of the same name), where our outfit of furs and necessaries for the high latitudes was completed. Here we were joined by the companion steamer, the Lena. On July 25 both vessels sailed from Tromsöe, passed through the Yugor Strait (south of Nova Zembla) on August 5. There was not a particle of ice to be seen between the Waigatsch (Vaigatza, a Russian island) and the continent. The Kara Sea, hitherto dreaded by all sailors in the Arctic regions, was equally free from ice, and anchor was cast at Port Dickson, near the mouth of the Yenisei, on August 6.

STEERING NORTHEAST.

"After a three days' delay there the two steamers of our expedition steered northeast toward the dreaded Taimur land and the North Cape. The ice arrested our passage and we were compelled to remain at Tajoyr (Cape Taimur?) four days. On August 19, Tsejdekin, the extreme northern point of Asia, was reached, where a short rest was taken. The Vega coasted the peninsula, very little ice being encountered, and anchored at the mouth of the Lena River on August 26. To the northeastward were the islands of New Siberia, which we soon sighted, but were unable to explore because of the great field of ice that girt their shores. The mouth of the Kolwya River (latitude 69 deg. 30 min., longitude 161 deg. 30 min.), a broad estuary, was found open, and we hastened to make all possible progress eastward. Our difficulties soon began, however, and increased daily. We were delayed much with the ice between Cape Cook and Van Karema. We crossed Kolintschm Bay on September 27 with comparative ease, but were imprisoned on the 28th near a Tchuktchi settlement (latitude 67 deg. 7 min. north, longitude 177 deg. 24 min. west).

THE WINTER IN THE ICE.

"We wintered in the pack ice at this point, one mile from land. The entire ship's company maintained the best of health and spirits. Not a single case of scurvy occurred on board. During the shortest day the sun was above the horizon less than three hours, and then only the upper limb was visible. At this point much time was devoted to interesting scientific and ethnographic studies. There were 4,000 inhabitants in the several villages near by, who subsisted by fishing and sealing. They are called the Tchuktchi, and are a very agreeable class of people for an exploring party to meet. They supplied the expedition with bear and reindeer meat. The cold was intense, averaging 36 centigrade (32.2 degrees below Fahrenheit.) The game was abundant in the spring, wild fowl being taken in large numbers. We were detained in the ice at this point 264 days, but were released on July 18, and passed East Cape into Behring Straits on the 20th. Such is the story of our voyage.

COMPLETE SUCCESS.

"I fully accomplished the object for which the expedition was sent out by Dr. Dickson—namely, a practical proof of the existence of a Northeast passage. Then the Asiatic coast was followed and St. Lawrence Bay was crossed to Port Clarence, Alaska. Thence we crossed to Koniyan, dredging carefully in order to determine the formation of the bottom of the sea, many specimens of the fauna and flora being obtained. The location, breadth, velocity, and approximate volume of the currents of the Arctic and Pacific Polar currents were charted and calculated. Having touched at St. Lawrence Island we next proceeded to Behring Island, where we received the first news from Europe through the resident agent of the Alaska Trading Company. The fossil remains on Behring Island are of immense variety. A new marine animal was here discovered, which we named *Rhytina stellari*. The Vega left the island on August 19, and had a pleasant voyage until August 31, when a severe gale was encountered, accompanied with lightning. During the storm the lightning struck and shivered the maintopmast, slightly injuring several men. We arrived off Yokohama at half past eight on the evening of September 2. All are well, and no deaths have occurred during the voyage.

PROSPECT.

"The Vega is the first vessel to make the passage, and I think the voyage from Europe to Asia by Behring Strait is certain and safe, with very little more experience of navigation in the Northern seas. From Japan to the mouth of the Lena River there are no difficulties in the proper season for experienced sailors. The Lena River taps Central Siberia, and a large prospective trade can readily be developed.'

Apart from the obvious commercial advantages to result from the outlet to Siberian trade, opened up by this plucky and successful voyage of the Vega, and the contribution to science made thereby, it is impossible as yet to estimate the probable good results of the expedition. If, as Professor Nordenskjöld believes, a safe and easy Northeast passage is demonstrated, its availability must be confined to two or three summer months at best—too brief a period for an established commercial route; and vessels which take the southern routes during ten months of the year, are not likely to venture into icy waters for a single trip, however much it may promise to save in distance. With good luck the northern voyage, say from England to Japan, might possibly be made in half the time now required, but instead of having open sea room for the most part, the trip would be mainly along a dangerous and inhospitable coast in a narrow channel between ice fields and foggy shores, with the ever imminent risk that northerly winds might at any time bar the passage with Arctic ice floes, and imprison the ship for an Arctic winter.

Under improbably favorable conditions the Northeast passage may prove a useful route between Western Europe and our Pacific coast; but it will require more than one successful passage—a two seasons' trip at that—to induce many shipmasters to go that way.

PLATINUM IN THE UNITED STATES.

Notice was taken some time since of Mr. Edison's circular letter of inquiry with regard to the possible occurrence of platinum in various parts of the country. Mr. Edison informs us that, so far, he has received some three thousand replies. Instead of being an extremely rare metal, as hitherto supposed, platinum proves to be widely distributed, and to occur in considerable abundance.

Before Mr. Edison took the matter in hand platinum had been found in the United States in but two or three places—in California and in North Carolina—and in these places it occurred but sparingly. It is now found in Idaho, Dakota, Washington Territory, Oregon, California, Colorado, Arizona, New Mexico, and also in British Columbia.

It is found where gold occurs, and is a frequent residual of gold mining, especially placer mining. Mr. Edison thinks he can get 3,000 lb. a year from Chinese miners in one locality. One gravel heap is mentioned from which a million ounces of platinum are expected. Hitherto the product of the entire world would not suffice to supply electric lamps for New York city. Now Mr. Edison believes that our gold mines will supply more than will be required. The possible uses of this metal in the arts, however, are so numerous that there is no danger of an oversupply.

In addition to platinum Mr. Edison finds, among the large number of samples received daily, many other valuable metals and minerals, so that his researches in this direction are likely to result in increasing greatly the resources of our country in respect to the rarer and more costly minerals and metals.

THE *Insurance World* thinks our present complicated system of fire alarm telegraph should be substituted by the much more desirable system of telephonic communication. The advantages, like an axiom, are so self-evident as not to admit of any elaborate demonstration. One of the special features is that it will enable the person sending in the alarm to affix the exact location of the fire, and thus obviate the necessity of the firemen hunting for the exact point in the district at which their services are needed.

Bog Oak Ornaments.

A gentleman, connected with the manufacture of ornaments from Irish bog oak, gives to *Land and Water* some interesting particulars with regard to the history of that industry. When taken up this bog oak is perfectly black from the action of the peat or bog water. It is very rarely obtained in a sound state, and in most cases the outer portions of the tree or log are rotted, and useless even for fuel. When laid up for use, care must be taken that it is not placed in the open air, lest it may, from the sun's rays, become open and shattered into chips from end to end. To preserve it, it must be put into some cool place, and left to dry gradually, and when properly seasoned it must be cut in lengths of from two to four feet, and these lengths be split again, and the sound parts removed from the unsound.

It takes from four to six years to season some specimens, as in many instances the wood is found at a depth of eight and sometimes ten feet under the surface. When properly seasoned, any portion requiring to be glued becomes hard as stone, and is firmer and less liable to give way than any portion of the manufactured article. The finish is not quite perfect until the article has been for some time in use, and the longer, the finer the article seems to be, no matter whether used as a personal or table ornament. The men employed are all, without exception, self-taught; each one makes his own tools, and will not take any apprentices; and each person has a peculiar taste for a certain class of ornaments, which he follows, and to which he is left to produce the best specimens he can. There are also jewelers who mount and embellish the ornaments with gold and silver, and with rare and most brilliant Irish gems, such as the Kerry Irish diamond, the emerald, the garnet, amethyst, beryl, aquamarine, and Donegal pebble. The Celtic ornaments are generally studded with the above native gems; they are beautiful, and most artistically executed. The designs embrace some thousands, and all of them are both classic and historically illustrative of Irish antiquities. Extensive deposits of bog oak and other buried woods have been discovered in Germany.

Lesseps and the Canal.

M. De Lesseps would have made a good actor if he had not been a successful engineer. He has been making a tour of France, visiting the commercial cities and lecturing on his new scheme of the Panama Canal. He carries with him his little daughter Totoitte, and she goes to the public meetings at which her father speaks. When she becomes drowsy, M. De Lesseps points to her and says: "That little girl will fire the first mine when we come to quarry the canal." Then Mlle. Totoitte awakes, and the crowd enthusiastically cheers.

SKIMMING MILK BY CENTRIFUGAL ACTION.

One of the results of modern systems of dealing with agricultural produce has been the growth in most civilized countries of large establishments for carrying out dairy operations in a wholesale way, such establishments being really manufactories in which mechanical appliances can be largely and profitably used to assist or replace hand labor. Among the operations to be performed in connection with such dairies, the skimming of milk occupies no unimportant place, yet until comparatively recently no efficient means of accelerating the ordinary mode of separating the milk from the cream had been perfected. As is well known, the mixture of the milk and cream is a purely mechanical one, the lighter fatty particles of the cream being as it were entangled in those of the milk, and separating from the latter by the action of gravity if the mixture is allowed to remain undisturbed for a sufficient length of time.

Experience has shown that the separation of the cream and milk is facilitated by maintaining the latter at a low temperature; but even under the most favorable circumstances the natural separation of the two substances is a slow operation. The shortest time, in fact, in which the separation has ever been thoroughly produced—so long as the ordinary action of gravity is relied upon to effect the operation—is, we believe, about twelve hours, the milk in this case being treated on Mr. Senwartz's plan, and kept at a constant temperature of about 50° Fah. by means of ice. According to the mode of procedure usually followed in this country and in Europe, the separation of the milk and cream occupies from 24 to 96 hours, the result being that in some cases the milk will not stand the period of exposure required to effect the thorough separation of the cream.

Under these circumstances, the idea some years ago occurred of intensifying the action of gravity by employing centrifugal force, and thus effecting the separation of the milk and cream more promptly. So far as we are aware, the first suggestion of this kind was made by Professor C. F. Fuchs, of Carlsbad, who, in 1859, proposed to employ centrifugal force to prove the amount of cream in milk, while in 1864 Mr. Brandtl, a brewer of Munich, applied centrifugal force to the skimming of milk on a large scale. The results of his experiments, however, were not published.

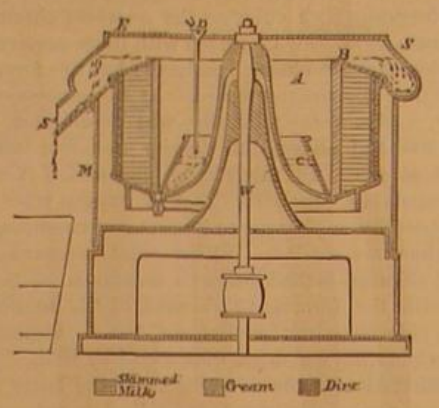


FIG. 2.—CENTRIFUGAL MILK-SKIMMING MACHINE.

Later on, Messrs. Lefeldt and Leutsch, engineers of Schöeningen (Germany), produced a practical machine for skimming milk by centrifugal action. This machine was recently patented in this country through the Scientific American Patent Agency.

Our engravings represent the machine as made by Mr. F. Wannieck, of Brünn, Austria. A is the drum of a centrifugal machine containing the milk to be treated, this drum being provided with a couple of internal paddles which insure the milk being carried round at the same speed as the drum. At the top the drum is partially closed by the cover, B, while within is a conical diaphragm, C, which reaches nearly to the bottom of the drum, as shown. A funnel, D, dips into the drum within the conical diaphragm, this funnel boing supported by the cover, E, which does revolve, it being carried by the external casing, M, of the machine.

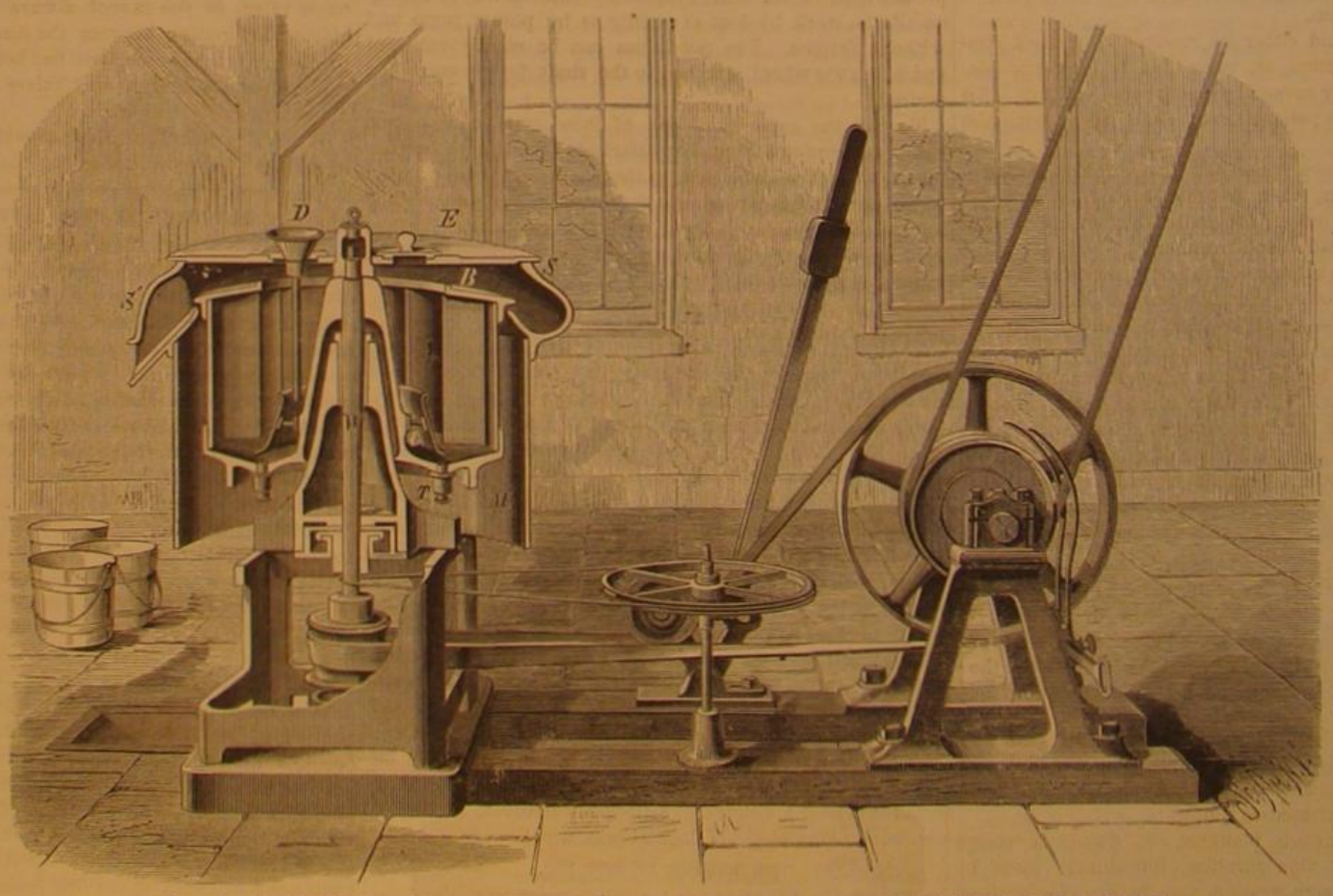


FIG. 1.—LEFELDT AND LEUTSCH'S CENTRIFUGAL MILK-SKIMMING MACHINE.

The vertical shaft of the drum runs in two bearings, as shown by the section, Fig. 2. It will be seen that the external case carries at its top an annular trough, S, this trough being furnished at one side with a discharge spout, S'. The revolving drum is furnished at the bottom with discharge cocks, T'. The mode of driving the drum will be readily understood from the engraving. The base of the machine is connected to a couple of pieces of timber which carry the standards for supporting a short horizontal countershaft provided with fast and loose pulleys, and a larger pulley from which a twisted belt is led off to the pulley on the vertical shaft of the revolving drum. The speed given to the latter is 1,000 revolutions per minute, and the belt driving it passes under a tightening pulley adjusted by the lever shown, this tightening pulley enabling the drum to be started gradually. A light belt on the vertical shaft of the drum gives motion to a revolution counter as shown.

The mode of using the apparatus is as follows: The drum having been charged with milk is set in motion, and as the speed increases the milk rises at the sides of the drum, and eventually assumes the position indicated in Fig. 2. In this position the particles of the milk will evidently, under the influence of the centrifugal force to which they are subjected, have a tendency to arrange themselves in layers in the order of their specific gravity, the heavier particles moving outward, while the light or fatty particles collect on the inner surface of the liquid column. The action of the centrifugal force being much more energetic than the ordinary action of gravity, this separation of the different particles of milk takes place very much more rapidly than when milk is allowed to stand in the usual way, and after the drum has been running at from 800 to 1,000 revolutions per minute for from 25 to 30 minutes, the cream is found to have collected on the inner surface, as indicated in Fig. 2, while all dirt in the milk has been thrown outward against the side of the revolving drum

The next operation is to remove from the revolving drum the cream thus collected. This is effected as follows: It will be noticed that the amount of the charge of milk is such that when it is, by the action of the centrifugal force, thrown into the form of an annular column, the inner circumference of the column is just level with the inner circumference of the partial cover, B, of the drum. To remove the cream some milk—generally skim milk—is poured down the funnel, D, and falling within the conical diaphragm, C, passes under the lower edge of the latter, as indicated in Fig. 2. The milk so introduced passes into the charge without disturbing the layer of cream, and the latter being displaced inward, flows over the inner edge of the annular cover, B, and escapes into the trough, S, from which it is discharged into suitable vessels through the spout, S'. The cream having been thus collected, the machine is stopped, and the skimmed milk run off through the cock, T.

With two machines containing 11 gallons each, 250 gallons of milk can be effectively skimmed in a day of ten hours, while the operation requires no skilled labor and but very ordinary care. Owing to the short time required, also, all chance of the milk turning sour is avoided, and the butter made from the cream is considered of first rate quality. Another advantage of this system, which was not at first counted upon, lies in its thoroughly separating from the milk all dirt which may have become mixed with it either during the process of milking or subsequently. This dirt, which collects as indicated in Fig. 2, smells badly, and an astonishing amount of it is separated by the centrifugal action even from milk which has been carefully filtered through hair cloth, thus showing that the hair cloth filters usually relied upon are far from being thoroughly efficient.

Spontaneous Ignition.

E. Bing, of Riga, Switzerland, has experimented with different materials: wadding, raw flax, hemp, the waste from silk, wool, and cotton spinnings, as well as sponge, and finally wood dust as found in any cabinetmaker's shop. They were saturated with various fluids, namely, oils, fresh and in a gummy state; turpentine, petroleum, various varnishes, etc. All the fibrous materials took fire when saturated with any of these oils or with mixtures of the same. Sponge and wood dust, on the contrary, proved to be entirely harmless.

Combustion ensues, with 17 grains of wadding and 67 grains of a strong oil varnish, in thirty-four minutes; while 200 grains of washed cotton waste, of which a portion was saturated with 750 grains of strong oil varnish, and the remainder wrapped about it, required almost fourteen hours. These materials were placed in a well sheltered spot, and subjected to a heat of from 40° to 65° Fah. Silk did not flame up, but slowly charred.

Disinfectants and How to Use Them.

The National Board of Health, consisting of a number of our leading physicians and chemical experts, of which Prof. C. F. Chandler is chairman, have issued the following instructions for disinfection, intended especially for the guidance of physicians and nurses in the yellow fever districts, but which are equally applicable in other classes of contagious diseases. In submitting this report the chairman says:

It has been the aim of the committee to prepare concise directions for disinfection, so simple and clear that they may be easily followed by any person of intelligence.

In the selection of disinfecting agents the aim has been: 1st, to secure agents which can be relied upon to accomplish the work; 2d, which can be procured in a state of comparative purity in every village in the United States; 3d, so cheap that they can be used in adequate quantities.

It is extremely important that the people should be instructed with regard to disinfection. They must be taught that no reliance can be placed on disinfectants simply because they smell of chlorine or carbolic acid, or possess the color of permanganate, and that, in general, proprietary disinfectants with high-sounding names are practically worthless, as they either have no value whatever, or, if of value, cost many times as much as they are worth, and cannot be used in sufficient quantity.

EXPLANATIONS.

Disinfection is the destruction of the poisons of infectious and contagious diseases.

Deodorizers, or substances which destroy smells, are not necessarily disinfectants, and disinfectants do not necessarily have an odor.

Disinfection cannot compensate for want of cleanliness or of ventilation.

I.—DISINFECTANTS TO BE EMPLOYED.

1. Roll sulphur (brimstone) for fumigation.

2. Sulphate of iron (copperas) dissolved in water in the proportion of one and a half pounds to the gallon; for soil, sewers, etc.

3. Sulphate of zinc and common salt, dissolved together in water in the proportions of four ounces sulphate and two ounces salt to the gallon; for clothing, bed linen, etc.

NOTE.—Carbolic acid is not included in the above list for the following reasons: It is very difficult to determine the quality of the commercial article, and the purchaser can never be certain of securing it of proper strength; it is expensive, when of good quality, and experience has shown that it must be employed in comparatively large quantities to be of any use; it is liable by its strong odor to give a false sense of security.

II.—HOW TO USE DISINFECTANTS.

1. *In the Sick-Room.*—The most available agents are fresh air and cleanliness. The clothing, towels, bed linen, etc., should at once, on removal from the patient, be placed in a pail or tub of the zinc solution, boiling hot if possible, before removal from the room.

All discharges should either be received in vessels containing copperas solution, or, when this is impracticable, should be immediately covered with copperas solution. All vessels used about the patient should be cleansed with the same solution.

Unnecessary furniture—especially that which is stuffed—carpets, and hangings, when possible, should be removed from the room at the outset; otherwise, they should remain for subsequent fumigation and treatment.

2. *Fumigation* with sulphur is the only practicable method for disinfecting the house. For this purpose the rooms to be disinfected must be vacated. Heavy clothing, blankets, bedding, and other articles which cannot be treated with zinc solution, should be opened and exposed during fumigation, as directed below. Close the rooms as tightly as possible, place the silver in iron pans supported upon bricks, set it on fire by hot coals or with the aid of a spoonful of alcohol, and allow the room to remain closed for twenty-four hours. For a room about ten feet square, at least two pounds of sulphur should be used; for larger rooms, proportionally increased quantities.

3. *Premises.*—Cellars, yards, stables, gutters, privies, cesspools, water closets, drains, sewers, etc., should be frequently and liberally treated with copperas solution. The copperas solution is easily prepared by hanging a basket containing about sixty pounds of copperas in a barrel of water.

4. *Body and Bed Clothing, etc.*—It is *best* to burn all articles which have been in contact with persons sick with contagious or infectious diseases. Articles too valuable to be destroyed should be treated as follows:

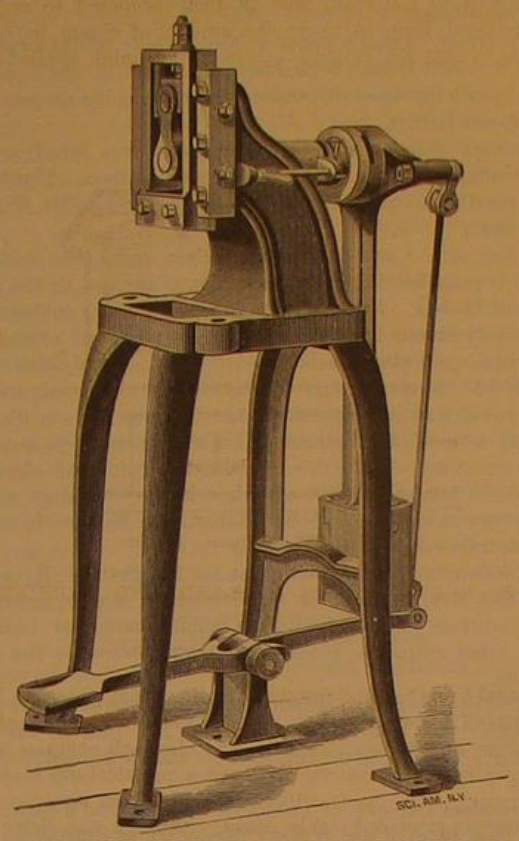
a. Cotton, linen, flannels, blankets, etc., should be treated with the boiling hot zinc solution, introducing piece by piece, securing thorough wetting, and boiling for at least half an hour.

b. Heavy woolen clothing, silks, furs, stuffed bed covers, beds, and other articles which cannot be treated with the zinc solution, should be hung in the room during fumigation, pockets being turned inside out, and the whole garment thoroughly exposed. Afterward they should be hung in the open air, beaten, and shaken. Pillows, beds, stuffed mattresses, upholstered furniture, etc., should be cut open, the contents spread out and thoroughly fumigated. Carpets are best fumigated on the floor, but should afterward be removed to the open air and thoroughly beaten.

5. *The corpses* should be thoroughly washed with a zinc solution of double strength, then wrapped in a sheet wet with the zinc solution, and buried at once. Metallic, metal-lined, or air-tight coffins should be used when possible, certainly when the body is to be transported for any considerable distance.

A NEW PUNCHING AND SHEARING PRESS.

In our last issue we gave a brief description of a press somewhat larger and heavier than that represented by the accompanying engraving. The working principle is the same in both, the power being obtained by the swing of a weighted pendulum at the back of the machine in combination with a shaft, automatic clutch, and slide.



"PEERLESS" PUNCH AND SHEAR PRESS No. 2.

In this machine the pendulum is kept in motion by foot pressure upon the treadle, and it punches easily a three eighths inch hole in one quarter inch iron, and an inch hole in one eighth inch plate, six inches from the edge. It is designed to do boilermakers' small work, as well as for the use of sheet metal workers, and especially brass manufacturers. The opening in the bed is six and a half by four inches.

The press weighs 380 lb., and, with the exception of the pendulum and treadle, is in all respects similar to power presses used for the same purposes. With it a boy can easily do all the work by foot as rapidly as by power press and without fatigue. The pendulum can be readily removed and a balance wheel attached to the shaft for power when desired.

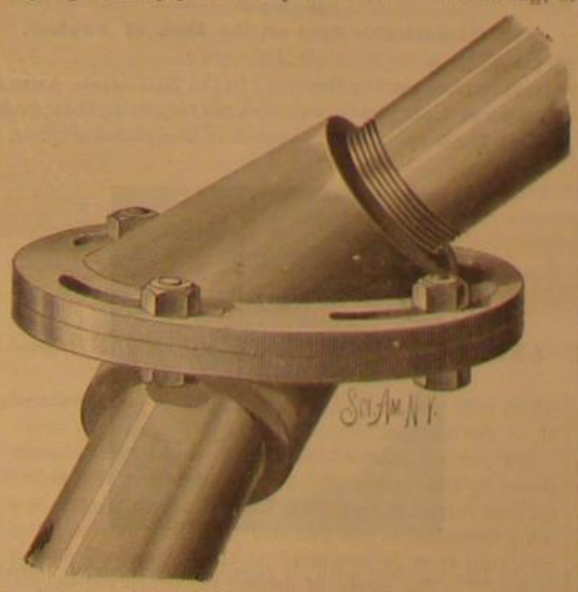
To test the capacity of one of these small presses, the manufacturers state that they attached a thirty inch balance wheel, with three inch belt, to the shaft, and with a speed of 125 revolutions per minute they could not punch an inch hole in one eighth inch iron; while the pendulum, worked by foot alone, enabled the machine to punch such holes rapidly and continuously.

This press stands about four feet high, occupies comparatively little space, and seems very substantial. The punch may be easily removed, and a shear may be inserted in the slide for shearing light sheet metal.

These presses are protected by several patents, and are made by the Peerless Punch and Shear Company, 52 Dey street, New York city.

NEW FLANGE COUPLING.

The annexed engraving represents an improved flange coupling recently patented by Mr. Charles H. Cushing, of



CUSHING'S FLANGE COUPLING.

Tidioute, Pa. It is designed for connecting sections of pipe at any angle to each other, from a straight line to an angle of 90°.

The invention consists of two circular plates, each flat upon one side, and having on the other a short internally threaded tubular projection inclined at an angle of 45° to the plane of the plates. The plates are slotted to receive the bolts that fasten them together. This coupling serves as an elbow for pipe and for forming in pipes a joint of almost any desired angle.

A FEW WORDS TO YOUNG STEAM FITTERS.

BY A STEAM FITTER.

Feed Pipes.—The feed valve should be a globe or angle valve placed near the boiler, with the fewest possible joints in the feed pipe between it and the boiler. If it is a loose or swivel disk valve, it should be secured with solder (sweated in) in the threads of the double part of the disk, so as to make it almost impossible to lose the disk from the stem; a mark with a center punch or chisel is not enough. The valve should be so turned toward the boiler that the inflowing water will be under and against the disk, so that in the case of the loss of the disk it will not act as a check valve against the influx of the feed water. This arrangement will bring the pressure of the water in the boiler always against the stuffing box of the valve; but all things considered it is best.

The check valve should be close to and outside the feed valve, with only a nipple between them. Always use horizontal check valves, as they admit of easy cleaning. With the ordinary vertical check it makes it necessary to take down some part of the feed pipe to clean it.

When two or more boilers are fed from the same pump, or when the pump is used for pumping water for some other purpose, it is well to have a stop valve on each side of the check valve, as it will enable the engineer to get at his check without stopping the water to the other boilers or elsewhere.

In passing through boiler walls or cast iron fronts, care should be taken that the feed pipe does not nest, or the settling of the boiler will break it off.

Use a flange union on the feed pipe instead of the common swivel union; the engineer can take it apart with a monkey wrench, and it makes a more permanent job and it will not leak.

Never put a T in the feed pipe inside the feed valve for the purpose of a blow-off; make a separate connection to the boiler.

Blow-off Cocks.—Never use anything but a plug cock of the best steam metal throughout. The reasons for using a cock are that the engineer is always sure when he looks at it whether it is shut or open. It gives a straight opening; if chips, packing, or dirt gets into the cock it will shear them off when closing, or if it does not, the engineer knows it is not shut. Do not use an iron body cock with brass plug, for when the cock is opened to blow down a little the hot water expands the plug of the cock more than the body, and it is almost impossible to close it. Do not use a globe or angle valve, as you cannot always tell when it is shut; a chip or dirt getting between the disk and seat will prevent its closing. I have seen two fine boilers destroyed from this cause. Gate or straight-way valves are subject to the same objections as globe or angle.

When it is practicable there should be a T with a plug in it in the blow-off pipe outside the blow-off cock, the plug to be removed when the cock is closed. By this means the engineer can always tell if he is losing water from his boiler.

The blow-off pipe should be large, with few bends in it, and fire bends are better than elbows. It should be attached to the bottom of the shell of a horizontal boiler, and not tapped into the head a few inches up. When there is a mud pipe, attach it to it at the opposite end from the feed pipe.

Safety Valves.—They are the main stay of the engineer, acting both as a relief and a warning signal. They should be attached to the steam dome high up. At the side is better than the top, as they are not so liable to draw water when blowing off in that position. They should be large and have a large pipe connection all to themselves. The ordinary cross body safety valve is very much to be condemned, and I think in some countries there are regulations against their use; they are constructed to save making an extra connection for the main steam pipe, thereby drawing the largest amount of steam directly from under the disk of the safety valve. A weighted safety valve is better than a spring valve when it can be used, as the lifting of the valve makes practically no difference in the leverage; not so with a spring valve, for the higher it is lifted the more power it takes to compress the spring.

Gauge or Try Cocks.—Gauge cocks are various in style, the wood handle compression gauge cock being a very good kind for all purposes. When setting gauge cocks care should be taken that they are not too low, and that the drip will not flow over the person who tries them. They should be tapped directly into the boiler if possible; but when it is necessary to use a piece of pipe to bring them through a boiler front or brickwork, give the pipe an inclination backward, that the condensation may run back and into the boiler. When the pipe inclines outward and down, the condensation remains in it and the cock, and will deceive the unwary, giving the appearance of plenty of water with a short blow.

Glass Water Gauges.—Water gauges are best set when attached to a vertical cylinder at the front of the boiler. The cylinder should be connected to the boiler with not less than one inch pipe, top and bottom; the top or steam connection should be taken from the boiler shell near the front head, and not from the dome or steam pipe, as the draught of steam in either will cause the glass to show more water

than the boiler contains. The bottom or water connection should be taken from the front head at a point where about two thirds of the water in the boiler will be above it and one third below; this will lessen the chances of the pipe stopping up with mud, etc., and it should also be provided with a half inch pipe at the lowest point for a blow-out. When gauge glasses are set this way the condensation in the cylinder is downward, and the flow of water being toward the boiler through the bottom pipe, the tendency is to cleanse the glass and cylinder and keep them so.

Steam Gauges should never be set much above or below the boilers to which they are attached, as each two feet of fall or elevation from the direct connection is nearly equal to a difference of one pound on the steam gauge; always when the gauge is below, for the condensation in the gauge pipe fills it with water, which leaves a pressure on the steam gauge equal to the hydrostatic head, which is a little over two feet perpendicularly to the pound per steam gauge, giving the gauge the appearance of being weak. When the gauge is above it is not always so, though generally, the pipes being long and of small diameter or trapped, which prevents a circulation of steam in them, they fill with water, which acts against the pressure from the boiler and gives a gauge the appearance of being strong. A good way is to connect the gauge pipe to a boiler below the water line, say 12 or 18 inches, and have the gauge on the boiler about 12 inches above the water line, using no water trap or siphon, that the water may run back from the gauge when there is no pressure in the boiler, thereby preventing the possibility of freezing or of getting steam to the spring of the gauge.

Sometimes a steam fitter has to run a gauge pipe a long distance to an office or engine room. When such a gauge is far above the boiler he should run a large pipe direct from the steam dome and give it sufficient pitch to clear itself of water; it should be covered with some non-conducting material, and be of such size that the flow of steam through the pipe to supply the loss by condensation will be so slow as not to interfere with the flow of water along the bottom of the pipe in a contrary direction, and it should have a siphon immediately under the gauge.

When it is necessary to have a gauge very much lower than a boiler, fill the pipe with water, but before doing so remove the glass and lift the hand or index over the stop-pin and mark where it remains stationary; now fill the pipe to its highest point with water, then with two knives draw the index from its spindle and set it back to the mark where it remained stationary before the pipe was filled, and press it on; then bring it to its normal position on the stop pin and adjust the glass.

The Main Steam Pipe for Heating Apparatus should be high up on a boiler, and any pipe larger than 2 inch should not be tapped in, but connected with a flange bolted or riveted to the boiler. Two and a half inch pipe and larger sizes have eight threads to the inch, and will not make a good job otherwise.

Automatic water feeders, combination water gauges, or steam gauges, should not be tapped into the steam heating or engine pipe, as the draught of the steam through the pipe interferes with their proper working.

Engine or pump pipes should not be taken from the steam heating pipe, as the draught they cause relieves the pressure in the heating apparatus and spoils the circulation, especially if it is a direct return gravity circulation.

With an automatic return steam trap applied to an old job, if the steam heating pipe is large enough, it will not be necessary to move the engine pipe, but should the circulation be still defective, remove the engine pipe to shell of boiler remote from heating pipe. W. J. B.

PROCEEDINGS OF THE AMERICAN ASSOCIATION.

Subsequent to our last week's report, at one of the general meetings the chief incident was the reception of Professor Otto Struve, Director of the Imperial Observatory at Pultowa, Russia. Professor Struve explained his mission to America in the interest of the observatory under his care, and announced that Messrs. Alvan Clark & Sons, of Boston, Mass., had undertaken to construct for it the finest telescope the world could produce.

Among the more valuable papers read were: Professor Peirce's on the meteoric constitution of the sidereal universe, in which he developed at great length the theory set before the readers of the SCIENTIFIC AMERICAN last winter. Professor Leeds, of Stevens Institute, reviewed the long standing problem as to the solubility of ozone in water, and gave the reasons for believing that it is so dissolved, and that it retains in the solution its characteristic oxidizing power. Professor H. W. Wiley, of Purdue University, Lafayette, Ind., described an improved method of collecting and measuring gases soluble in water, and Professor F. W. Clarke, of Cincinnati, gave a preliminary notice of results obtained in an elaborate revision of the calculations determining the atomic weights of the chemical elements.

The paper of Professor Goode, of Middleton, Conn., on the menhaden, presented that cousin of the shad as not only the most valuable of the food supplies of edible fishes, but as the most important source of fish oil. Its annual yield of oil exceeds that of the whale (from American fisheries) by 200,000 gallons; and in the commercial value of all its products it is surpassed by but three fish: the cod fishery, estimated in 1876 as yielding $4,826,000; the whale fishery, $2,850,000; the mackerel, $2,275,000. The value of the menhaden taken this year amounted to $1,658,000.

Major Powell delivered, in Section B, the suggestive and valuable address on Mythologic Philosophy, printed in the SUPPLEMENT last week; and Professor Stephen P. Langly, whose instructive series of articles on the Sun has just been completed in this paper, discussed the same subject in his address as vice-president of Section A.

Commander E. P. Lull, U.S.N., read an important and timely paper on the Interoceanic Canal Problem, illustrating by maps and diagrams the several routes surveyed. The character and advantages of the Nicaragua route were specially dwelt upon; and the belief was very positively expressed that no commercially practical route without locks had been found.

Professor Draper's paper on the Identity of the Lines of Oxygen with Bright Solar Lines, as shown in photographs taken with increased dispersion, was read, in his absence, by Professor Barker.

A very popular and enjoyable paper was Mr. Wm. T. Hornaday's on the Orang-Outangs of Borneo. Touching the possible human relationships of the orangs, Mr. Hornaday said:

"Let such a one (if, indeed, such a one exists to-day), who is prejudiced against Darwinian views, go to the forests of Borneo. Let him there watch from day to day this strangely human form in all its various phases of existence. Let him see it climb, walk, build its nest, eat and drink, and fight like human 'roughs.' Let him see the female suckle her young and carry it astride her hip precisely as do the Cooly women of Hindostan. Let him witness their human-like emotions of affection, satisfaction, pain, and childish rage—let him see all this, and then he may feel how much more patent has been this lesson than all he has read in pages of abstract ratiocination."

Another interesting paper was on the Serpent Myths of the Red Men, by Judge J. G. Henderson, whose paper on superstitions connected with the rabbit, among our Indians and other primitive people, had been listened to the day before.

Mr. Edison's electro-chemical telephone was exhibited and explained by Professor Barker, and Mr. Edison, the inventor, acting also as draughtsman for the blackboard illustrations.

President Barnard, of Columbia College, read a paper on the Past State of the World's Metrology as Bearing on the Progress of Science, in which the progress of modern science was shown to hinge on the possession of exacter means of measurement than the world had previously known.

The chief paper of the closing day was Mr. Edison's on the Phenomena of Heating Metal in Vacuo by Means of an Electric Current, a report of which will be found on another page. Both this paper and that by Mr. Edison's mathematical assistant, Mr. Upton, on Tests of Faradic Machines, furnish ample confirmation, if it were needed, of the position we took last week in respect to the scientific investigations of modern inventors.

In this brief notice it is obviously impossible to do anything like justice to the multitude of valuable papers presented to the association. It has been an active, earnest, business-like session, as notable for its good work as for its full attendance. The place of meeting had been happily chosen, the weather was favorable, and all the external conditions conspired to make the meeting as pleasant as it was profitable.

It was resolved to hold the next meeting in Boston, beginning the last Wednesday in August, 1880. The following officers were elected for the coming year:

President—The Hon. L. H. Morgan, of Rochester.

Vice-President, Section A—Professor Asaph Hall, of Washington.

Vice-President, Section B—Professor Alexander Agassiz, of Cambridge.

Permanent Secretary—Professor F. W. Putnam, of Cambridge.

General Secretary—Professor John K. Rees, of St. Louis.

Secretary of Section A—Henry B. Nason, of Troy.

Secretary of Section B—Professor C. V. Riley, of St. Louis.

Treasurer—William S. Vaux, of Philadelphia.

The Remarkable Spot on the Disk of Jupiter.

To the Editor of the Scientific American:

Having from time to time seen in the SCIENTIFIC AMERICAN notices from your correspondents respecting the appearance of black spots upon the disk of the planet Jupiter, I

have of late watched with all possible care for such phenomena, but have seen no spots save such as any experienced observer would readily recognize as being produced by the transit of a satellite or its shadow. However, on the 25th inst., at 9:30 P. M. time at this place, I observed advancing upon the eastern wing of the planet, midway between the southern equatorial belt and the southern gray zone, a dusky patch of irregular outline, which in one hour and fifty-five minutes reached the position and assumed the appearance, shown in the accompanying rough yet faithful diagram.

The length of this patch when seen in the position shown was little more than one-fifth of the planet's diameter, and about one-fourth as broad as long. Color, decided pink; indeed the color at times appeared so vivid as to make the equatorial belts, usually of a dusky red color, appear by contrast of a somber gray.

From the first appearance of this patch until it commenced to pass off on the opposite limb, the time elapsed was three hours and fifty minutes. The same phenomen on was again observed on the evening of the 28th inst., without any apparent change.

These observations were made with an achromatic of four inches aperture.

Phenomena of this kind, though not unknown, are of rare occurrence. South mentions having seen a large spot, somewhat of this kind, on the 3d of June, 1839, but of so evanescent a nature that it partly disappeared before a sketch of it could be made. I have recently noticed other disturbances of the Jovial atmosphere well worthy of vigorous scrutiny with the highest optical aid.

As some of your readers are students of astronomy, I should be pleased to know the results of their observations on this subject. F. S. DAVENPORT.

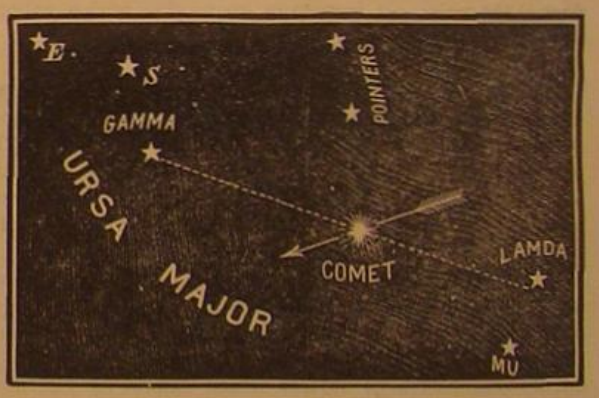
Jerseyville, Ill., Aug. 30, 1879.

ASTRONOMICAL NOTES.

PALISA'S NEW COMET.

It was my pleasure to obtain, at half past three o'clock this morning, very good observations of the new comet discovered by Palisa at Vienna on the 21st inst. It is not well situated for observation in this part of the world, owing to its slight altitude in the morning before daybreak, and in the evening the moon at present interferes. Notwithstanding this, it is quite a conspicuous object in the telescope, about twice as bright as Swift's last comet. It must really be a magnificent object in localities where it can be seen at a good elevation, as was the case when discovered. It is now nearly pointed at (south) by the "pointers" in Ursa Major, being in that constellation, and nearly on a line drawn from *Lambda* to *Gamma* Ursæ Majoris.

The comet is directly opposite the Pole Star from the



"pointers," and moving slowly toward the southeast, as indicated by the arrow in the diagram.

GRANDEUR OF THE MORNING SKIES.

A grander spectacle seldom greets the eye of man than that presented by our early morning skies at the present time. Three gorgeous planets form a royal girdle across the heavens. Jupiter in the west, Saturn high in the south, Mars well up in the east, and beyond, almost in a direct line with these planets, ruddy-faced Aldebaran. Overhead Cassiopeia and the Pleiades. Well down in the east noble Orion on his ride, while later, in the morning glow, shines silver-faced Sirius, in splendor rivaling Venus in the evening twilight. He who misses these grand scenes, misses royal soul feasts that the gods might envy.

SUN SPOTS.

A very pretty group of sun spots was observed on the 24th, just below the center of the disk, now much changed and nearing the western limb, but surrounded with intensely bright faculæ. Yesterday morning an interesting group appeared on the eastern limb with the faculæ very marked, and giving in its structure manifest evidences of rapid change. This morning confirmed the impression, for a large spot, unseen before, had broken out, and numerous small ones. Its appearance this morning (28th) is indicated in Fig.

2. This group of spots will be watched with interest as it traverses the solar disk, and may be seen with quite a small telescope. WILLIAM R. BROOKS.

Red House Observatory,
Phelps, N. Y., Aug. 28, 1879.

MISCELLANEOUS INVENTIONS.

Mr. Edward R. Mollenhauer, of New York city, has patented an improvement in violins which relates to the arrangement of their interior, effected without changing their outward form or structure or altering the manner of playing them This improvement increases the power of the instrument, and gives greater roundness and fullness to its tone without sacrificing any of its special and peculiar properties. The invention consists in interposing a board at any intermediate point between the belly and back of the instrument, parallel thereto, so as to divide the interior into two chambers, and providing the board with sound post, sound ports, and a bass bar.

An improved fastening for shoes, etc., has been patented by Mr John Howenstine, of Fort Wayne, Ind. It consists of a case secured to the flap, in which is pivoted a catch, held in position by a spring. A tongue is fastened to the other side of the opening, which is adapted to enter the case and to be engaged by the catch. The catch is made to release the tongue by pressing the projecting end with the finger.

Mr. Thomas B. Mosher, of Portland, Maine, has invented an improved ruler, which consists of a narrow strip of suitable material, made flat on its under surface to prevent rolling, provided with a sharp edge to serve as a paper cutter. It has a hollow cylindrical back piece running its whole length on its upper surface, so combined with it as to form a step along the line of junction. This step is sufficient to prevent ink from soiling or blotting the paper. The back piece is made hollow throughout for holding pencil or pen handle, or other articles, and in each end there is a plug, one forming the handle of an ink eraser, the other forming the handle of a piece of erasive rubber

An improved process for removing the germ and fuzzy or woody fibers found upon the ends of wheat and other similar grains before reducing the grain to flour has been patented by Mr Samuel Potts, of Minneapolis, Minn. The process consists in separating the grain kernels into grades of uniform length, and treating the grades in a continuous operation in separate mills, having each a stationary roughened surface and an opposing revolving roughened surface, these surfaces being rigidly adjusted with respect to each other at a distance apart which is invariable, and greater than the lateral axis of the grain kernels, and less than their longitudinal axis.

An improved life preserving suit, patented by Mr. Frank Vaughan, of Elizabeth City, N. C., has a lower section made in the form of rubber pants, distended and protected by rigid frames and rings, and having a sectional annular float at the waist. It is worn in connection with a rubber shirt having a strap and draw cords to connect it with a flange on the float.

Mr. Anson L. Sonn, of Toledo, Ohio, has invented a novel brush, which is an improvement in the class of hair and other bristle brushes having sheet metal back or casing. It consists in constructing the case or frame of the brush of two metal parts, one being let into or inclosed by the overlapping edges of the other, and united to form a water-tight joint.

Mr. James A. Peek, of Beloit, Kan., has patented an improved scraper for use upon railroads, ordinary roads, and in other places where grading is to be done, or soil moved from place to place. The invention consists in a novel combination of devices which cannot be described without engravings.

An improved mail package has been patented by Mr. George Bassett, of Chicago, Ill. It consists of an outer metal case made in two parts, each having a perforated head and inside rubber springs, on which the transparent box containing the samples or other articles is held, so as to be free from the jarring and pressure to which the package is subjected.

A horseshoe, provided with a spring attached to the under side of the toe and carried back in a median line to the heel, and then brought up in an enlarged form on a double or fold to support the frog of a horse's foot, has been patented by Mr. George Bacon, of White, Mich.

A lamp stand, which can be readily attached to a table, shelf, sewing machine, etc., and will securely hold the lamp placed in it, has been patented by Mr. Joseph Robison, Sr., of Birmingham, Conn. A clamp grasps the edge of the sewing machine table or shelf, and is firmly secured by means of a screw. The lamp sets in the ring with its handle between two uprights; a slide, moved down upon the lamp handle, holds the lamp in place.

A simple and, it is claimed, unfailing device for instantly detaching horses from vehicles, whether in motion or at rest, has been patented by Mr. Elijah Stevens, of Somerville, N. J. By this device a horse is attached to a vehicle securely, and in case of threatened accident he can be instantaneously disengaged, the strength of a child being sufficient for the purpose.

An improved butter package, constructed so as to keep the butter sweet and pure for any desired length of time, and which can be conveniently transported, has been patented by Mr. Arthur White, of Derby Line, Vt.

An improved barbed fence wire has been patented by Mr. John A. Duncan, of Kansas City, Mo. It consists in providing the main wire or wires with a loop or loops, and passing the wire barbs through the loops and twisting them together and around the wires so that they will be at right angles to each other and held immovable in their places.

A purse or pocketbook fitted with devices for registering or printing figures upon a strip of paper by the act of closing the purse or book, has been patented by Mr. Hugh C. Baker, of Hamilton, Ontario, Canada. The figures are adjustable, so that they may be set to print as desired. The device is intended for keeping an account of money taken from the purse from time to time without the necessity of using a pen or pencil.

An improved brick kiln has been patented by Mr. Thomas S. Hawkins, of Chattanooga, Tenn. The kiln is built in the form of a cupola furnace, with a chimney stack connected to the upper part of the burning chamber. In the lower part of the chamber is a platform that is raised and lowered by a screw. Access to the platform is had through an opening at the bottom of the kiln, through which the bricks can be removed.

An improved device for sprinkling water or other liquid in a fine spray upon clothes, plants, tobacco, leaves, and for various other purposes, where the liquid is required to be delivered in a fine spray, is the invention of Mr. James H. O'Connor, of Helena, Ark. The sprinkler consists of a cup, having a handle, a convex perforated plate or rose, and a valve, which facilitates the entrance of water into the cup by permitting the air to escape.

An improvement in sugar evaporators has been patented by Mr. James F. Sargent, of Strafford, Vt. This invention relates to improvements in the construction of the furnace and evaporating pans used in the manufacture of sugar. The object of the improvement is to direct the fire under the whole or a part of the pan; also, to enable a part of the pan to be used for boiling sap and another part for granulating the sirup.

Mr. Almon P. Whiting, of Astoria, N. Y., has invented an improved rail tie, to which rails may be firmly secured in a novel manner. The rail tie is double flanged and notched to receive the rails, and the rail is secured by a slot bolt and a clip of peculiar form.

Cumberland Mountain Caves.

One of the members of the Harvard University Summer School of Science (which, under the direction of Professor Shaler, has been studying the geology of the Cumberland Mountains in Virginia) writes from Pennington's Gap to the Detroit *Free Press* describing some of the caves of that region. He says:

"There are numerous small, and a few large, caverns in the limestone hills about here, but none of them have any true cave beetles. In one cave I descended into a pit by means of a rope and from this pit into a second pit, in which I found the floor strewn with bones of cave bear, cave men, and five or six other animals, all of which I got out and packed for the survey. The largest cavern I have examined is only two miles from camp. I have spent three entire days in exploring it, of course returning to camp each night. Of three passages examined I reached the end of but one. I walked for four hours through one series of chambers, which constantly increased in size as I went on, and was obliged to turn back without finding any end, simply because I could not carry in mind the many land marks that had to be remembered on the return.

"This cave contains the most exquisite chalcite and gypsite formations. One large chamber is lined for half a mile with delicate frostwork of crystals as white as snow. The walls seemed to be draped with folds of ermine puffed with bunches of ostrich plumes. In other places are sloping banks covered with an apparently vegetable growth of fungi, moss, and ferns, but all formed of chalcite needles or bunches of white, brown, rose pink, and crystal clear gypsite. There are pillowy masses, like couches of eider down, inviting the tired explorer to repose, but stinging like nettles the hand that brushes, no matter how lightly, against their bristling points. There are ledges, like the shelves of a museum, stored with branching coral. This part of the cave exhibits the perfection of this kind of cave ornamentation, and was said by members of the survey to be unusual in its extent and beauty. Other parts contain curious stalactite and stalagmitic formations, such as one sees in many other caves, halls of statuary, giant coffins, waterfalls, organs, and unexpected imitations of natural and artificial objects."

Explosion in a Bessemer Shop.

An accident occurred at Sheffield, England, the other day, which shows the danger of experimenting with petroleum in blast furnaces. The men in the Bessemer shop of Messrs. Brown, Bayley & Dixon's works had been engaged in what is known as the "patent injector experiment," in the course of which an apparatus for blowing vaporous petroleum by steam through molten metal is used, so as to render it hotter —"cold heat," as it is technically called. Shortly before seven o'clock the last of these experiments was being conducted. If it works well, combustion is immediate at the tuyere holes, and thus none of the heat caused by the presence of petroleum is lost. In this instance the experiment was on the point of being concluded, and some thirty men were engaged in the final operations, when an explosion, which shook the entire building, and was heard over the whole district, took place. Mr. Cooper, the acting manager, was at the works, and the inquiries he made showed that the petroleum had exploded in the box of the patent injector (or the vessel used in the experiment) containing the molten metal, and had blown the bottom lid of the latter off. The vessel then turned down, as usual when the experiment is concluded, and the molten metal commenced to run into the pit below, but fortunately no one was there, for the men had run for their lives as soon as they saw the danger. The foreman, however, did not escape, and he was somewhat severely singed over the face and arms. The cause of the explosion is attributed to the fact of there being an excess of petroleum—some of it vaporized—in the box, and that this larger quantity, coming into contact with the air, caused it to spring into a flame, and led to the explosion.

A NOVEL EXHIBITION.

The Royal Agricultural Society of England has issued a circular calling for examples of agricultural engines and machines for their next exhibition, which have been damaged in part or entirely by the incapacity or negligence of the operatives.

It is a novel idea, but such a collection of machinery as it proposes to get together is calculated to do much service to the manufacturer, who can inform himself wherein his machine may be improved in the whole or strengthened in parts, and not less so to the farmer or owner of the machine, who will thus be informed of the incapacity of his employés. The society also request that a written statement accompany each exhibit, stating the circumstances under which the damage was done. These specimens are to be displayed in a special shed in the show, which is to be held at Carlisle, on the 1st of July, 1880. Early notice is thus given that farmers may preserve their injured machines for the exhibition.

In addition to the great loss of property caused in the mismanagement of agricultural machines by incompetent help, a great many innocent persons lose their fingers and some their lives from the same cause. Such an exhibition is intended to form the basis for further investigation, first as to the cause, and then to devise a remedy for such evils.

Progress in Railway Making.

In a recent address Mr. Edmund Smith, one of the vice presidents of the Pennsylvania Railroad, said that thirty years ago 10,000 tons each way daily, or 7,000,000 tons a year, was thought to be the maximum capacity of a double track railway between Philadelphia and Pittsburg. Yet in 1878, the tonnage of the Pennsylvania Railway was 11,000,000 tons, and the extent of its capacity is far from having been reached In loading cars, a few years ago the rule was one ton to a wheel. The cost of moving one ton one mile under the most favorable circumstances on first class railroads a few years ago was 1 cent; now it is reduced to ½ cent. The most important element in causing these reductions has been steel rails, which are furnished now at two thirds the cost per ton of iron rails 30 years ago. He did not think there was any reason why we should not go on to improve and develop the system in the future as in the past, and he ventured the opinion that the day is not far distant when the main lines of railway will be illuminated at night by the electric light, while other and greater improvements will keep pace with the spirit of the age.

Impurities Contained in Glacial Acetic Acid.

The actual acid present in the 57 specimens examined varied from 87 to 99·5 per cent. The author finds that the oil of turpentine may serve for determining with exactness the acid present. For this purpose he takes 10 c.c. of the sample, and carefully drops into it oil of turpentine from a burette graduated into tenths of a c.c. until the last drop added dissolves after slight agitation without producing a permanent turbidity. The quantity of oil which may thus be added increases with the quantity of pure acid. In samples above 99·5 per cent in strength the oil dissolves in any proportion. To obtain comparable results the samples operated upon should be at one and the same temperature, 15° being the most suitable.

In practice it is sufficient to add to a known volume of the acid eight or ten times its volume of the oil and to stir two or three times. If the mixture remains clear the strength of the acid is at least 97 to 98 per cent. Otherwise it should be rejected.—*M. Bardy.*

English Silk Mills to Remove to New Jersey.

We have had several occasions lately to mention the transplanting of English manufacturing establishments to this country. Another significant and important move in this direction is reported in the New York *Times* of August 31. It appears that three gentlemen prominently engaged in the manufacture of silk in Macclesfield, formerly the great center of that industry in England, have been visiting the silk mills of Paterson, N. J. One of the gentlemen builds silk machinery, and hearing of the great prosperity of the Paterson mills, he thought he would find a market for his machinery in that city. He was surprised to learn that nearly all the machinery wanted is made in Paterson, one silk manufacturing company making all its own machinery on the premises. One of the other visitors is superintendent of a large silk mill in Macclesfield, and the other is the son of a great mill owner. Both of these gentlemen, after a tour of the Paterson mills, confessed that the American manufacturers had nothing to learn from their English rivals, but that the latter had much to learn from the former.

A NEW INDUSTRY—FROG FARMING.—A Mr. Soule, of Elgin, Ill., is in his third year of frog farming, and his first crop is now being marketed. He has an acre and a quarter devoted to the frog industry. The kind grown is the "Goslin frog," much larger than the common sort. Mr. S. will, next season, furnish St. Louis, Chicago, and Cincinnati with frogs, and is confident of success in the business.

Proposed English Channel Bridge.

A recent project is the scheme for bridging the English Channel, put forth by M. Verard de Sainte Anne, France. He maintains that his bridge scheme is preferable to the tunnel scheme, because its execution would not cost more than 300,000,000 francs, whereas the tunnel could not be constructed for less than 500,000,000 francs. M. De Sainte Anne, moreover, affirms that his viaduct could be constructed in a much shorter space of time than the tunnel.

As described in the London *Standard* the proposed viaduct is to span the Channel from Cape Grisnez to Folkestone. According to the Admiralty soundings the greatest depth of water to be found on the passage is fifty five meters, and this is only for a distance of some four kilometers about half way between the Varne Rock and the French coast. This Varne Rock and its neighbor, the Calbart Reef, play an important part in the scheme. The former, situated at fifteen kilometers from Folkestone and twenty kilometers from Cape Grisnez, is some four kilometers broad, covered with no more than from two to fifteen meters of water. Being of solid rock, and in a direct line with the projected viaduct, it offers itself as a natural half-way resting place. This rock has, till now, constituted one of the greatest dangers to the navigation of the Channel. M. De Sainte Anne proposes not only to turn it to account by using it as the foundation for a portion of the viaduct, but also, in conjunction with the Calbart Reef, for the construction of a free port in which vessels of the greatest tonnage will be able to seek shelter from the storms so frequent in the strait which separates England from France. Both for the construction of this port and for reducing the depth of the water to twenty meters in those places where he will be obliged to construct his columns, M. De Sainte Anne proposes to adopt the method employed in the construction of the Cherbourg breakwater, which consists in dropping huge masses of rock into the sea, and in consolidating them by means of Roman cement.

On the foundations thus established it is intended to raise solid masses of masonry to some forty meters above the level of the sea. This is, of course, a gigantic work, the immensity of which will be seen at a glance, when it is remembered that M. De Sainte Anne does not contemplate attempting in his viaduct any span exceeding two hundred meters. The distance from Folkestone to Cape Grisnez being thirty-five kilometers, it will, therefore, be necessary to construct at the very least 175 immense blocks of masonry on which to place the superstructure. As to the superstructure itself he proposes to employ three systems. On the Varne Rock and at the two extremities where the water is shallow and the exigencies of navigation permit, he proposes to construct solid stone arches which will have nothing to fear from the fiercest tempest. This massive masonry is to be followed by the girder bridge system, such as employed in the Charing Cross railway bridge. But to span the deep water he has recourse to the tubular bridge system as applied by Sir Robert Stephenson in the erection of the Menai bridge. With these three systems combined he believes that he is not only certain to succeed in crossing the Channel, but also in satisfying the demands of every government concerning the precautions to be taken to prevent the navigation of the English Channel being rendered even more dangerous than it is at present.

The Bite of the Skunk.

In the *Forest and Stream*, of recent date, is a contribution to the question whether the bite of the skunk is poisonous and will produce rabies. In the West and Southwest of the Mississippi Valley this seems generally believed. A writer from Colorado quotes several instances.

Dr. Cushing, of Trinidad, Colorado, who has, no doubt, seen several cases, gives it as his opinion that the natural bite of the skunk produces hydrophobia—that it does not need to be suffering from rabies itself. He says its bite will kill the victim sooner or later, without fail. Dr. W. L. South, who has had great experience in Texas and New Mexico, says "the bite will fetch the victim some time," meaning that it will sooner or later result in death.

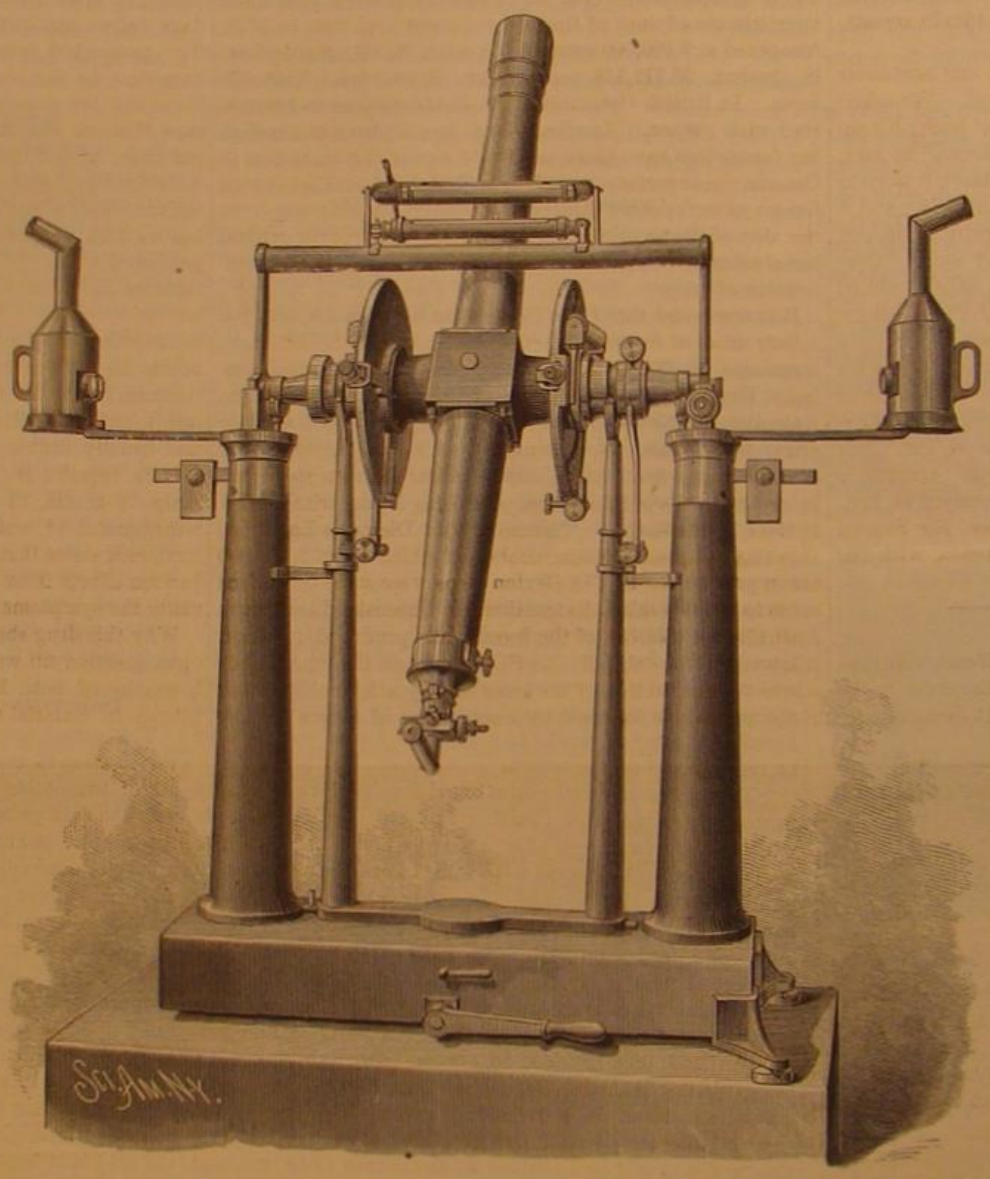
We do not believe this is the case in the Eastern States. The skunk is very common in Pennsylvania. We have seen dogs bitten by it, and have known those who hunted it constantly for its valuable skin, but have never heard of any such ill result from its bite either in man or dog.—*Medical and Surgical Reporter*

Relation of Religious Belief to Epidemics.

The Montreal *Witness* states that diphtheria is more prevalent among the Protestant section of Montreal community than among the Catholic. It is not a mere coincidence, nor is it of a temporary character. A study of the health statistics of Montreal for several years past reveals the same state of things. It is the more peculiar, inasmuch as the general death rate is much higher with the Catholics, particularly so in contagious diseases, and conspicuously so in the case of smallpox. But these admit of explanation. The only solution of the problem seems to be that the bulk of the Protestant community reside in the upper part of the town, where the drainage is less perfect than in the lower town.

NEW FORM OF TRANSIT INSTRUMENT.

The engraving represents an instrument made by Fauth & Co., of Washington, D. C., of the same class as the one described in our issue of August 23, being a transit instrument of smaller and more portable size. This instrument—of which quite a number have been made by Fauth & Co. for colleges in this country, as well as Mexico and Japan—is complete in itself, having base, standards, and reversing apparatus all in one piece, and is, as a glance at it will show, "American," being as convenient and adapted to the purpose as it can well be. As generally made, this instrument has a telescope of 3 inches aperture; the circles, which are divided on the edge, the graduation thus facing the observer, are from 12 to 13 inches in diameter; the latitude and striding level are sensitive to single seconds and chambered. Improved machinery, division of labor, and the great saving of time by only finishing the parts that require it, enable this firm to successfully compete in price with European makers. All the parts not polished are coated with "flocking." This finish gives the instrument a beautiful appearance, and makes handling comfortable, especially in cold weather.



FAUTH & CO.'S PORTABLE TRANSIT INSTRUMENT.

Prosperity in the Lumber District.

According to the *Northwestern Lumberman* the lumber interests of the West, which have been so greatly depressed along back, are now prosperous. There is a sharp demand for lumber, and thus far light receipts, which is pushing prices upward. From the same source we learn that the Hon. Erastus Corning, of Albany, N. Y., has formed a connection with Wm. H. Gratwick & Co., of Tonawanda and Albany, and Oscoda, Mich., for the handling of his entire stock of lumber, embracing some 200,000,000 feet, the product of his large and valuable tract of pine timber on the western shore of Michigan. This gigantic enterprise comprehends about $4,000,000 in value, supposing the lumber to have been marketed. Gratwick & Co., who own about 30,000 acres of fine timber land, will curtail the cutting from their own lands somewhat while the Corning tract is being operated.

Photography of the Spectra of Geissler's Tubes.

The spectrum of *hydrogen*, which appears to the eye to consist of only four lines, showed when photographed upon gelatine plates, besides these four lines, hundreds of lines in the blue, violet, and ultra (invisible) violet. Many of these are light and delicate, while some are of extraordinary density. Among these are, besides the mercury lines, four lines in the ultra violet and one which coincides with the thick first H line of the sun's spectrum. The length of the undulations of the lines was measured, and their position as respects the Fraunhofer lines of the sun's spectrum determined.

The spectrum of *mercury* in the Geissler tube furnished in the photograph, besides the remarkable lines in the blue and violet which Thalen saw and measured, a surprising group of lines lying far into the ultra violet (length of the wave of the outermost, 3650). The spectrum of the mercuric spark in the open air coincided in many points with the spectrum of mercuric vapor in the Geissler tube, but it also differed from it in a surprising way. Thus, in the spectrum of the Geissler tube, the distinct line close by H in the violet was absent, while, on the other hand, in the violet and ultra violet it showed a variety of bands which were not present in the spectrum of the spark in the open air between the poles of mercury.

The spectrum of *nitrogen* in the Geissler tube furnished a very characteristic photograph, with magnificent lines in the violet and ultra violet. Several of the latter far exceeded in intensity the visible lines in the violet. The appearance of the lines in the photograph was quite different from that which is given to them in ordinary drawings; they formed no simple shaded-off bands, but sharply defined lines, at the most strongly refrangible side of which lay a weak, washed-out looking band.

The nitrogen lines in the pale blue, which appear strongest to the eye, exercised but a slight action on the photographic plate, and on the green lines even a slighter.

If nitrogen and mercury be both inclosed simultaneously in the same Geissler tube, with a spark one gets the lines of both elements; but if the tube be warmed, the nitrogen lines disappear and only the mercury lines remain. This has already been observed by Herr C. Wiedemann. Thus, if one were to photograph upon the same plate the spectrum of a nitrogen tube containing mercury in a cold and in a warm condition, he would easily get the spectrum of nitrogen and that of mercury together, and by comparison he would be able to recognize which lines belong to one element and which to the other. The nitrogen spectrum reaches as far into the ultra violet as the mercury spectrum.

Then I photographed the spectrum of an electric spark struck through atmospheric air, oxygen, and carbonic oxide gas. Thus upon one and the same plate we had all together the spectra of oxygen, atmospheric air, and carbonic oxide gas. The comparison of the pictures showed that the carbonic oxide gave by preference oxygen lines, and that by the spark it was decomposed into oxygen and carbon (the latter was actually visibly drawn out to the poles.)

It was further observed that the spectral lines which are ascribed to the atmosphere are very different in character according as the different poles are used. For example: the spectrum of the air between mercury poles is very matt and undetermined; that obtained between platinum and aluminum poles is much more brilliant. Many of the lines in photographs of spectra of the air obtained in this way coincide, but many others do not, showing undeniably that the spectrum of one and the same substance may suffer by the presence of modifications which are very likely to arise. The changes in the spectrum of certain elements—as calcium, lithium, iron—which Lockyer ascribes to a decomposition of the elements, should therefore rather be attributed to the influence of foreign substances. The photographs which were obtained will appear, reproduced in lichtdruck, in the report of the Academy of Sciences.—*Dr. H. W. Vogel in Mittheilungen.*

According to a German authority (*Pharm. Zeitung*) a very handy sulphureted hydrogen apparatus may be made by putting into a large test tube, fitted with a cork and delivery tube, a mixture of equal weights of paraffine and sulphur. On applying heat hydrogen sulphide is given off, and on withdrawing the lamp the evolution of gas at once ceases, so that the same mixture may be used many times and will last for a long period.

PROPOSED NEW BRITISH POLAR EXPEDITION.

Our readers are probably aware, says the London *Graphic*, that an influential Central Committee has been formed, to which forty-nine provincial committees are affiliated, for the purpose of organizing an expedition to the North Pole on the plan recommended by Commander Cheyne, R. N., who is strongly of opinion that balloons will form an important element in all future Arctic explorations.

Our illustration depicts the three balloons as ready to start from the winter quarters of the ship during the first week in June, their destination being the North Pole. The average temperature in the early part of June is about 25° Fah. The balloons are named Enterprise, Resolute, and Discovery; each will be capable of lifting a ton in weight, the three carrying a sledge party intact, with stores and provisions for fifty-one days. The ascent will be made on the curve of a roughly ascertained wind circle, a continuation of which curve will carry them to the Pole, but should the said curve deflect, then the required current of air can again be struck by rising to the requisite altitude, as proved by experiments that different currents of air exist according to altitude; this fact Commander Cheyne himself observed when, in charge of the government balloons in his last expedition, he sent up four at the same moment to different altitudes; being differently weighted, they took four different directions to the four quarters of the compass, giving him his first practical idea of ballooning in the Arctic regions. Captain Temple's experiments with the war balloons from Woolwich Arsenal have fully confirmed this important desideratum in aerostation.

About thirty hours would suffice to float our aeronauts from the ship to the Pole, should all go well. We asked Commander Cheyne how he was going to get back; his answer was cautious: "According to circumstances," he said, "My first duty is to get there. When there leave it to us to get back. We have many uncertainties to deal with, and a definite programme made now might be entirely changed when the time came to carry out the journey south. Condensed gas would be taken in steel cylinders, hills would be floated over by expansion and contraction of the balloons, and in the event of any accident occurring, we always have our sledge party with sledge, boat, stores, and provisions for fifty days intact and ready for service." Scotland has taken up this novelty in Arctic exploration with avidity, and England, though more cautious in the matter, has at last given her adhesion to the project being carried out. Canada is likely to join, and Commander Cheyne has received an invitation from the Canadian Minister of Finance, Sir Samuel Tilley, K.C.B., to deliver his lectures in Canada, with the promise of a warm reception.

Atlantic Temperatures.

From the coast-station observations of the Weather Bureau it appears that the maximum temperature of the water in the months of July and August respectively is: At Jacksonville, Florida, 87·75 and 88·25 degrees; at Charleston, S. C., 86·00 and 87·25 degrees; at Wilmington, N. C., 85·50 and 83·50; at Norfolk, 81·00 and 82·25; at New London, Conn., 70·66 and 74·00; at Wood's Holl, Mass. (near Nantucket), 76·25 and 75·25; and at Portland, Me., 60·25 and 60·50 degrees. A very noticeable fact, apparently established by these data, is that the sea water bathing on the coasts and inlets all the way up to Portland is slightly warmer in August than in July, the greatest difference noted being found at New London, where the August temperature is three and a third degrees higher than that of the preceding month. If we tabulate all the observations from Jacksonville to Portland, the average temperature for July is 78·24 degrees, against 78·85 for August.

The lowest August temperatures of the water at Norfolk average 72·00 degrees; at New London, 65·25; and at Wood's Holl, Mass., 69·00. There are no reports for Cape Cod and the Jersey beach, but it is probably safe to assume that the waters on the latter are seldom, if ever, chilled below 70 degrees in August, and that on the east sides of Cape Cod and thence to Newport it is rarely that the August sea temperature falls below 69 degrees.

Timber in the English Colonies.

The English Government has been collecting information from the colonies as to their timber supply. It appears that during the five years ending 1876, Canada sent England about $125,000,000 worth of timber. In Nova Scotia the approximate amount of timber-producing land was, in 1875, computed at 9,000,000 acres; in Ontario, 30,000 square miles; in Quebec, 73,711,114 acres; New Brunswick, 6,000,000 acres. In British Columbia about 110,000,000 acres are covered with timber. Newfoundland, too, is densely wooded, but forest fires have there, as also to a considerable degree in Canada, made serious inroads. In Natal (Africa) the Crown forests have for some time been suffering so seriously from the depredations of the natives that the surveyor-general has absolutely prohibited the use of forest lands for the cultivation of crops.

It is computed that Cape Colony has between 500 and 600 square miles of forest. Between 1868 and 1878 British Honduras sent 34,000,000 feet of mahogany. In Victoria, Australia, timber is diminishing far too rapidly, and in western Australia the Governor thinks that steps must be taken to arrest destruction. In Queensland an annual license fee is exacted from wood cutters, and an officer has been appointed to report on the public timber-producing lands, with a view to their conservation. Tasmania (Van Diemen's Land) has about 8,000,000 acres under timber, of which about 1,000,000 are in private hands. In Ceylon steps were some time since taken to arrest reckless destruction. In Queensland and South Australia the clearing of the forests has produced no effect whatever on the rainfall. In St. Helena, on the other hand, where the destruction of the trees shortly after colonization of the island was followed by a succession of severe and destructive droughts, now that the forests have been allowed to grow again there has been much less trouble on that score. The climate of Jamaica is reported much drier of late years in the south side of the island, where the greatest clearances have been made.

IODINE AS A SUBSTITUTE FOR QUININE.

The power possessed by iodine over malarial troubles seems to have been known many years ago, but the knowledge was evidently confined to few, and not appreciated as it ought to be. Recently several physicians have recorded their experience with this drug, and among others Dr. Wm. Anderson, who gives a highly favorable account of it in the *Proceedings of the Medical Society of the County of Kings.*

Dr. Anderson's experience with the remedy dates back about five years, when, meeting a statement that iodine was a reliable remedy in intermittent fevers, he resolved to give it a thorough trial. He therefore prescribed it in the form of the simple tincture to a number of patients. After watching the results very carefully, he became thoroughly convinced that he had a valuable remedy, and from that time to this he has invariably, with a few exceptions, prescribed iodine in all his cases of intermittent fever, both in private and dispensary practice. He states that up to the present time he has treated at least 300 cases in this manner, and with almost invariable success. The time required to effect a cure naturally varied. In a large number there was no paroxysm after the first dose; frequently it took two or three days before any mitigation was observed. Iodine is so seldom prescribed internally that most physicians look with suspicion on the idea of substituting it for quinine, and think that the stomach would not tolerate it. Dr. Anderson says that this mistaken notion is merely the result of inexperience; he has had but one patient who could not retain it, but neither could she retain quinine. He has found that children take it readily, and in giving it to such patients he has not had a fraction of the trouble that he formerly experienced with quinine. Although he formerly used simple tincture of iodine in sirup and water with good effect, he has recently found it advisable to add iodide of potassium to the mixture to prevent precipitation of the iodine. For adults he prescribes 12 to 15 minims of this compound tincture, freely diluted, to be taken three times a day after meals, and regardless of fever. For children, 5 to 10 minims usually suffice. The author's favorite prescription in private practice is: Tincture of iodine comp., 6 drachms; sirup of acacia, 18 drachms. Mix. Dose: teaspoonful in wineglassful of water three times a day, after food. Dr. Anderson states that he has never as yet observed any injurious effects from the internal exhibition of iodine, especially the symptoms designated as "iodism."

Why this drug should act so beneficially must remain an open question till we know more about the disease itself. It is worthy of note, however, that the remedies usually employed in malarial troubles have marked antiseptic proper-

PROPOSED NEW ARCTIC EXPEDITION.—COMMANDER CHEYNE'S PLAN FOR REACHING THE NORTH POLE.

ties, and this is a prominent trait of iodine. To the American physician, indeed to the inhabitants of all countries cursed by malarial fevers, this is a subject of unusual importance. It would be a national blessing to have an effective, safe, and cheap substitute for quinine; for, although the government has recently removed its protection from the latter, this action will affect not so much the pocket of the patient as that of the apothecary.

THREE RULES FOR ABBREVIATING MULTIPLICATION.*

(From the "Talkhys Amali al Hissab.")

The "Talkhys Amali al Hissab" ("Analytical Résumé of Calculating Processes"), written by Ibn al Banna, of Morocco, contains, in the chapter devoted to the multiplication of integral numbers, some abbreviated methods by means of which, in certain particular cases, the product of the multiplication of two integral numbers may be obtained very quickly. As these processes deserve to be known, and are not found in any arithmetical treatise (although the "Talkhys" gave them nearly six centuries ago), we publish them for the benefit of our readers.

FIRST RULE.—Suppose it be required to multiply by itself a number composed of figures, each equal to unity; for example, 11,111 × 11,111.

We say that the product will be, 123,454,321.

To obtain this we write the number of figures contained in one of the factors, and to the left and right of this number we place symmetrically the natural decreasing series of numbers less than it. Thus, in the example proposed we write down 5, that being the number of figures in one of the factors, and then we place on each side of that number the natural decreasing series of figures less than 5, that is, 4, 3, 2, 1, in the following form, 1234 5 4321.

Another Example.—Multiply 1,111,111 by 1,111,111. The product will be at once obtained by writing to the left and right of 7 (the number of figures contained in either of the two factors) the numbers 6, 5, 4, 3, 2, 1, as follows: 1,234,567,654,321. If we multiply 11 by 11, the application of the same rule will give as result, 121.

SECOND RULE.—To multiply by itself a number composed of figures, each equal to 9; for example, 99,999 by 99,999. We say that the product will be, 9,999,800,001.

To obtain this result, we write down the figure 8, placing to its left as many *nines*, and to its right as many ciphers, as there are figures less one, contained in either of the two factors, afterwards adding to the extreme right of the resulting number the figure 1. Thus, then, in the proposed example (99,999 × 99,999) we write the figure 8, and to its left the figure 9 repeated four times (5—1), and to its right four zeros (5—1), giving as a result 9999 8 0000; now annexing the figure 1, we obtain the product sought, 9,999,800,001.

Another Example.—If we desired to find the product of 9 by 9, we should obtain, by applying the general rule, 81. In fact, in this case, the number of figures of either factor, diminished by 1, gives zero as a result. This explains why the figure 8 does not appear accompanied by *nines* or cipher, but only by the figure 1 of the units.

THIRD RULE.—To multiply a number composed of figures each equal to 9, by another whose figures, although equal to each other, are different from 9; for example, 999 by 666.

In this case we say the product will be equal to 665,334.

To obtain this result, we first obtain the product of a figure of the multiplicand by that of the multiplier; the figure of the units of this preliminary product will be the number of the units of the product sought. To the left of the figure of the tens of the said preliminary product we write the figure of the multiplier as many times as there are figures, less one, in either of the two factors; and to its right we place the same number of figures, each equal to the difference between a figure of the multiplicand (9) and a figure of the multiplier (6). To the extreme left of the quantity thus obtained we annex the figure of the unit of the preliminary product; thus we have the product sought. To make this clearer: in the proposed example, 999 × 666, the preliminary product will be 9 × 6 = 54; so that, to the left of the figure (5) of the tens, we place the figure of the multiplier (6) as many times, less one, as there are figures in either factor, which in this case will be twice (3—1), and to its right twice the figure 3 (the difference between 9 and 6), as follows, 66 5 33; and to complete this number we annex to its right the figure (4) of the units of the preliminary product (54). We then have the product sought, 665,334.

Another Example.—Suppose it be required to multiply 9,999,999 by 3,333,333. The preliminary product is 27, and the number of figures in each of the factors is 7; so that, writing to the left of the figure 2 (of the tens of the preliminary product) six (7—1) figures, each equal to one of those of the multiplier (3), we have, 3333332. Now, if to the right of the same figure (2) we write six figures, each equal to the difference between the figures of the two factors (9—3), we have, 333333 2 666666; and finally, we obtain the definite product by annexing to the right of the foregoing quantity the number 7 (the unit figure of the preliminary product), as follows: 33,333,326,666,667.

Another Example.—If 99 be multiplied by 22, as the preliminary product is 18, and each factor contains two figures, it will be sufficient to write, to the left of the figure of the tens (1), the figure of the multiplier (2) but once, and to its right the figure 7 but once (the latter being the difference between 9 and 2); we will thus have 217, and to this we annex the number 8 (the unit of the preliminary product), and obtain the product sought, viz., 2,178.

This rule will hold good in all cases except those in which the factors contain each but a single figure. If, for example, we should apply the rule to the case 9 × 2, the preliminary product, 18, would at the same time be the final product. It is easy to see that the second rule may be considered as a particular case of the third—one in which the difference between the figure of the multiplicand and that of the multiplier is zero.

* Translated from the *Cronica Scientifica*, of Barcelona.

ENGINEERING INVENTIONS.

An engine valve, so constructed and arranged that the pressure of the steam upon the valve from above will be nearly or quite counterbalanced by the pressure from below has been patented by Lewis H. Baker, of Fairfield, Ill.

Mr. Jean L. Nevers, of Pass Christian, Miss., has patented in this country and in England an improvement in vibrating propellers, in which reciprocating propeller blades are employed, and the improvement consists in a novel device for controlling the propeller blades. In this propeller the change of direction is always under the immediate control of the person who has charge of the steering wheel, and though the motion of the engine may not cease, the positions of the blades can readily be changed at each stroke so that they will exert no force upon the water.

Mr. James H. Gray, of Connellsville, Pa., has patented an improved device for attachment to locomotive, marine, and other engines, to operate them by compressed air. The invention consists in a series of air drums, arranged at some distance apart in the water tank of a steam engine, connected together by pipes, and communicating with suitable pumps operated by the engine, and connected by a pipe along the outside of boiler with the steam chest and cylinders.

Mr. James H. Gray, of Connellsville, Pa., has patented a direct acting pump, in which a steam or water pump and steam cylinder are operated in connection with a single piston. The invention consists in an improved construction of valves, by which a steam chest is dispensed with and the pump is rendered cheap and effective.

A switch bar, having jaws which are adjustable lengthwise of the switch bar so that they may be moved to fit the rail, and the rails and jaws shifted to the desired gauge, has been patented by Mr. William K. Dunwoody, of Eagle Mills, Mich.

Bearing Fruit.

Twenty-five years ago we went to the wedding reception of a charming and brilliant young woman from a New England State, just married to a young physician in a Western city. She had come from the best schools, and was the woman, of all others, who was looked at as a leader in the higher literary and artistic life of a prominent circle in the town. Seven years ago we again met that woman, now a matron of forty-five, in a Western university town, where her husband had finally landed as a professor of sciences in the college. We saw that the family were living in quiet and simple elegance on the small salary of a Western professor, with a house full of fine children, and no servant that we could discover.

At tea we ventured the question, "What has been the result of your studies and experience in the last twenty years? I have seen no book, or magazine article, or poem, over your name, as we expected." "I will show you my one book," she replied, leading the way to her kitchen. There she exhibited a most ingenious machine for washing the dishes of her table, which abolished the drudgery of this disagreeable end of housekeeping, and enabled a child, with the help of two "lifts" from mother, to make a play of what would be the work of a servant.

Now, of course, not every cultivated school girl has the inventive faculty to do what this woman had accomplished. But think what she has done! She has made it possible for every mother in America to save an hour a day for study, or work, in the upper side of life. She has made it not only a respectable, but an artistic employment to wash table dishes. She has made home duties and housekeeping more attractive to all her daughters, and taken one more step toward the abolition of the drudgery that has so crushed out the lives of a thousand generations of women since the days of mother Eve. We doubt if any book, even a new novel by George Eliot, or a new picture, a new voice like the warble of Gerster, or any splendid thing that may be done by a woman in America, would go so deep, touch on higher realms of life, or more justly entitle that cultivated Christian lady to the respect and admiration of the country.—*New England Journal of Education.*

Running Expenses of Narrow Gauge Railroads.

The St. Louis *Republican* gives the following estimate of the running expenses of a narrow gauge railroad, based on the performance of nineteen locomotives during the month of June last:

The locomotives consume one ton of coal per seventy miles, one pint of oil for thirty-eight miles, one pound of tallow for seventy-seven miles of running. Engine repairs have cost 4 3-10 cents; the wages of engineers, firemen, and round-house men have cost 5 9-10 cents; fuel has cost 1¼ cents; and oil, tallow, and waste have cost ¼ of a cent per mile run by the engines, making a total for engine services of 12 cents a mile; a result which is seldom equaled in the direction of economy.

Memoranda for Disinfecton of Yellow Fever.

The following rules have been published by the National Board of Health:

1. It is prudent to assume that the essential cause of yellow fever is what may, for conciseness, be called a "germ," that is, something which is capable of growth and propagation outside the living human body; that this germ flourishes especially in decaying organic matter or filth, and that disinfection must have reference both to the germ and to that in or on which it flourishes.

2. Disinfection, when used in a place not infected, for the purpose of rendering filth, or foul soils, waters, etc., incapable of propagating disease germs, is a poor substitute for cleanliness, and is mainly useful to make the process of cleansing odorless and harmless. The best disinfectants for this purpose are sulphate of iron, carbolic acid, fresh quicklime, fresh charcoal powder, chloride of zinc, chloride of aluminum, and permanganate of potash.

3. The two great difficulties in destroying the vitality of the germ of yellow fever are, first, to bring the disinfecting agent into actual contact with the germ; and, second, to avoid injuring or destroying other things which should be preserved.

4. *When the germ of yellow fever is dry, or partially dried, no gaseous disinfectant can be relied on to destroy it.* It must either be moistened or subjected to a dry heat of not less than 250° F., to obtain security.

5. In disinfecting or destroying infected clothing, bedding, or movable articles, *move them as little as possible while dry.* Before disturbing them have them thoroughly moistened, either with a chemical disinfecting solution or with boiling water, in order to prevent the diffusion of dried germs in the air in the form of dust.

6. The best method of disinfecting rooms, buildings, ships, etc., is still doubtful, owing to the difficulty of destroying the vitality of dried germs.

The Board proposes to have this subject carefully investigated, and in the meantime advises thorough scrubbing and moist cleansing, to be followed by the fumes of burning sulphur, at the rate of 18 ounces per 1,000 cubic feet of space to be disinfected.

The sulphur should be broken in small pieces, burned over vessels containing water or sand, which vessels should be distributed in the closed space to be disinfected at the rate of one to each 100 square feet of area of floor.

7. No patented compound known to the Board is superior, as a disinfectant, to the agents above mentioned, and none is so cheap. Some of these patent disinfectants are good deodorants, but *the removal of an unpleasant odor is no proof that true disinfection has been accomplished.*

8. In districts where yellow fever prevailed last year the following precautionary measures should be taken:

(*a*) Textile fabrics of every description which were exposed to yellow fever infection during the year 1878, and which have remained packed or boxed in a closed space since such exposure, should not be opened or unrolled, but should either be burned or placed in boiling water for half an hour or more, or in suitable heated ovens, or disinfected, according to the nature and value of the individual article or articles.

(*b*) Every house or room in which cases of yellow fever occurred in the year 1878, and since that time have remained unoccupied, should not be opened for occupation until they have been thoroughly cleansed and disinfected, by persons acclimated to yellow fever.

(*c*) Every privy, vault, underground water cistern, dry well, or closed cellar, connected with a house in which yellow fever existed last year, and which may not have been opened since that date, should not be reopened, but if possible should be covered with several feet of earth.

(*d*) Every suspicious case of sickness should be at once isolated, and every possible precaution taken to prevent infection, by providing attendants who have had the disease, and thorough disinfection of all discharges from the sick. If the disease prove to be yellow fever, all articles of cloth ing and bedding used about the sick should be burned, the house should be vacated, and every room tightly closed and fumigated with burning sulphur.

A New Way to Treat Diphtheria.

Quite a discovery in the treatment of diphtheria has been made here. A young man, whose arm had been amputated, was attacked by diphtheria before healing took place, and instead of the matter incident to that disease being deposited in the throat, the greater portion appeared on the wounded arm, and the diphtheria was very light and easily managed. Dr. Davis, of Mankato, profited by this, and in his next case of diphtheria blistered his patient's chest, and on this blistered part the chief deposits appeared. This was also an easy case of the disease. The theory of Dr. Davis is that diphtheria usually appears in the throat because of the thinness of the lining of the throat. Hence, when the blister breaks the skin upon any other part of the body, the disease appears there.—*Minnesota letter to the Salem (Mass.) Gazette.*

American Institute Exhibition.

This exhibition opens on the 17th day of September, by which date all exhibitors should be in position. The incompleteness of all exhibitions is the cause of general and well deserved complaint, yet we hope our frequent notices may have at least the effect of having this exhibition in good shape on opening day. Any parties intending to exhibit should apply at once, and address all communications to General Superintendent, American Institute, New York city.

The Silver Mines of Arkansas.

A correspondent of the St. Louis *Globe-Democrat*, writing from Little Rock, describes the mining region of Montgomery county and its minerals as follows:

The district embraces townships 1 and 2 south, ranges 23, 24, 25 west, which includes a district of about 216 square miles.

The main water courses are the Wichita proper, and its south and north forks, besides a large number of small streams and rivulets, all more or less suitable for water power. The same tract of land is well timbered with yellow pine, white and black oak, ash, hickory, black walnut, gum, etc., well adapted for building and mining purposes.

The district forms a basin of small rolling hills, which are continuous throughout its entire length, and is surrounded by the Ozark Mountains on the north, the Mazerne Mountains on the south, the eastern spur of the Cassotal and Little Missouri Mountains on the west, and the Crystal Mountains on the east. These mountains are of secondary and primary formation, containing hornblende, granite, slate, and porphyry.

South of the Mazerne range is a younger formation of novaculate and limestone. The summits of the Crystal Mountains show ledges of metamorphic sandstone, underlaid by slate and sub-carboniferous limestone, which leads to the conclusion that this entire mineral belt is underlaid by sub-carboniferous limestone and porphyry.

The basin itself shows calcous shale and slate—the latter being generally exposed in the gulches and river banks—and is traversed by a belt of quartz veins which runs in an eastwardly and westwardly direction, and can be followed westwardly its entire length through the Cassotal range to the Indian Territory, thence through the Wichita Mountains, in the northwest part of Texas, striking the Rocky Mountains in New Mexico, the belt showing the same formation throughout its entire length, which has been conclusively proven by many of our most eminent geologists and mining engineers who have spent years of time and labor in determining this important fact, and who offer as an evidence of the correctness of this view the fact that the same minerals exist in the same character of quartz and spar throughout both entire districts.

The veins opened up to the present time have given evidence of walls and selonge, and are the quartz veins freely impregnated by gouche, which dip north, and have more or less strong overlap south, and have a general strike from 8° to 25° north of east.

The eminent geologists, Professors Church and Phillips, during their stay in Silver City, made upward of thirty assays, with the most gratifying results, the quartz with two exceptions ranging from 200 to 600 ounces of silver to the ton, and this from specimens picked up indiscriminately from the surface, and in which not the slightest indication of ore was perceptible. These gentlemen were astonished to find such results from quartz that made no showing whatever, and was in no case taken from a greater depth than twenty feet, which was hardly sufficient to enable them to determine with any degree of accuracy the extent or value of the ores of greater depth, but gave it as their opinion that their greatest richness would be at a depth of one hundred and fifty feet.

Prof. Phillips, who was in Mexico in the months of September, October, and November, examined a large number of old silver mines in Chihuahua and Durango, and who has been four months in Arkansas examining its silver resources, states that the two fields, in their general geology, are almost identical in character, and feels convinced that these high grade ores from the quartz veins of Montgomery county will run to wire and other forms of native silver at a depth of 100 to 200 feet, as similar surface ores were found in the same character of quartz incased in slates as were mined by the old Spaniards at Parral, Santa Barbara, and Inde, in the State of Durango, and all of which veins carried more or less native silver at a depth not exceeding 100 feet from the surface.

PAPER is worth six cents a pound in Peru until it is made into money, then it depreciates, adds a wicked editor next door, about fifty per cent.

GOTHIC OAK PRESS.

The carved oak press, with metal work after the style of the close of the 15th century, is an admirable specimen of its class. It is now in the possession of the Art Industry School of Vienna, and is preserved as a good example of fine Gothic carved work.

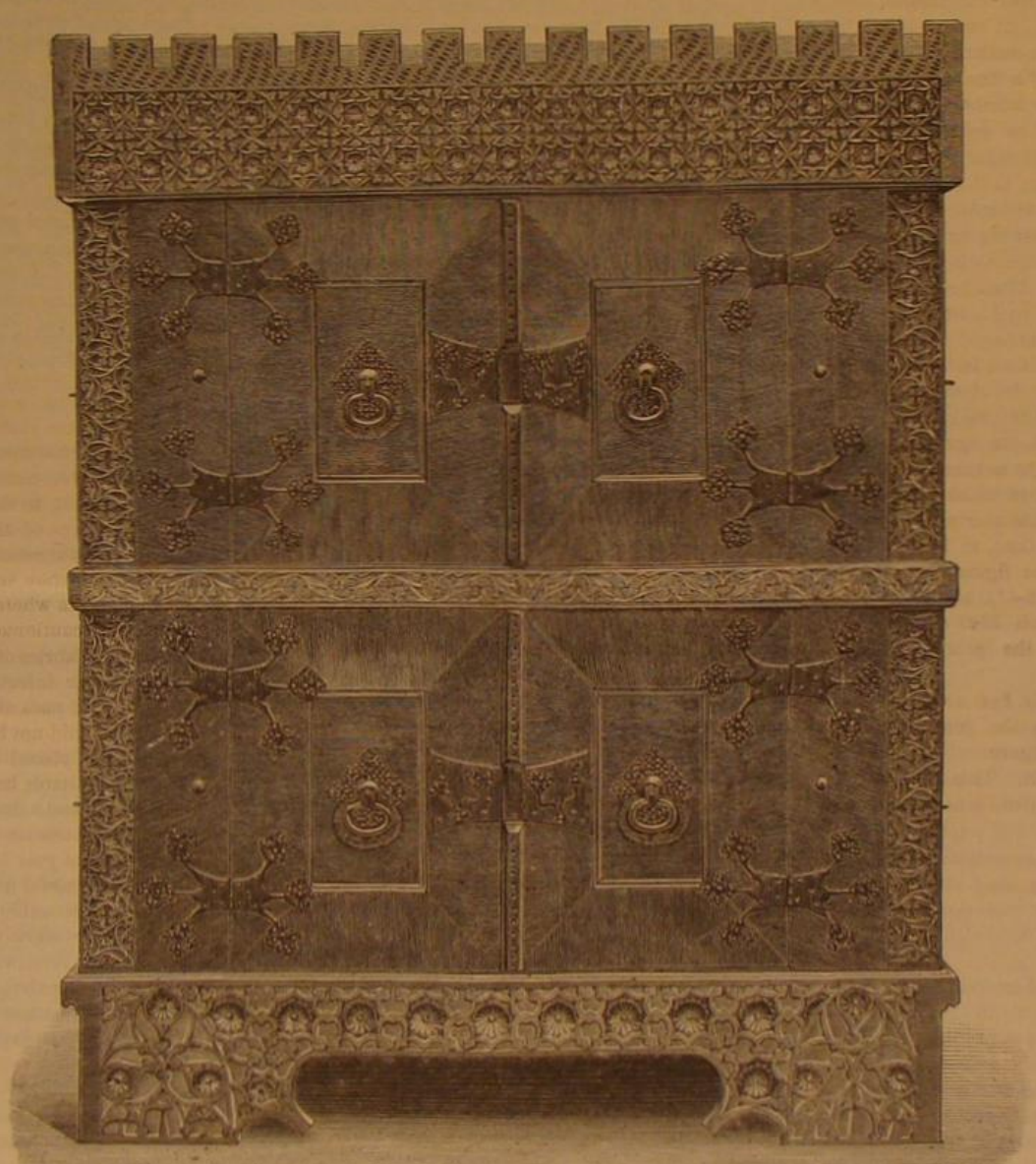
RECENT AGRICULTURAL INVENTIONS.

Mr. William H. Sterns, of Humboldt, Neb., has patented a simply constructed and easily operated churn, in which the agitation of the cream is produced by the rapid movement of the apparatus in a horizontal plane, so that the cream is thrown violently from side to side of the receptacle, a circular or rotary movement being prevented by cream breakers in the sides of the receptacle.

An improvement in corn planters has been patented by Mr. Allen F. Hall, of Onarga, Ill. The object of this invention is to improve the construction of the corn planter for which letters patent No. 197,549 were granted to the same inventor, November 27, 1877, so as to make it simpler in construction, more easily operated, and more readily thrown into and out of gear.

An economical and powerful press for cotton, hay, rags, etc., that may be worked by hand, horse, or steam power, in field, farm, or factory, has been patented by Mr. John Rossell, of Galveston, Texas. The invention consists in combining worm gearing with an eccentric cam for working the movable head of the press, and in a novel arrangement of pins and an endless rope for retracting the movable head.

Mr. Thomas T. Harrison, of Aubrey, Kan., has invented an improved attachment for breaking and cultivating plows, by which the plow can be easily and fully controlled. The invention consists in a novel arrangement of vertical and horizontal bars for supporting and guiding the plow.



CARVED OAK PRESS.—AFTER THE STYLE OF THE 15TH CENTURY.

The General Wool Monument.

The largest monolith ever transported any distance in this country is the granite shaft to be set up in honor of Major-General John Ellis Wool, at Troy, N. Y. It is of gray granite, measures 3,784 cubic feet, and weighs 254 tons. In the rough it measured 4,763 cubic feet, and weighed 398 tons. The entire monument will stand 73 feet 7 inches high, the shaft alone measuring 58 feet. The stone was cut and finished at the quarry of the Bardwell Granite Company, Fox Island, Maine. This monolith is considerably smaller than the obelisk known as Cleopatra's Needle, lately transported from Egypt to London. The great Lateran obelisk in Rome, originally from the Temple of the Sun, in Egypt, is 150 feet high and weighs 440 tons.

The Swiftest Ship in the World.

A new British war steamer, called the Mercury, built of steel, has just been completed and successfully tried at Portsmouth, England. The vessel is 300 feet long, 45 feet beam, 16 feet 3 inches hold. Displacement, 3,750 tons. On her late trial trip the engines developed 7,595 horse power, and the speed attained was within a trifle of 22 miles an hour. These are remarkable results for a vessel of the dimensions given. The Mercury has twin screws, driven by separate engines arranged in separate engine rooms. Her machinery nearly fills the hull. There are twelve boilers, four high pressure cylinders, each 41 inches diameter, and four low pressure cylinders, 75 inches diameter. Stroke, 3 feet; boiler pressure, 60 to 65 lb.; coal consumption, 2·35 lb. per hour per horse power. One man governs the rudder, which is worked by steam. The vessel's armament will consist of ten 64-pounders.

Two More New Metals.

The discovery of two new metals is announced, named samarium and norwegium. Paradoxical as it may sound to speak of the finding and christening of a hitherto unknown metal before it has been either seen or handled, yet such is the case with samarium. As happened in the instance of the metal gallium, mentioned in the SCIENTIFIC AMERICAN a few numbers back, it has first become known to science by means of the spectrum analysis alone; nor can it be doubted, predicts one of our foreign exchanges, that in the verification of its existence by the senses it will, in due time, follow the same precedent. It is well known that by means of the characteristic rays which are seen in the luminous spectrum, produced by the combustion of any substance, it is possible to single out the known or unknown bodies which enter into the combination. As are the rays, such are the elements producing them. When rays are found answering to no substance already catalogued, the existence of some new body is naturally inferred from the fact. That was how gallium was first brought to light, and now we have a like history for samarium. M. Lecoq de Boisbaudran, who has greatly distinguished himself by his researches in this branch of science, found, as he was examining a mineral known under the name of samarkite, an emission of unfamiliar rays. He has inferred thence the existence in this mineral of a new metal, which he has accordingly named samarium, and all he has now to do is to isolate it from the other elements with which it is as yet combined. This has already been done for another new metal, norwegium, patriotically so named after his fatherland by its discoverer, Professor Teller-Dahll, of the University of Norway, who detected it in a metallic compound of arsenic and nickel. The professor has even determined the principal properties of this new metal, which he describes as being white, slightly malleable, of about the hardness of copper, and fusible at a dull red heat. Its density is represented by 9·44, and its chemical equivalent is 145.

Heating Metals in Vacuo by the Electric Current.

A very interesting paper, by Mr. T. A. Edison, was read before the American Association at Saratoga the other day:

"In the course of my experiments on electric lighting," says the author, "I have developed some striking phenomena arising from the heating of metals by flames and by the electric current, especially wires of platinum and platinum alloyed with iridium. These experiments are still in progress.

"The first fact observed was that platinum lost weight when heated in a flame of hydrogen, that the metal colored the flame green, and that these two results continued until the whole of the platinum in contact with the flame had disappeared.

"A platinum wire, twenty-thousandths of an inch in diameter, was wound in the form of a spiral one eighth of an inch in diameter and half an inch in length. The two ends of the spiral were secured to clamping posts, and the whole apparatus was covered with a glass shade. Upon bringing the spiral to incandescence for twenty minutes that part of the globe in line with the sides of the spiral became slightly darkened; in five hours the de-

posit became so thick that the incandescent spiral could not be seen through the deposit. This film, which was most perfect, consisted of platinum, and I have no doubt but that large plates of glass might be coated economically by placing them on each side of a large sheet of platinum, kept incandescent by the electric current. This loss in weight, together with the deposit upon the glass, presented a very serious obstacle to the use of metallic wires for giving light by incandescence, but this was easily surmounted after the cause was ascertained. I coated the wire forming the spiral with the oxide of magnesium by dusting upon it finely powdered acetate of magnesium. While incandescent the salt was decomposed by the heat, and there remained a strongly adherent coating of the oxide. This spiral so coated was covered with a glass shade and brought to incandescence for several minutes; but instead of a deposit of platinum upon the glass there was a deposit of the oxide of magnesia. From this and other experiments I became convinced that this effect was due to the washing action of the air upon the spiral; that the loss of weight in and the coloration of the hydrogen flame was also due to the wearing away of the surface of the platina, by the attrition produced by the impact of the stream of gases upon the highly incandescent surface, and not to volatilization, as commonly understood.

"I will now describe other and far more important phenomena observed in my experiments.

"If a short length of platinum wire, one thousandth of an inch in diameter, be held in the flame of a Bunsen burner, at some part it will fuse and a piece of the wire will be bent at an angle by the action of the globule of melted platinum; in some cases there are several globules formed simultaneously, and the wire assumes a zigzag shape.

"With a wire four thousandths of an inch in diameter this effect does not take place, as the temperature cannot be raised to equal that of the smaller wire owing to the increased radiating surface and mass. After heating, if the wire be examined under a microscope, that part of the surface which has been incandescent will be found covered with innumerable cracks. If the wire be placed between clamping posts, and heated to incandescence for twenty minutes by the passage of an electric current the cracks will be so enlarged as to be seen with the naked eye, the wire under the microscope presents a shrunken appearance, and is full of deep cracks. If the current is continued for several hours these effects will so increase that the wire will fall to pieces.

"This disintegration has been noticed in platina long subjected to the action of a flame, by Prof. John W. Draper. The failure of the process of lighting invented by the French chemist, Tessié-du-Motay, who raised sheets of platinum to incandescence by introducing them into a hydrogen flame, was due to the rapid disintegration of the metal. I have ascertained the cause of this phenomenon, and have succeeded in eliminating that which produces it, and in doing so have produced a metal in a state hitherto unknown, and which is absolutely stable at a temperature where nearly all substances melt or are consumed; a metal which, although originally soft and pliable, becomes as homogeneous as glass and as rigid as steel. When wound in the form of a spiral it is as springy and elastic when at the most dazzling incandescence as when cold, and cannot be annealed by any process now commonly known.

"For the cause of this shrinking and cracking of the wire is due entirely to the expansion of the air in the mechanical and physical pores of the platinum, and the contraction upon the escape of the air. Platinum as sold in commerce may be compared to sandstone in which the whole is made of a great number of particles with many air spaces. The sandstone upon melting becomes homogeneous and no air spaces exist. With platinum or any metal the air spaces may be eliminated and the metal made homogeneous by a very simple process. This process I will now describe. I had made a large number of platinum spirals, all of the same size and from the same quality of wire; each spiral presented to the air a radiating surface of three and one sixteenths of an inch; five of these were brought by the electric current up to the melting point, the light was measured by a photometer, and the average light was equal to four standard candles for each spiral just at the melting point. One of the same kind of spirals was placed in the receiver of an air pump and the air exhausted to two millimeters; a weak current was then passed through the wire to warm it slightly for the purpose of assisting the passage of the air from the pores of the metal into the vacuum. The temperature of the wire was gradually augmented at intervals of ten minutes until it became red. The object of slowly increasing the temperature was to allow the air to pass out gradually and not explosively. Afterward the current was increased at intervals of fifteen minutes. Before each increase in the current the wire was allowed to cool, and the contraction and expansion at these high temperatures caused the wire to weld together at the points previously containing air. In one hour and forty minutes this spiral had reached such a temperature without melting that it was giving a light of twenty-five standard candles, whereas it would undoubtedly have melted before it gave a light of five candles had it not been put through the above process. Several more spirals were afterward tried, with the same result. One spiral which had been brought to these high temperatures more slowly gave a light equal to thirty standard candles. In the open air this spiral gave nearly the same light, although it required more current to keep it at the same temperature.

"Upon examination of these spirals, which had passed through the vacuum process, by the aid of a microscope, no cracks were visible; the wire had become as white as silver, and had a polish which could not be given it by any other means. The wire had a smaller diameter than before treatment, and it was exceedingly difficult to melt in the oxyhydrogen flame, as compared with untreated platinum; it was found that it was as hard as the steel wire used in pianos, and that it could not be annealed at any temperature.

"My experiments with many metals treated by this process have proved to my satisfaction, and I have no hesitation in stating, that what is known as annealing of metals to make them soft and pliable is nothing more than the cracking of the metal. In every case where a hard drawn wire had been annealed a powerful microscope revealed myriads of cracks in the metal.

"Since the experiments of which I have just spoken, I have, by the aid of Sprengel mercury pumps, produced higher exhaustions, and have, by consuming five hours in excluding the air from the wire and intermitting the current a great number of times, succeeded in obtaining a light of eight standard candles from a spiral of wire with a total radiating surface of 1-32 of an inch, or a surface about equal to a grain of buckwheat.

"With spirals of this small size which have not passed through the process the average amount of light given out before melting is less than one standard candle. Thus I am enabled by the increased capacity of platinum to withstand high temperatures, to employ small radiating surfaces, and thus reduce the energy required for candle-light. I can now obtain eight separate jets, each giving out an absolutely steady light, and each equal to sixteen standard candles, or a total of one hundred and twenty-eight candles, by the expenditure of thirty thousand foot pounds of energy, or less than one horse power.

"As a matter of curiosity I have made spirals of other metals, and excluded the air from them in the manner stated. Common iron wire may be made to give a light greater than platinum not heated. The iron becomes as hard as steel and just as elastic. Nickel is far more refractory than iron. Steel wire used in pianos becomes decarbonized, but remains hard and assumes the color of silver. Aluminum melts only at a white heat."

Economy of the Electric Light.

Further experiments with the electric light on the Thames Embankment, London, indicate that the light may be produced at less cost than appeared possible at the time when only 20 lights were in circuit. It will be remembered, says the *Electrician*, that the engine employed is of 20 horse power nominal, manufactured by Messrs. Ransomes, Sims & Head, and that the Jablochkoff lights are used. Operations were commenced at the end of last year, the engine driving 20 lights, indicating about 23 horse power, and consuming 3·8 lb. of coal per indicated horse power per hour Six months afterward a second Gramme exciter and divider were added for lighting 40 lights, when the engine indicated about 38 horse power, and the consumption of fuel was about 3·2 lb.

Last month a lengthened experiment was made, in order to test whether the engine was capable of driving three exciters and three dividers for supplying light to 60 candles through a circuit of nearly a mile and a half, and it was found that with an indicated power of about 60 horses, and making 140 revolutions per minute, the engine was completely master of the work, and the 60 lights burned more steadily than when the smaller number were driven. As the consumption of fuel will not probably exceed 3 lb. per indicated horse power when working 60 lights, and the working charges will be about the same as when the experiments were made upon which Mr. Keates founded his report respecting the cost of 20 lights, it seems evident that the cost of electric lighting may be reduced by existing machinery and appliances to something not greatly in excess of that of gas.

The Fourth of July under the Midnight Sun.

A party of Americans celebrated the 102d anniversary of our national independence at North Cape, Norway, latitude 71° 15′, longitude 25° 50′. They arrived there at 11 o'clock on the night of July 3d, and at one minute after midnight guns were fired and the shrill sounds of the engine's whistle were made to respond to the number of stars on our flag, and loud cheers given to usher in our great national holiday. The party then ascended the almost perpendicular cliff (900 feet high) and raised the American flag, the flag being made for the occasion by the ladies of the party out of materials purchased at one of the Norwegian towns. When the flag was raised cheers and guns again resounded over the waters. It was certainly a most extraordinary place for such a celebration—probably the first time that a party of Americans ever celebrated the Fourth of July at such an hour and at such a latitude and longitude. The midnight sun shone upon them all the time with dazzling brightness. Far to the north they gazed out on the Atlantic Ocean dashing against the great cliff on which they stood. Behind them were the snow-clad mountains, along which they had been coasting, and not a living creature was near them but the sea birds that arose screaming from the water as the silence of their home was broken. The North Cape is beyond seventy-one degrees of north latitude and about 100 miles north of Hammerfest, the most northerly town in the world. It is five degrees further north than the most northern part of Iceland.

Invisible Spines of the Cactus.

I landed one day on one of the small outliers of St. Thomas, Little Saba Island, about a mile and a half distant from the main island.

A puffin (*Puffinus sp.*) was nesting in holes among the grass, laying a single large white egg. The birds allowed themselves to be caught in the nest with the hand. Our spaniels kept bringing them to us, retrieving them with great delight.

The island was covered with thorny cactuses. It was impossible to avoid their prickles, and I got covered with them when in pursuit of wild goats and pigeons. There were four kinds of cactuses: a prickly pear (*Opuntia*), with spines ¾ of an inch long; a quadrangular stemmed cactus, like the most familiar one in greenhouses; a cactus with rounded ribbed stem, growing in candelabrum-like form (*Cereus*); and a large dome-shaped cactus, a foot and a half high, and bearing a crown of small red flowers (*Melocactus*).

The spines must be a most efficient protection to the cactus from being devoured by large animals. I have often noticed that if one approaches one's hand slowly toward some of the forms with closely set long spines, doing it with especial care, to try and touch the end of one of the spines lightly without getting pricked, one's hand always does receive a sharp prick before such is expected, the distance having been miscalculated.

There seems to be a special arrangement in the color of the spines in some cases, possibly intended directly to bring about an illusion, and cause animals likely to injure the plant to get pricked severely before they expect it, and thus to learn to shun the plant.

While the greater length of the spines next the surface of the plant is white, the tips are dark colored or black. The black tips are almost invisible, as viewed at a good many angles against the general mass as a background. The spines look as if they ended where the white coloring ends, and the hand is advanced as if the prickles began there and is pricked suddenly by some unseen black tip. The experiment is easily tried in any cactus house at home.—*Notes by a Naturalist—Moseley.*

Fusible Metals.

Of mixtures of metals which become liquid at temperatures at or below the boiling point of water, there are several known, some of which are placed in convenient order as follows:

1. D'Arcet's: Bismuth, 8; lead, 5; tin, 3 parts. This melts below 212° Fah.

2. Walker's: Bismuth, 8; tin, 4; lead, 5 parts; antimony, 1 part. The metals should be repeatedly melted and poured into drops, until they can be well mixed previous to fusing them together.

3. Onion's: Lead, 3; tin, 2; bismuth, 5 parts. Melts at 197° Fah.

4. If, to the latter, after removing it from the fire, one part of warm quicksilver be added, it will remain liquid at 170° Fah., and become a firm solid only at 140° Fah.

5. Another: Bismuth, 2; lead, 5; tin, 3 parts. Melts in boiling water.

Nos. 1, 2, 3, and 5 are used to make toy spoons to surprise children by their melting in hot liquors. A little mercury (as in 4) may be added to lower their melting points.

Nos. 1 and 2 are specially adapted for making electrotype moulds. French cliché moulds are made with the alloy No. 2. These alloys are also used to form pencils for writing, also as metal baths in the laboratory, or for soft soldering joints.

Direct Determination of Silver in Galena on Volhard's Principle.

From two to five grammes of the galena, according to its supposed richness in silver, are very finely ground and intimately mixed in a porcelain mortar with from three to four times its weight of a flux composed of equal parts of soda and saltpeter, placed in a porcelain crucible, covered, and heated over a burner to thorough fusion, when the mixture is well stirred with a glass rod. It is then let cool and placed in an evaporating dish partly filled with water, in which the melted matter is softened, dissolved out of the crucible into the dish, which is then heated, and the watery solution is filtered into a flask. The residue on the filter, after being well washed, is rinsed back into the dish, very dilute nitric acid is added, and the whole evaporated to dryness. The dry residue is taken up in water acidulated with nitric acid, heated, and filtered into the same flask in which is the aqueous solution. The residue is washed with hot water, the filtrate is allowed to cool in the flask, ferric sulphate or iron alum is added, and the liquid is titrated.—*C. A. M. Balling, in Oest. Zeitschrift Berg. u. Hütten.*

The Royal Kew Gardens were recently devastated by a severe hail storm, which broke glass in the conservatory to the estimated number of 16,000 panes. The hailstones were found to average one and a half inches in diameter, and to weigh three quarters of an ounce. They came down with sufficient force to bury themselves in the bare earth of the flower borders, and even penetrate the turf to the depth of an inch. In some cases perfectly circular holes were cut out of the glass panes, while the hailstones went through the succulent leaves of the Echeverias planted out in the beds with as clean an outline as if it had been made with a punch.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Fuller & Stillman, Chemical Engineers and Assayers, 40 Broadway, New York

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

The Secret Key to Health.—The Science of Life, or Self-Preservation. 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr W. H. Parker, 4 Bulfinch St., Boston, Mass.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Cut Gears for Models, etc. (list free). Models, working machinery experimental work, tools, etc., to order. D Gilbert & Son, 212 Chester St., Philadelphia, Pa.

Magnets, Insulated Wire, etc. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks, prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company No. 13 Barclay St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 142.

Band Saws a specialty. F. H. Clement, Rochester, N.Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Eagle Anvils, 9 cents per pound. Fully warranted.

Vertical Engines. F.C.& A.E. Rowland, New Haven, Ct.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

New 8½ foot Boring and Turning Mill for sale cheap. A first class tool. Hilles & Jones, Wilmington, Del.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 78.

Cooper Manufacturing Company, Mt. Vernon, Ohio, Manuf's of Stationary, Portable, and Traction Engines, Saw Mills, Grist Mills, Mill Machinery, etc. Engineers and Contractors. Circular free.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Drop Hammers, Die Sinking Machines, Punching and Shearing Presses. Pratt & Whitney Co., Hartford, Ct.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings, all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., and 93 Liberty St., N. Y. city, U.S.A.

Steam and Gas Fitters' Tools a specialty. Send for circulars. D. Saunders' Sons, Yonkers, N. Y.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

The Asbestos Roofing is the only reliable substitute for tin; it costs only about one-half as much, is fully as durable, is fire-proof, and can be easily applied by any one. H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, are the sole manufacturers.

Book free to Inventors. Address C. A. Shaw, Boston.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Wanted.—A place is desired by a man of experience and with good references, in charge of experimental machinery. Parties having machines to develop or under way, are invited to correspond or talk with William A. Lorenz, 363 Macon St., Brooklyn, N. Y.

NEW BOOKS AND PUBLICATIONS.

THE NEW YORK HERALD WEATHER SERVICE. 1877-78-79. 8vo, paper, pp. 34.

This pamphlet sketches the development of the *Herald* Weather Bureau, and gives a list of the storm warnings cabled by it to Europe and the manner of their fulfillment, with other cognate information.

GEOLOGICAL SURVEY OF KENTUCKY. N. S. Shaler, Director.

The late publications of this survey embrace the following: Iron: the impurities which commonly occur with it, and their effects. By Wm. B. Caldwell, Jr. Report on the Limonite Ores of Trigg, Lyon, and Caldwell Counties. By Wm. B. Caldwell, Jr. Notes on the Yellow Fever Epidemic, at Hickman, Ky., during the summer and autumn of 1878. By John R. Proctor.

ANALYSES OF THE SUGAR QUESTION. By Henry A. Brown. Saxonville, Massachusetts. Paper, pp. 42.

Mr. Brown, formerly Special Treasury Agent of the United States, discusses the very complex sugar question as an expert, and reaches the conclusion that the present sugar tariff ought to be modified. By making the following "moderate changes" he believes that the consumption of sugar would be enormously increased, while the revenue from sugar food would still be ample, without injuriously affecting any public or national interest: First, the classification of melado as not above No. 7 Dutch standard sugar. Second, abolish the additional 25 per cent ad valorem on all sugar. Third, strike out the words "after being refined" in the section relating to colored sugars. Fourth, all sugars under No. 10 D. S. in color, containing 92 per cent or more of crystallizable sugar, to pay the same duty as sugars above No. 10 and not above No. 13 D. S. in color.

PROCEEDINGS OF THE ENGINEERS' CLUB OF PHILADELPHIA. Edited by Charles E. Billin. Vol. I., Nos. 1 and 2.

No. 1 of this new journal embodies the principal papers and more important topics of discussion brought before the club during its first year. No. 2 covers the proceedings of the fore part of the current year. The club starts off with vigor, and the character of the papers presented justifies the hope, if not the prediction, that it will live long and prosper. The proceedings are published at the rooms of the club, No. 10 North Merrick street, Philadelphia.

LIFE AND WORK OF JOSEPH HENRY. By Frank L. Pope. New York: D. Van Nostrand. 12mo, paper, pp. 31.

This puts in an attractive and keepable form Mr. Pope's sketch of the life and discoveries of Professor Henry (having special reference to the development of the electric telegraph), first printed in the Journal of the American Electrical Society.

DARWINISM AND OTHER ESSAYS. By John Fiske. London and New York: Macmillan & Co. 12mo. Price $2.

The dozen detached essays here brought together are well worth preserving. Mr. Fiske is always outspoken, bright, and suggestive; and he has a happy faculty of seizing upon and setting plainly forth the vital points of a critical discussion. Several of the essays have a historical rather than an immediate interest to those who have kept up with the drift of recent thought; still as a part of the literature of evolution they are worth keeping. The book is well made and has a good index.

HINTS TOWARD A NATIONAL CULTURE FOR YOUNG AMERICANS. By S. S. Boyce. New York: E. Steiger. Price 25 cents.

We should be glad to see this little work (little in size but great in spirit and promise) in the hands of every American parent, teacher, and pupil. It is too much to hope that the traditions of the schools can be displaced by the spirit of true, practical, scientific, and industrial culture, without the waste and misdirection of a large portion of the childhood of many generations. But we believe that the good time is coming, though remote, and the general circulation of Mr. Boyce's Hints would do much to hasten it. The hints to young men on self culture and on growth by culture, are especially sensible and valuable.

TEACHER'S HAND BOOK TO ACCOMPANY AVERY'S ELEMENTS OF NATURAL PHILOSOPHY. New York: Sheldon & Company. 1879.

This little book is chiefly remarkable for the proper emphasis it lays upon the truth that no science teacher can hope to do justice to his work without keeping a constant watch upon the current literature of science. The progress of discovery is so rapid that the most carefully prepared treatise is liable to become deficient in essential particulars before it is published. It may be "up to date" when it goes to press, and antiquated when it leaves the bindery; and the teacher who trusts entirely to his text books is not only sure to be behind the time in the matters of technical information, but is also necessarily lacking in general knowledge, in practical intelligence, and in that affluence of every day facts and suggestions which the true teacher must possess.

ÆSOP'S FABLES. Printed in pronouncing orthography. Published by C. W. Knudsen. South Norwalk, Conn.

Forty fables from the versions of the Rev. Thomas James and Mary Godolphin, printed phonetically to show the application of the English Demotic Alphabet, and to call attention to the spelling reform movement. Though of the opinion that none of the alphabets yet suggested will be the accepted one when English print becomes phonetic, as it is sure to be sooner or later, we believe that efforts like Mr. Knudsen's should be encouraged. They tend to familiarize the rising generation with phonetic print, and thus indirectly break down the absurd prejudice that prevails in favor of our current misspelling, simply because it is familiar.

SEARCY'S LESSONS IN PHONOGRAPHY. By W. E. H. Searcy. Philadelphia: J. B. Lippincott & Co.

The author, a practical law reporter, offers his book as a contribution to the common cause of phonography. He has drawn his material from all available phonographic sources, and claims to have stripped the subject of all unnecessary mockery and useless verbiage, retaining only such principles and introducing such "improvements" as seem to him needful for the work of verbatim reporting. How far he has succeeded in his aim it is impossible to say without mastering a multitude of books and other stenographic devices, which seem to one practically familiar only with Pitman's system, as fearfully numerous.

SCIENCE LECTURES AT SOUTH KENSINGTON. Vol. II. London: Macmillan & Co. Price $1.75.

These South Kensington lectures set forth in fairly non-technical style the latest results in several departments of science, as understood by English scientists of high rank. The subjects treated are: Polarized Light, by W. Spottiswoode; Thermal Conductivity, Thermodynamics, and the Velocity of Light, by Professor Forbes; Balances, by H. W. Chisholm; Geometrical and Engineering Drawing, and Light House Illumination, by Professor T. F. Pigot; The Laws of Fluid Resistance, by W. Froude; The Bathometer, by Dr. Siemens; Instruments for Experiments on Sound and Temperament, evidently by Dr. W. H. Stone, though no name is given; Sensitive Flames as Illustrative of Sympathetic Vibration, by Professor Barrett; Apparatus for Physiological Investigation and for Physiological Chemistry, by Drs. Burden Sanderson and Lauder Brunton; On Endiometers, by Professor McLeod; and Technical Chemistry, by Professor Roscoe.

ELEMENTARY LESSONS ON SOUND. By Dr. W. H. Stone. London: Macmillan & Co. cloth, pp. 191. Price 80 cents.

As an elementary text book this work of Dr. Stone's presents several admirable features. It is well digested, compact, and better illustrated than works of the size are apt to be. The frequent summaries of facts and principles are tersely expressed and serviceable. And the book is well indexed. As a whole the work is peculiar in the fullness of the information given in the neglected field lying between acoustics and music—neglected, that is, in ordinary text books. The marked deficiency of the book is in respect to the more recent developments and applications of sound in connection with the phonograph, the telephone, the microphone, and the like. Though imprinted 1879, there is little to indicate that it was not written more than a twelve-month earlier.

COMMERCIAL ORGANIC ANALYSIS. By Alfred H. Allen, F. C. S. Vol. I. Cyanogen Compounds, Alcohols and their Derivatives, Phenols, Acids, etc. London: J. & A. Churchill.

The first volume of a practical work which has no rival in English. Its scope is aptly described in the subtitle: A treatise on the properties, proximate analytical examination, and modes of assaying the various organic chemicals and preparations employed in the arts, manufactures, medicine, etc., with concise methods for the detection and determination of their impurities, adulterations, and products of decomposition. Mr. Allen appears to be competent to the task he has undertaken, and claims to have tested in his own professional experience the correctness of the methods given. The book is well made and printed in good type.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) P. M. asks: 1. Is zinc a mineral or compound metal, and where found? A. Zinc is a metal, seldom found pure. The existence of native zinc seems still to need confirmation. The chief ores are the silicate and oxide. The largest mines of this metal in the United States are in Sussex county, New Jersey. 2. Is tin a mineral or compound metal, and where found? A. Tin is a metal; reported as occurring with the Liberian gold; also in the Rio Tipuani valley, in Bolivia, but probably only an artificial product. (D. Forbes, *Phil. Mag.*, iv., xxix. 133, xxx. 142.) The principal ore of this metal is cassiterite or tinstone, found largely in Cornwall, England—not in this country. 3 What are brass and pewter composed of? A. Brass is an alloy of copper and zinc. Pewter is an alloy of tin and lead, common, 82 tin to 18 lead; fine, 5 tin to 1 of lead.

(2) H. L. V. N. writes: In connection with the "new optical delusion" in the SCIENTIFIC AMERICAN, for August 9, and explanations of same in August 30, I would call attention to one of a similar character, and very, almost unpleasantly, common occurrence. If a person looks intently at a swiftly moving body, such as a train of cars, near by, and then looks at a stationary body, as the ground, the whole surface of the stationary body will appear to move around several axes with a peculiar compound sinuous motion.

(3) E. H. asks if anything has been discovered which will remove freckles, either instantaneously or by repeated applications? A. A solution of corrosive sublimate, either pure or mixed with cyanide of mercury, is commonly employed for the removal of freckles; but a collodion, containing ten per cent of its weight of sulpho-carbolate of zinc, has given excellent results without being accompanied by any of the dangers attending the use of the mercurial solution. The following formula is an excellent one: Sulpho-carbolate of zinc, 1 part; collodion, 45 parts; oil of lemon, 1 part; absolute alcohol, 5 parts. Consult your physician in regard to application.

(4) G. P. A. asks: 1. Will ordinary clay, such as is used for flower pots, answer for the porous cells of a galvanic battery? A. If well burned, yes. 2. How may commercial zinc be purified for use in a battery? A. Pure zinc is prepared by distilling a mixture of zinc oxide and charcoal. The oxide must be purified by solution in an acid, and precipitation therefrom by a dilute alkali. See Wagner's Chemical Technology. New Jersey zinc is pure enough for ordinary battery purposes.

(5) J. R. H. asks: 1. Do gum belts require any dressing? A. No. 2. What kind of couplings are the safest and most durable for main shafts where belts run in all directions from it? A. Flange couplings and bolts. 3. Can dust from emery belts used for polishing wood be removed from each belt and the room as it is made: if so, by what means? A. Yes, by the use of an exhaust fan. 4. Is there any known composition or paint which, if applied to tin valleys and roofs, will prevent leaking? A. Some of the so-called India rubber paints may answer.

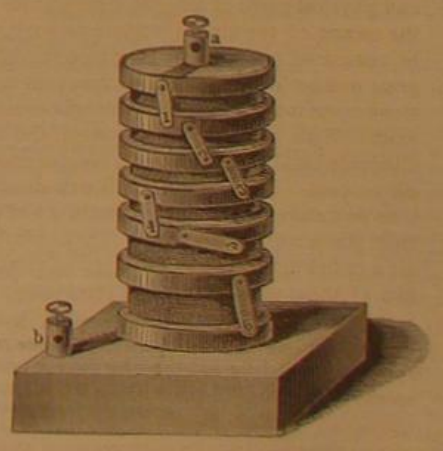
(6) C. C. asks (1) how to find the horse power of an engine. A. See p. 267 (4), Vol. 40, of the SCIENTIFIC AMERICAN. 2. What is the difference between a high and low pressure boiler; please explain and oblige? A. There are certain forms of boilers which are designated in the trade as low pressure or high pressure, but any form of boiler can be used as a low or a high pressure boiler, if it have strength proportionate to the pressure of steam to be carried.

(7) C. G. & Co. ask: Will a band saw run on wooden pulleys for sawing oak plank 2 inches thick or for sawing wagon fellies? A. The pulleys would answer for a time, but the wood would shrink and swell under the influence of the weather, and give constant trouble.

(8) H. M. D. writes: To ascertain the amount of power it takes to drive a certain number of machines, can it not be done by putting them all at work at their full capacity and then throw off the main belt, leaving them all ready to start to work as soon as there is power enough applied, then take a cord or belt, and make one end fast to one arm of the main pulley and throw the other over on the outside and wind around, then hang on weights enough, on the lower end of the cord to start the machinery at its usual speed, then weigh the weights? It seems to me that the above method is a correct one to ascertain the correct amount of power used. A. If you can accomplish it as you propose, it will give you the amount of power; but we think you will find it a difficult thing to do.

(9) B. B. M. asks (1) for a receipt for making mustard for table use. A. 1. Salt, 1½ lb.; scraped horse radish, 1 lb.; garlic, 2 oz.; cloves, 2 oz.; hot vinegar, 2 gallons; macerate in a covered vessel 24 hours, strain and add flour of mustard, *q. s.* 2. Mustard, 3 lb.; salt, 1 lb.; vinegar, grape juice, or white wine, to mix. 2. What is the rule for getting the weight of hay in bulk as in a mow? A. A solid cube of dry hay, 10 feet square, weighs about one ton.

(10) A. R. M. asks how to make a cheap rheostat. A. Eisenlohr's column of resistance, shown in the accompanying cut, is inexpensive and very convenient. It consists of a cylinder of mahogany or other compact wood, having about nine grooves cut in it. The cylinder is saturated with paraffine or varnished with shellac, and the spaces between the grooves are bound with brass bands. A little brass bar, turning on a screw, is made to extend from one ring to the other, as shown; these bars must be slightly bent so as to press



with some force upon the bands. Covered wire of a known resistance is wound in these grooves, the shortest length containing the given unit once or an even number of times. The length of the coils of wire in the successive grooves increases from 1 to 9; the ends of each wire are soldered to the two nearest bands, the upper band being connected with the screw, *a*, and the lowest with *b*. When this column is inserted in a circuit, the current passes from one ring to another through the bars, whose resistance is inconsiderable, but when one of the bars is turned aside, as shown in the engraving, the current passes through the intervening coil.

(11) W. W. M. asks: Where can manganese in the metallic state be obtained; can it be melted in a plumbago crucible, either by itself or in molten copper? A. Metallic manganese is not a commercial article, but small quantities of it may be purchased from dealers in rare chemicals, etc., at $1 per gramme. In appearance it somewhat resembles iron, but is usually much harder, and requires a very strong white heat to effect its fusion. In small quantities the metal will alloy with copper at a high temperature, if protected from the air by powdered carbon. 2. I obtained some

of the ore in a comminuted state, and was told that it could not be melted. I put some of it, with some borax for a flux, in an anthracite coal furnace, and obtained something like the inclosed sample. Is it of any value? A. The sample probably consists of the double borate of manganese and sodium, used in Germany as a substitute for litharge in the manufacture of paint driers, japans, etc. It would hardly command a remunerative return here.

(12) W. C. B. asks: How much more (if any) than its own weight, can a railroad engine start on a perfectly level track, assuming that there is no slack between the engine and cars? A. It depends upon the style and proportions of the locomotive, number of drivers and diameter, proportion of weight on drivers, and steam carried, also the style of the cars in the train.

(13) J. W. M. asks: How many feet should the piston head of a steam engine travel per minute? A. There is no fixed rule for the speed; it depends upon the length of stroke and the work that is to be driven, in other words, the speed of the piston is adapted to the work to which the engine is applied.

(14) C. E. B. writes: I am running an engine in a saw mill, driving wheel 20 feet, drum on saw shaft 2 feet, engine makes about 35 revolutions per minute. Can I increase the capacity for work by double gearing: if so, I would like to reduce the driving wheel to 16 feet? A. No, it would be better, if you wish to reduce the pulley to 16 feet, to increase the speed of the engine proportionately.

(15) L. M. D. asks: 1. What is the best way to yack the screw shaft of a toy propeller? A. Pack with cotton wicking. 2. What should be the dimensions of cylinder for running the boat, which is two and a half feet long? A. From 1 inch to 1¼ inch diameter, and 2 inch to 2¼ inch stroke. 3. What is the best shape of boiler? A. A vertical tubular.

(16) J. C. M. asks: 1. In a flour bolt is it usual to put on two widths of bolting cloth; what would be the objection to putting on three? A. Two, three, or four are used; it is common to put on three; it depends upon the number of grades you wish to turn out. 2. I have built my dam V shaped, sharp part down stream; would that shape cause the water to rise less on the abutments? A. In strong currents there will be less rise on the shore abutments. 3. At what speed should an overshot water-wheel run? A. 4 to 8 feet per second. 4. Can a horse pull as much 500 feet from his load (on a level with his shoulders) as if within 5 feet? A. Yes, all other things being equal; but if there is 500 feet of rope dragging on the ground, its friction is a part of the load.

(17) W. N. R. writes: In a late number, p. 267, SCIENTIFIC AMERICAN, you gave a simple method of finding pressure in steam boiler with weight at a certain point on lever. Now, will you please give as simple a method of finding the point at which to place the weight so that steam will blow off at any required pressure? A. 1st, Multiply the pressure per square inch by the area of the valve; the product is the total weight required upon the valve. 2d, Divide this total pressure by the weight to be hung on the valve lever; the quotient is the number of "leverages" which you must give the weight from the fulcrum. Suppose 100 lb. steam and 12 inches area of valve: then total pressure on the valve is 1,200 lb.; and if the weight be 80 lb., then 1200÷80=15 "leverages." Now, if the distance from fulcrum to center of valve be 3 inches, then the weight must be set at 3x15=45 inches from fulcrum, or 42 inches from center of valve. Of course this does not take into account the effect of the lever or weight of the valve.

(18) E. F. W. asks: Can you inform me of a place where engineering ability is appreciated and paid for, and where men are obliged to be engineers who have charge of engines? A. We know of no such paradise. The ability of a competent engineer is not appreciated. So long as men will employ any one at low wages who can stop and start an engine, so long real engineers will not be put in their proper place.

(19) J. S. A. asks: 1. How fast an engine, with cylinder 3¼ inch diameter and 3 inch stroke, and 80 or 100 lb. of steam, and connected with paddle shaft by gears (bevel), would propel a flat-bottomed skiff 15 feet 6 inches long and 30·5 inches wide, and drawing 5 or 6 inches of water? A. If geared 3 or 4 to one, would probably drive the boat about 5 miles per hour. 2. What would be the dimensions of the boiler to supply 100 lb. steam, and how thick should the iron or steel plates be of which it is constructed to safely withstand the pressure and at the same time be as light as possible? A. The size of your boiler and thickness of iron depend upon the speed you run the engine and the design of the boiler.

(20) M. B. writes: We have placed a hydraulic ram to force water to the barn, a distance of 1,300 feet, and 40 feet rise and 2 feet fall for a 2 inch feed pipe 40 feet long. We had at first a No. 4 ram, which furnished but a ¾ inch stream, and have now placed a No. 5 ram, which will not strengthen the stream. We were advised to place a ¾ inch discharge pipe, which we did. I would like to know if it would not throw a stronger stream with ½ inch pipe, and work more freely. A. According to the tables the ram should have 1 inch pipe instead of ½ inch. Apply to the maker of the ram for advice. 2. How much water is contained in the air chamber? A. The quantity of water in the air chamber will depend upon the pressure under which the water is delivered.

(21) J. N. T. asks: What is a suitable size of engine for a boat 35 to 40 feet long and 8 feet beam? A. A high pressure engine of 8 inch cylinder and 9 or 10 inches stroke will give your boat good speed.

(22) B. T. L. asks: 1. Supposing a horse attached to an empty wagon runs rapidly around a sharp curve, which wheels of the wagon bear hardest on the ground? Or, in other words, if the velocity be sufficient to raise any of the wheels from the ground, from natural causes which will be raised, the inner or the outer wheels? A. Inside wheels. 2. If a man be in a wagon rapidly turning a curve, will he, to preserve his balance, instinctively lean toward the outer or inner edge of the curve? A. Toward the inner side of curve. 3. Why, on railroad curves, is the outer rail raised several inches above the inner? A. To counteract the effect of centrifugal force in running the curve.

(23) C. R. J. asks: Will black lead do for a substitute for gas coke in batteries? A. Yes, Professor Silliman, Jr., used it in the Grove form of battery as a substitute for platinum, in 1842. Gas carbon is found to answer a better purpose.

(24) L. H. H. asks: 1. Does a low pressure engine gain power by condensing its steam? A. Yes, the gain is considerable. 2. Are high pressure engines made with walking beams? A. Yes, in great numbers.

(25) "Tropic" asks if there are furnaces made to burn petroleum oils (that could be used instead of coal or wood in hot climates) sufficient to heat a large-sized fruit evaporator continuously, and where such can be got. A. There are several petroleum furnaces now in the market, one of which would doubtless answer your purpose. See "Business and Personal" column. 2. Can you inform me if any material can be had that would absorb the moisture from the saturated air in a large sized drier so that the heat may be confined and yet the water or vapor disposed of? A. We know of nothing likely to be if any practical service in this connection. 3. Do you know of any of the refiners of petroleum oils do or will prepare the "petroleum jelly" made with digested soap wort and refined kerosene oil? A. "Petroleum jelly," or vaseline, is manufactured on a large scale. It is a proprietary article.

(26) T. F. writes: We have a natural supply of water at an elevation of about 100 feet and 1,500 feet distant from the center of our village, and we propose bringing the water down in pipes for the purpose of extinguishing fires. The main pipe will enter the main street at right angles, and a branch run not to exceed half a mile, and, as it is not probable that we can have hydrants near enough together, or have hose enough to bring more than two streams of water to bear upon one building, now what size should main pipe and branches be, or rather, what is the smallest size that can be used and make it effectual, and of what size should the hose and the discharge nozzles be? A. The larger the pipes the less the loss of head by friction. We think the main pipe should not be less than 6 inches, and the branch pipes, 4 inches diameter.

(27) A. W. S. asks what is put upon microscopes to keep them from tarnishing. I have just made one and wish to know what lacquer to put on it. A. A thin coating of fine alcoholic shellac varnish applied to the work, which has been previously warmed, will preserve the color of the brass. The color of the lacquer may be heightened by adding turmeric or dragon's blood, or both. 2. How can I resilver or recoat the back of a concave mirror or reflector for microscope? A. See article on silvering glass in SUPPLEMENT, No. 105. 3. I am a brass finisher by trade, and would like very much to know how yellow brass may be made to keep its color without appearing varnished. A. A thin varnish of white shellac or a coating of collodion will do this. It will retain its color for a long time without a protective coating of any kind, if the finish is sufficiently fine. A light film of gold is the best possible coating for fine brass work.

(28) D. J. T. O. asks for a good receipt for making wine for home use out of our common grapes. A. Put 20 lb. of ripe, fresh picked, and well selected grapes into a stone jar, and pour on them 6 quarts of boiling water. When the water has cooled enough, squeeze the grapes well with the hand; cover the jar with a cloth, and let it stand for three days; then press out the juice, and add ten pounds of crushed sugar. After it has stood for a week, scum, strain, and bottle it, corking loosely. When the fermentation is complete, strain it again and bottle it, corking tightly. Lay the bottles on their side in a cool place.

(29) J. S. writes: 1. I propose making an electric motor, and would like to use in its construction the Camacho electro magnet, as illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 182, page 2,900. Is the yoke made of iron or wood? A. Iron. 2. If of iron, would pieces of ordinary gas pipe, soldered to the yoke, do for the tubes? A. Gas pipe will do, but it must not be soldered. The iron of the yoke must make a good contact with the iron of the tubes. 3. Would ¾ inch (outside diameter) gas pipe be too large for first, or inside tube? A. It would be better to use a smaller size, say ½ inch. 4. Must the inside of each outer tube press tightly against the insulated wire of each inner tube? A. It need not necessarily press tightly, but the space between the two should be small. 5. The battery will be close to the magnets: will No. 16 cotton covered wire be suitable? A. Yes. 6. I propose making the cores five inches long, and use three or four thick tubes: how thick should the yoke be? A. ½ inch. 7. If four tubes are used in each core, about what attractive force would such a magnet exert, at a distance of ¼ of an inch, with a battery of 12 elements (large size), such as is illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 149, page 2363? A. It would be difficult to estimate the attractive force of such a magnet without knowing more of its construction and the circumstances under which it is used.

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

G. A. B.—No. 1. Limonite, a very fine iron ore. No. 2. Clay, aluminum silicate, containing much silica. If properly washed, of some value for the production of cheap pottery ware. No. 11. Hematite, an iron ore of good quality. No. 12. Chiefly iron pyrites, sulphide of iron. No. 10. Partially altered calcium carbonate, calc spar, containing traces of strontium carbonate and manganese oxide. No. 8. Ferruginous limestone. The other specimens are limestones. No. 6 will probably yield the best lime.—J. M. G.—It is a syenitic gneiss rock of little value.

COMMUNICATIONS RECEIVED.

On Boiler Explosions. By R. H. B.
Plan for the Darien Canal. By C. A.
On Fire Alarms and Fire Escapes. By W. A.
A Positive Discovery. By T. B. M.
On the Holloway Process. By L. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

August 19, 1879,

AND EACH BEARING THAT DATE.

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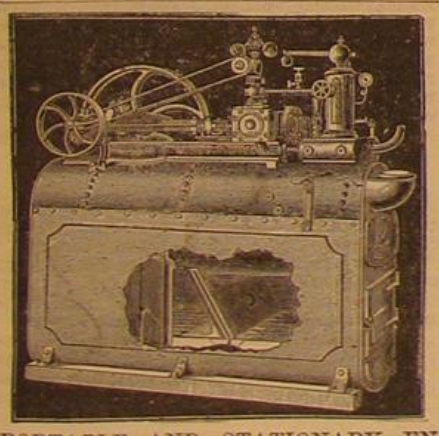

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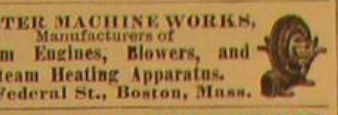

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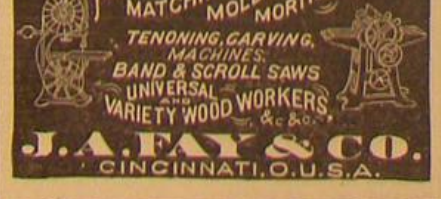

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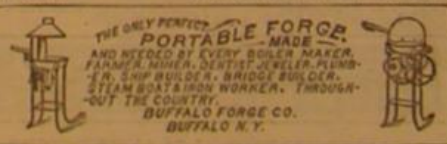

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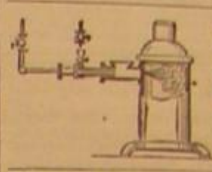

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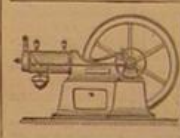

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