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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.

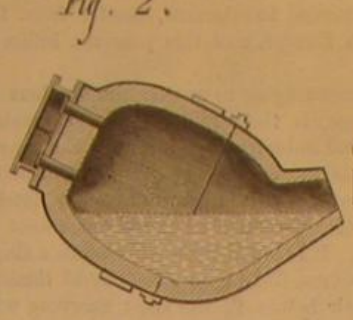
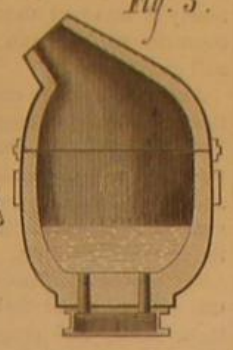


Fig. 3.

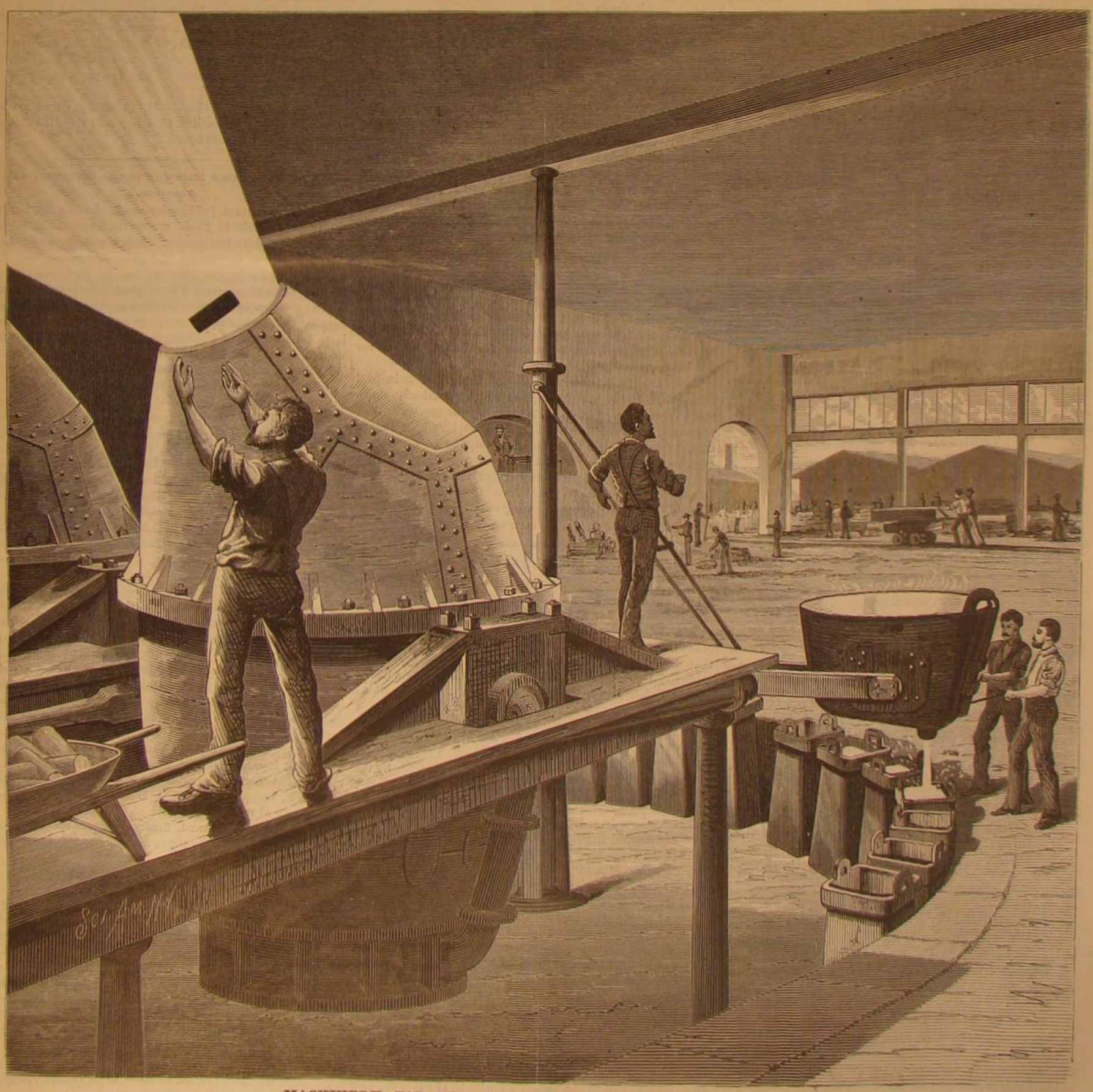


The construction of the converter is shown in the sectional views, Figs. 2 and 3. At one end it has a nose 18 inches in diameter, and at the other a tuyere box, communicating with the blowing engine through one of the trunnions.

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.

Scientific American.

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VOL. XLI., No. 9. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, AUGUST 30, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 191,

For the Week ending August 30, 1879.

Price 10 cents. For sale by all newsdealers.

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.

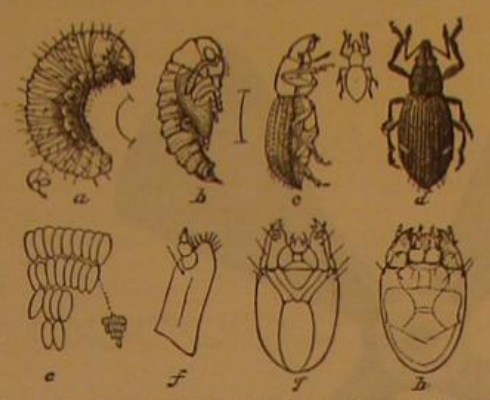
The only remedy that has been employed hitherto is to persistently catch and destroy the perfect insects, and the experience of Mr. John May, who has for five years been fighting it in this way at Madison, N. J., is to the effect that no substance will destroy the insect in its larva state without at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

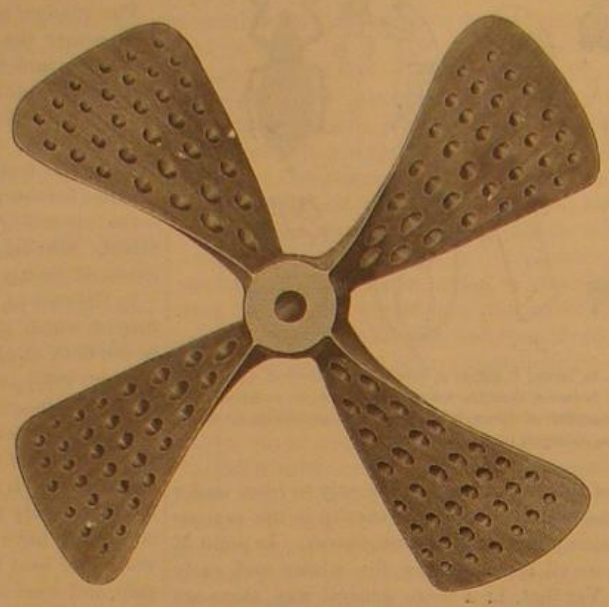
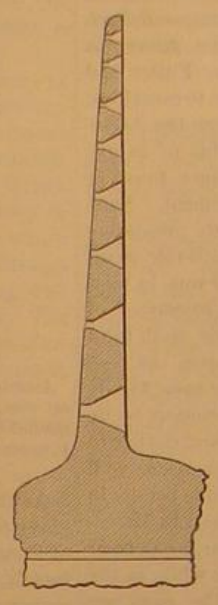


Fig. 2.



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.

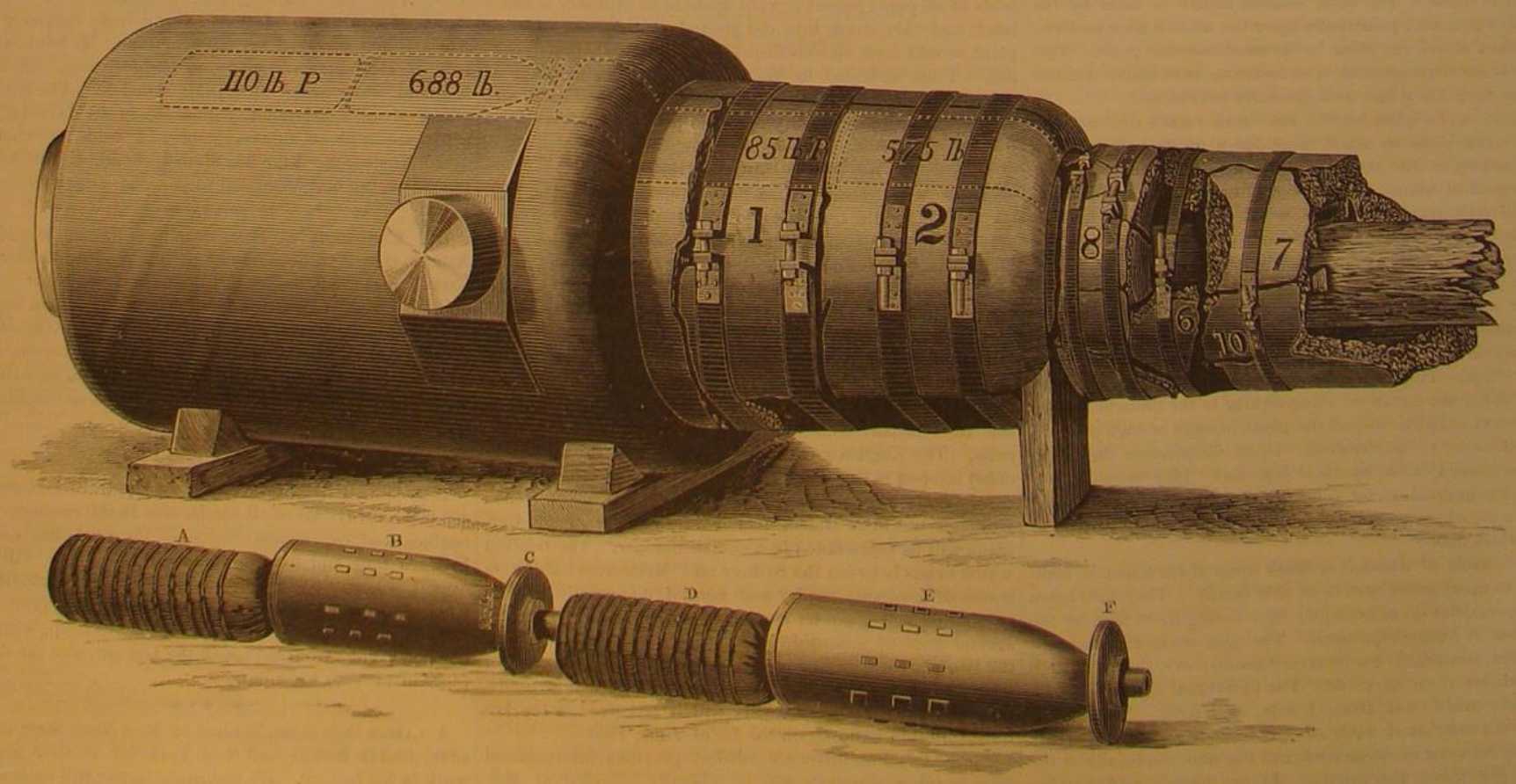
M. Delbœuf has found that if a person afflicted with Daltonism looks through a layer of fuchsine in solution his infirmity disappears. A practical application of this discovery has been made by M. Javal, by interposing between two glasses a thin layer of gelatine, previously tinted with fuchsine. By 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 c* and *d f*. These lines possess another important property: if we trace lines parallel to *e c* they will cut the oblique ones at a great number of points proportional to their distance from the line, *e c*. If, for example, the side, *e c*, is equivalent to 60 revolutions of the cylinder, and the

Fig. 1

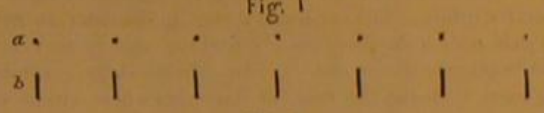


Fig. 2

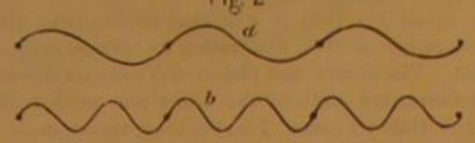


Fig 3

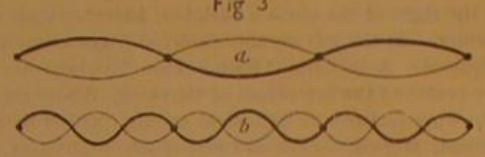
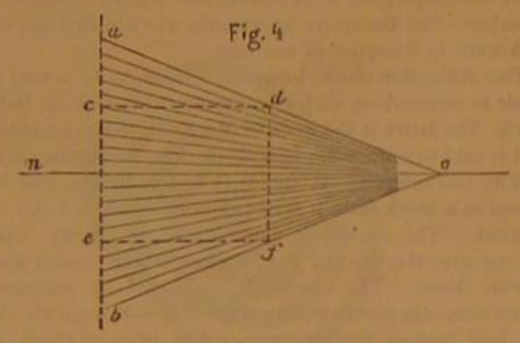


Fig. 4



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.*

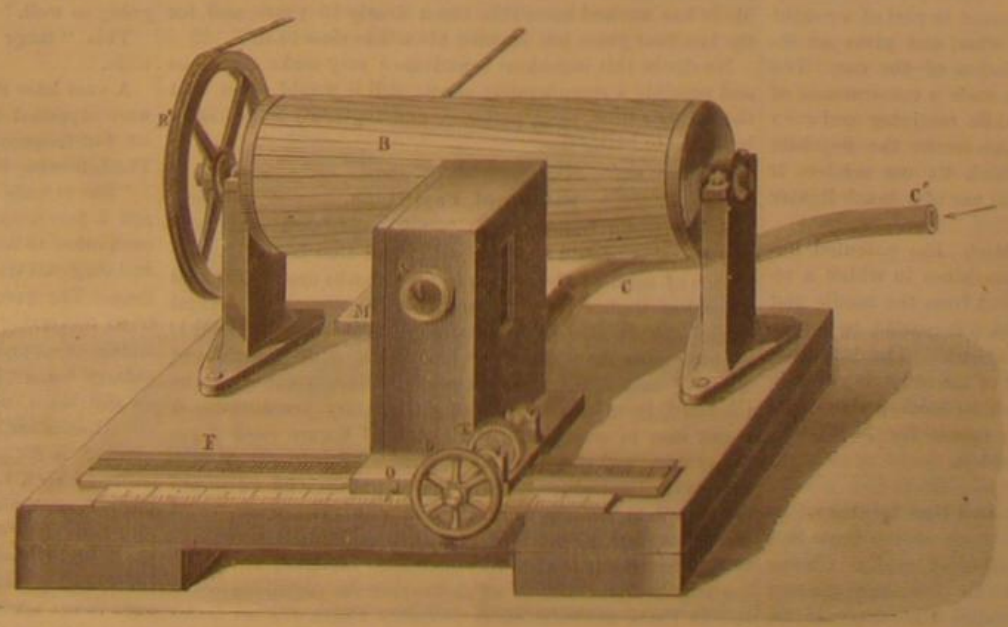


Fig. 5.—THE CYCLOSCOPE.

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

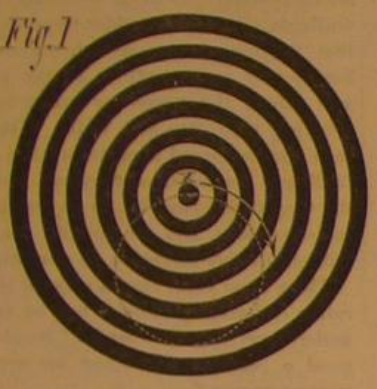
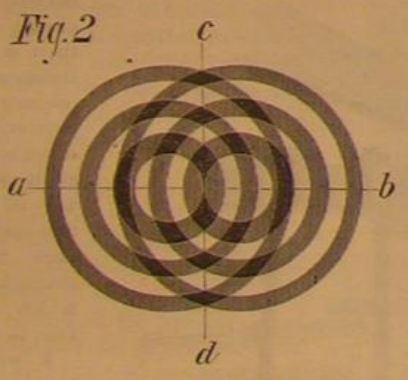


figure is to be moved in the same way that one moves a pail in rinsing it out. The rings will then appear to be rotating about their center in the same direction that one is moving the figure. The center of the circle in Fig. 1 is moved on the line of the dotted circle in the direction shown by the arrow. 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.

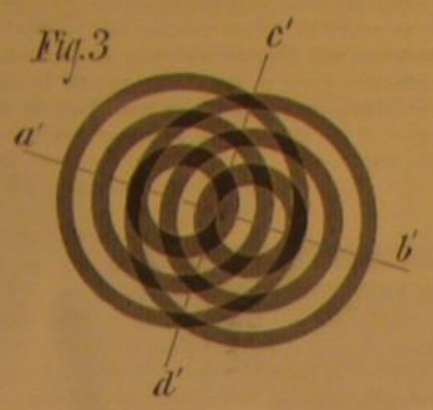
Fig. 2



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.

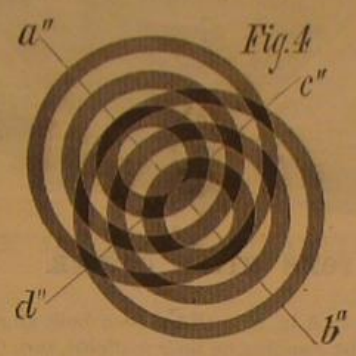
For the cogwheel puzzle, make the same suppositions as for the ring puzzle. An impression of the wheel, Fig. 5, is made on the retina; the wheel is moved an arc of $\frac{1}{16}$ of the dotted circle, when a second impression is made; the first impression still remains, and the eye sees an object like 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

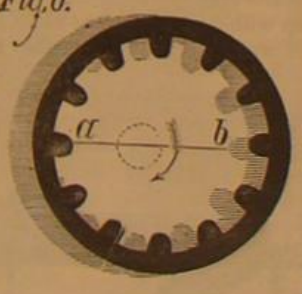


a part of the retina that is occupied by the, as yet unerased, first impression. These cogs, therefore, although on the actual wheel, are vaguely seen; the only cogs seen distinctly, therefore, are those at the left hand side of right hand wheel, at a. While the cogs, a, are clearly seen, the center 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.

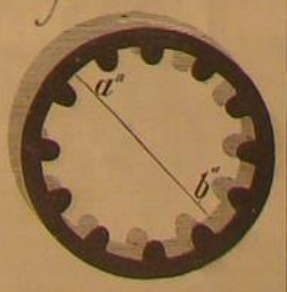
Fig. 6.



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.

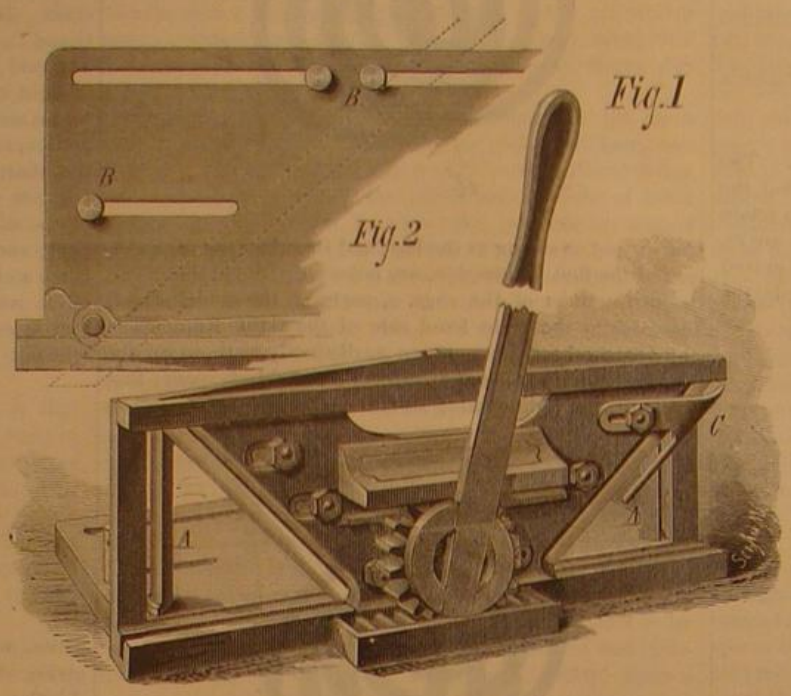
A NEW MITER CUTTER.

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.

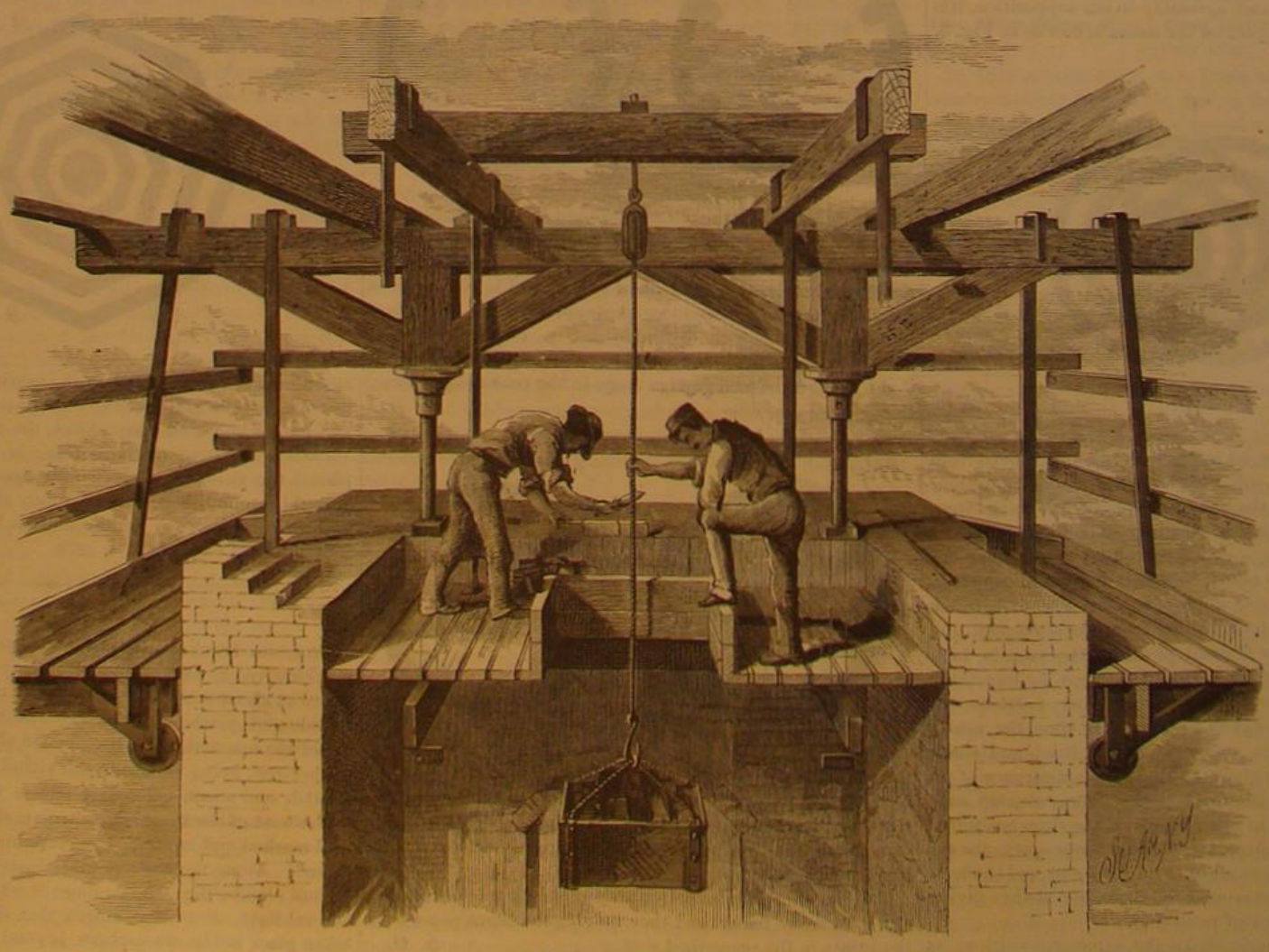
The first method is shown in the engraving.

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.

ROOT OF A GIANT TREE.

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.

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 iacobææ*, 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.

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 electromotive 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 folium*. 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.

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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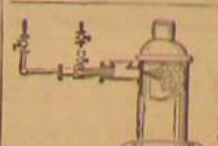

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