

SCIENTIFIC AMERICAN

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THE WIRE FOR THE EAST RIVER BRIDGE.

The work of manufacturing the crucible steel wire, from which the great cables and other portions of the superstructure of the East River Bridge are to be made, is now in active progress at the factory of Mr. J. Lloyd Haigh, in South Brooklyn. Some twenty-two months will be devoted to drawing the 6,800,000 lbs. of wire required. The size of wire at present being made is of No. 8 gage, or 0.165 inch. Each of the nineteen strands of each of the four main cables will contain 331 wires of this diameter, so that in each cable there will be 6,289 wires.

The mode of manufacture, which is illustrated in the engravings herewith presented, is quite simple, and its processes are few. The steel is received at the factory in the form of rods rolled to about one quarter inch in diameter, and made into coils. Each coil in turn is brought to a forge, where one end of the rod is heated and then hammered to a point by hand. If the wire to be produced is to be of fine gauge, necessitating several drawings, it is softened by annealing in a suitable furnace. The bridge wire, however, does not require this treatment, and therefore is carried at once to the cleaners, in order that any oxide or foreign matter on its surface may be removed. The cleansing process consists in dipping the coils in vats containing dilute sulphuric acid until the surface is sufficiently attacked. Then the further action of the acid is arrested by dashing a mixture of lime and water over the coils as they lie upon the

floor. The wire is now transported to a large oven in which it is placed and there kept until thoroughly dry, when it is ready for the principal operation which it has to undergo, namely, the drawing. This, with the pointing and cleansing processes already described, are illustrated in the large engraving, Fig. 1. The drawplate is simply a piece of very hard

is then several times heated and punched with successively smaller punches to secure tapering holes; though these, which are of course smallest at the steel or hardest side, are left to be finished in the cold plate by the wire drawer himself. For extremely fine wire, the drawplates are sometimes made of the hardest precious stones. With a plate having a hole pierced through a ruby of 0.0033 inch in diameter, a silver wire 170 miles long has been drawn so nearly uniform that neither the micrometer nor the weighing of equal lengths at the two ends showed any difference in size. Generally, however, for steel wire drawplates, a very hard steel, known as savage or wild steel, and made out of pig metal, is employed.

It will be observed in the large illustration that the workmen stand before a bench on which are a number of cylinders. These are heavily built, and are rotated by vertical shafts which extend under the bench. Just below each drum is a cam which acts upon the pivoted lever shown in the foreground on the left. To the end of this lever is fastened a chain which is attached to nippers or to a dog. Having thrown his coil over a reel, the workman inserts the pointed end as far as possible through the proper hole in the drawplate. Then, with the dog, he grasps the extremity which protrudes through, watching his chance to do so

as the cam on turning allows the nippers to be moved to the right. As soon as a firm hold of the wire is obtained, the cam in its revolution acts upon the lever with great power, and thus the wire is dragged through the plate for several inches. The nippers are loosed, and a fresh grasp is ob-

[Continued on page 130.]



Fig. 1. MAKING THE WIRE FOR THE EAST RIVER BRIDGE.

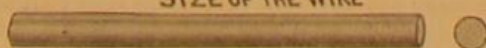
Fig. 2.



steel, of the shape shown in the illustration, and firmly affixed to the table or bench. From the flat side of this plate (at which they have their larger extremity) to the opposite side (which is not necessarily a truly flat surface) several conical holes are pierced, their smaller orifices being carefully finished to the sizes they are respectively intended to give to the wire drawn through them. The holes in each plate are made successively smaller by minute gradations, so that the reduction of the wire and the effort required shall be, at the successive drawings, as nearly uniform as possible. The

Fig. 3.

SIZE OF THE WIRE



drawplate is usually about 10 inches long and 1 1/2 inches thick, and it is made with great care. In France it is formed by repeatedly fusing and hammering, to insure their complete union, the two lateral parts of a compound bar, one part being of wrought iron and the other of a sort of steel called *potin*, previously obtained by melting to a paste fragments of cast iron pots with white wood charcoal, throwing this into cold water, and repeating the melting and sudden cooling ten or twelve times. When the union of the two parts is complete, the plate is reheated and extended; and it

Fig. 4.



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SCIENCE PROPHESIES THE FUTURE OF THE RACE.

M. Alphonse de Candolle is to be credited with the strikingly original idea of applying the principle of the Darwinian theory to determine, not the past, but the future of the human race. That principle he defines as "the forced adaptation of organized beings to surrounding circumstances of every kind, the result of which is that the modifications preserved are sometimes good, sometimes bad, that is, according to our human conception of what is good or bad." Reasoning from the truths determined as to the past history of the world as demonstrated by geology, and from the known records of the origin and progress, extinction or growth, of the various types of mankind which have existed or now exist upon the earth, he deduces a logical conception of life on our planet centuries hence.

The argument presented is based on these premises; first, that organized beings endowed with will and the faculty of locomotion always seek to adapt themselves to their environment, and none do so more effectually than man, because of his superior intelligence. Secondly, that those individuals least able thus to accommodate themselves are most likely to perish, and hence populations are principally recruited by individuals that possess the qualities best adapted to the circumstances of the country and the age in which they live. Thirdly, that the violent contests between nations and individuals accelerate modifications and adaptations to new circumstances. It will be evident that, in considering the subject, two possible conditions of the race at once present themselves, or rather two questions are before us to answer: What will be the state of mankind one thousand years hence, during which period it is reasonably certain that the physical conditions which affect the species will remain stable? And what will be the state of mankind several hundred thousand years in the future, when vast cosmical changes may possibly have occurred?

The period of one thousand years is an extremely short one in the earth's history. We have historic documents dating even further back; and since their origin, no material change in climate has taken place, nor have the configurations of the globe altered. The supposition of a continuation of present physical conditions during several generations of man is thus presumable; and such being the case, two phenomena may be foreseen, namely: The land will be more thickly inhabited, for everywhere the population is increasing and seeking new places of abode; and as a consequence, there will be more frequent mingling of races. Conformably to the doctrines of natural selection and survival of the fittest, the weaker races must then either be destroyed or absorbed by the stronger ones. This is already taking place with the Indians, the Australians, the Hottentots, and other aboriginal tribes. There are three great races, however, endowed with admirable qualities for invasion, which will mix with the inferior races more or less, according to circumstances. These are the white race, represented by the Europeans and their American descendants, the yellow race or Chinese and Japanese, and the negroes. The whites have the advantage of intelligence and ability to bear cold climates; but they cannot endure tropical heats. Negroes possess physical vigor; but as regards bearing cold and heat, they are the reverse of the whites. The Chinese can exist in all latitudes, but they lack courage and progressiveness. The mingling of the three races will therefore never be complete; and although, ten centuries hence, hybrid peoples of every degree will be found in Africa, in China, and in the north of Europe and America, the primitive races will predominate.

Before the far more remote period designated in the second question shall arrive, great changes may, as we have already intimated, occur. The entire habitable surface of the globe may be altered by the depressions and elevations of its surface, constantly, though slowly, in progress. New diseases may sweep off whole nations, or the race itself. The accumulation of ice at the poles may produce changes in winds, in currents, eventually in climate; and another glacial period may supervene, the effect of which would be to drive all organized beings toward the equator; and this change in habitation would result in the extinction of many species. Our entire solar system is moving with great rapidity in a certain direction. It may enter a warmer or colder part of the Universe, or the sun may blaze up and be destroyed, as did that other sun in the constellation of the Swan quite recently. But setting aside these hypothetical cases, let us see what Science predicts as absolutely certain:

Through the oxidizing action of the air and by human labor, the quantity of metals and coal on the surface of the earth is constantly being diminished. Undoubtedly as this occurs, new ways of working mines to great depth and of utilizing natural metallic oxides will be discovered; but these resources can never be so advantageous as those we now enjoy. As they become rare, so will population diminish and industries decrease; and this result will be the more marked in countries depending upon such resources. We know that the terrestrial surface is constantly diminishing, and elevated regions are being lowered through the incessant action of water, ice, and air. The earthy matter, washed or ground away, is carried to the sea, which is thus filling up. The result, however, will be a total submersion of the land as it now exists, and the destruction of all organized beings which live thereon or in fresh water. But the human species, because of its intelligence, will survive longest; and perhaps the last man will yield up his life on some isolated coral reef in the vast waste of water. Before this extreme period is reached, however, as the treasures of the earth disappear in certain localities, people will seek them elsewhere; and thus

the races will congregate in masses on smaller areas of terrestrial surface. This concentration will be enforced by other causes, as, combustibles and metals being scarce, intercommunication will be difficult; through the depression of mountain chains diminishing the condensation of aqueous vapors, now fertile countries will become sterile, and populations will accordingly diminish. Then, as the continents deprived of mountains become partial deserts or archipelagos, the people will become more and more maritime. They will draw their sustenance from the sea, which will form a barrier to the mingling of races. The whites who will avoid equatorial regions will suffer most from ice invasions from the poles; and the colored races in the central archipelagos, remaining pure as at present, on account of natural selection during their long isolation, will probably be the survivors of the race.

To recapitulate, M. de Candolle believes that our period and that which will follow for the next thousand years will be characterized by a great increase in population, a mingling of races, and a prosperity more or less marked. Then will probably follow a long period of diminution of population, of separation of the peoples, and of decadence.

A GOOD POLICY.

A very handsome compliment has just been paid to the United States by the Secretary of the Geological Society of Edinburgh, Scotland. Writing under date of January 20, to announce the election of Professor F. V. Hayden as Foreign Corresponding Fellow, the secretary justifies the defence of American science by Dr. Draper (see SCIENTIFIC AMERICAN, page 360, vol. xxxv.) and says: "I am glad to take this opportunity of stating that, in the opinion of myself and my scientific friends in this city, no government in the world equals that of the United States in the liberality, importance, and, I may add, magnificence of its donations to scientific societies throughout the civilized globe. Beside it the liberality of the British Government, even to British societies, sinks into insignificance."

This is as it should be. It is the very best policy of a government like ours to favor Science in every legitimate way. As a people, our indebtedness to Science at home and abroad is simply immeasurable. It has furnished the true basis of our national culture. It has made our agriculture what it is—the source of national wealth and strength. It has enabled us to become the great manufacturing country of the world, and has done more to further the speedy development of our mineral and other material resources than any other agency. We do well therefore to deal liberally with Science at home and to be lavish rather than niggardly in distributing abroad the results of our scientific surveys and experimental investigations.

This policy is particularly worthy of encouragement at this present time. Hitherto no effort has been spared to aid and encourage emigration: with what success and profit may be seen in our rapid increase in wealth and population, and in the rapid conquest of vast areas lately a wilderness, now overspread by fertile farms, dotted with thrifty towns and rising cities, knit together by railways and telegraph lines. The time has come, however, when our need is not so much empty handed emigrants, however stout and willing to work, as men of a higher intellectual and financial grade, men with capital to invest, men capable of taking a more important part in the discovery and development of our material resources. The old world is full of men of this sort, men of culture and enterprise, with money to sustain both, and give them a favorable impression of our country and people, than to be well represented at all the local centers of activity and culture. Our government publications are replete with matter of great interest and value; and it is a wise policy which secures their distribution among the libraries of the world, particularly among those of the scientific societies. There is that scattereth, and yet increaseth; and the converse is equally true, as the same ancient experience discovered. There is that withholdeth more than is meet, but it tendeth to poverty.

It is to be hoped that the ostentatious economy (?) that broke out in Washington awhile ago will pass away before this relatively inexpensive yet profitable policy, in dealing with Science at home and abroad, is completely reversed.

PROTECTION OF BUILDINGS FROM LIGHTNING.

Under this head, the English journals publish an abstract of a paper by Professor J. Clerk-Maxwell, which is likely, on account of the high reputation of its author as a scientist, to disturb the minds of many who have no very clear conception of the nature of electricity. The Professor states first that it appears to him that the extension of a lightning conductor above the highest part of a building, connected at its lower extremity with conducting strata underground, and thus tapping the electricity, is calculated rather to protect the surrounding country, and to relieve the clouds, than to protect the building.

This idea is in direct conflict with experience, which has taught us that buildings protected by well constructed lightning rods are never damaged, but that the surrounding buildings have often been struck; and hence we have the well established maxim that the protecting influence of a lightning rod extends around it in a radius of 50, 100, 150, or more feet, according to the height of the rod, and other incidental circumstances sometimes difficult to define. Whenever a house provided with a lightning rod has been

struck, it has invariably been proved that the rod was in defective condition; and defects in this regard are more common than is generally suspected. Professor Maxwell goes on to state what, according to his ideas, would be required to prevent the possibility of a discharge within a certain region. Take for instance a gunpowder manufactory. He says that it would be sufficient to surround it with conducting material, to coat the roof, walls, and ground floor with thick sheet copper, and make no earth connection. He even proposes to isolate the building and its contents with a layer of asphaltum. He says that if the building were struck it would remain charged, and that a person standing on the ground outside, and touching the wall, might receive a shock, but that no electrical effect would be perceived inside the building. We need hardly say that the execution of such a proposal would be so expensive as to make its practical application objectionable on account of the cost; but we must point out that the arrangement would lack one of the main virtues of good lightning rod, namely, the gradual and silent discharge of atmospheric electricity, and also that from thunderclouds, thus making explosive discharges less destructive, if not preventing them entirely. It would appear that Professor Maxwell wishes to prevent this discharge, and desires to charge the isolated gunpowder magazine with the electricity of the cloud; but he forgets the vicinity of the conducting earth under the layer of asphaltum. The surface of the earth always becomes charged by induction when an electrically charged cloud is over it; and if, according to Professor Maxwell's proposition, the powder magazine were isolated, and charged from the cloud, it would only serve to make the induced charge of the earth's surface stronger in proportion as the powder magazine is nearer to the earth than to the cloud, of which, electrically speaking, the powder magazine would become a part. If there were no connection between the cloud and the magazine, layers of dry air intervening, the powder magazine, being placed between the negative earth and the positive cloud, would not have its charge equally distributed, but its floor would have an excess of positive electricity, and its roof an excess of comparatively negative electricity. If a better communication, by means of moist air, were established with the cloud, so as to neutralize the negative electricity and charge the whole powder magazine with positive electricity, the danger would be of a different nature. Having the same charge as the cloud, and being, as we have stated, a part of the same, its antagonist is now the earth; and a discharge between the gunpowder mill and the earth, through or along the asphaltum isolator, is now to be feared, changing suddenly the electric condition of the magazine. We ask if this may not be undesirable, or even dangerous? Certainly, if this be considered an open question, it will be more safe not to run the risk.

Professor Maxwell goes further on to state that it is unnecessary to connect large masses of metal, such as engines, tanks, etc., in the building. But if any conductors communicating with outside objects, such as gas or water pipes, telegraph wires, etc., enter, they must be connected. This is a very curious statement. What now becomes of the isolation, on which, according to Professor Maxwell, the safety principally depends? If the gunpowder mill be connected with the earth, it can no more be charged like the cloud, but will, by induction, possess the opposite electricity, and the chances of explosive discharge will be made much greater. The greater or less danger from such explosive discharges depends entirely on the degree of perfection of the ground connections; these may be good enough to draw slowly the negative electricity from the ground, induced by a positively charged cloud floating over the building, which would also charge the building strongly by induction; but these very connections may be utterly inadequate to discharge suddenly a large quantity of electricity flashing from the cloud to the building: in which case the current is not confined to the lightning rod, but takes an additional path, any that it can find, and so does the damage. Professor Clerk-Maxwell says, further, that no telegraph wire from without should be connected with nor enter a powder mill, as it would make the telegraph useless; we would add another important reason—namely, that sparks of atmospheric electricity entering the mill by telegraph wire, as they often do telegraph offices, would be dangerous visitors.

In order to avoid the expense of covering a whole powder mill with sheet copper, the Professor finally suggested surrounding it with a network of copper rods, one fourth of an inch in diameter, the rods passing round the foundation and up each of the corners and gables, and along the ridges. He also proposes to build the copper wire in the wall to prevent theft, and recommends that it be connected with all metals on the outside of the house, such as sheet lead, rainwater pipes, etc., and also with the gas and water pipes in the building; but if these be not present, he says that there is no necessity to take any pains to facilitate an escape of the electricity into the earth; neither is it, he thinks, advisable to erect a tall conductor with a sharp point, to relieve the thunderclouds of their charges.

Now with all respect to Professor Maxwell, we must remark that all this is a mere rehash of a very old discussion on a question which was thoroughly ventilated and disposed of some seventy-five years ago, as will be found on reference to Gilbert's "Annalen der Physik," volumes VIII. and IX., wherein is described a controversy between Professors Wolf, of Hanover, and Reimann. Professor Wolf attacked the then increasing notion that tall conductors with sharp points were needless and even dangerous; the latter defended their use, and attempted to prove their effectiveness on the basis

of experience and observation, as well as on theory. In reading over this instructive discussion, we cannot help being struck by the fact that, with all our progress in the science of dynamic electricity, and its applications to telegraphy, electro-plating, artificial light, etc., we know little more of static electricity than we did seventy-five years ago: while our forefathers' heads were clear on the subjects of static and atmospheric electricity, more so than those of our present professors, and much more so than the heads of our modern lightning rod men, who, by their lamentable ignorance, have done much to bring lightning rods into disrepute among many classes.

THE BLUE GLASS DECEPTION.

In our last issue, we reviewed the alleged capabilities of sunlight filtered through blue glass, in causing plants to grow, etc.; and by reference to numerous experiments, we reached the conclusion that the light transmitted through the violet-blue glass is nothing more than normal sunlight diminished in intensity. We propose in the following to finish our discussion by examining into the effects of light and darkness upon organisms. And we may especially here recall the fact that General Pleasonton claims that not only does the blue light stimulate growth, but that it is a positive remedial agent for such severe ailments as spinal meningitis, nervous irritation and exhaustion, rheumatism, hemorrhage of the lungs, deafness, partial paralysis, shock due to severe contusion, and others, of all of which he cites cases.

The theory that various colored lights exercise different effects on the human system is an old one. In 1831, Dr. Newbery of this city asserted that yellow light stimulates the nervous, pink the nutritive, and blue the locomotive temperament; and recently Dr. Ponza, an Italian physician, has asserted that lunatics are greatly affected by being placed in different colored rooms. Red light, Dr. Ponza says, removes feelings of depression, blue induces calmness; and by violet light a crazy person was in one day cured.

It is a thoroughly demonstrated fact that light is an important vital stimulant; and that, if its operation be excluded, the development of the healthy bodily structure is arrested. Naturalists tell us that in the absence of light the transformation of a tadpole into a frog is stopped, and the reptile remains a tadpole. Plants in darkness become blanched and stunted in growth; the process of fixing the carbon in their tissues is arrested, a modification of the coloring principle takes place, and they appear white instead of green. The sad effects of deprivation of sunlight are especially observable among those who live in crowded alleys or cellars, or who work in mines, where the light of the sun seldom or never penetrates. The total exclusion of the sun's beams produces an impoverished and disordered state of the blood, emaciation, muscular debility, and the diseases due to imperfect nutrition.

On the other hand, it is known that for certain purposes darkness or shaded light is advantageous to the bodily condition. Fowls, for instance, may be fattened much more rapidly in the dark, and it would seem that the absence of light exercises a very great influence over the power possessed by food in increasing the size of animals. It likewise seems to exercise a soothing and quieting influence, increasing the disposition of animals to take rest, making less food necessary, and causing them to store up more nutriment in the form of fat and muscle. Now, if the organism to be treated is subjected to light, all of which is filtered through blue violet glass, then, as we have previously demonstrated, it is in light which is considerably shaded. And very probably to this cause—and not at all to the peculiar hue of the light—is to be attributed the quieting influence on nervous and insane people which Dr. Ponza has remarked.

But General Pleasonton does not use blue-violet glass alone. On the contrary, he employs a combination of blue light and pure sunlight, the latter very much preponderating. In his graper, for example, only every eighth row of panes is blue. The mingled light consequently is merely pure sunlight, very slightly shaded; and the animal or plant exposed simply takes a sun bath—the *solarium* of the ancients, who, knowing the vivifying influence of the sunbeams, had terraces built on the tops of their houses so that they might bask in them. This sun treatment is now frequently recommended by physicians for nervous diseases. Dr. Hammond, in one of his lectures, says: "In convalescence from almost all diseases, it acts, unless too intense or too long-continued, as a most healthful stimulant, both to the nervous and physical systems. * * * The delirium and weakness, by no means seldom met with in convalescents kept in darkness, disappear like magic when the rays of the sun are allowed to enter the chamber."

To recapitulate in brief, General Pleasonton's claims, of any superior powers for blue glass on account of the color which it produces in transmitted light, are, when tested by the result of previous investigations, unfounded. In some instances, where it is desirable to reduce the intensity of the light, blue glass may be used; but any other mode of shading the light, as by ground glass, thin curtains, etc., would without doubt serve equally as well. The cures produced are ascribable to two causes: first, to the healthy influence of the sun bath, and secondly, to the very powerful influence of the patient's imagination. There are abundant cases known where imagination has so powerfully affected the body as to cause death.

Experiments upon criminals have shown that in one instance, where a person was placed in a bed which, he was informed, had just been vacated by a cholera patient (but

which had not), he exhibited all the symptoms of that disease. Another person is reported to have shown all the signs of collapse from loss of blood, from the supposition idea that he was bleeding to death. As regards the animals fattened under the glass, all the circumstances go to show that the result was due to their enforced quiescence, their shelter from the weather, and their free exposure to the sun.

It is hardly necessary to add that in our opinion the use of blue glass, as advocated by General Pleasonton, is devoid of benefit.

HOW WE ARE ABLE TO DO IT.

Hitherto the price of technical publications, especially in the departments of mechanics, engineering, and the chemical arts, has been relatively very high, and for good reasons. The original cost of such matter is usually many times greater than for matter of a purely literary character; the tables and engraved illustrations are expensive, the market for technical works is limited, and their sale for the most part very slow. Consequently it has been impossible for publishers to offer such works at anything like the price at which ordinary works of the same size would afford a profit.

The actual cost of each copy of an edition of a technical treatise may be, say, ten dollars, four fifths of which will have gone for composition, engravings, etc., before the work is put upon the printing press; the other fifth will cover the cost of paper, printing, binding, and the author's pay. If the sale of the work is at all slow or doubtful, the publisher will have to charge from fifteen to twenty dollars a copy to get his money back. But if, instead of an edition of a thousand copies, it is possible to sell promptly ten, twenty, or fifty thousand copies, the cost of each volume will be very materially reduced. While the smaller element of the cost remains substantially unchanged, the larger will be distributed over ten, twenty, or fifty times as many copies, the share for each being proportionately reduced. In other words, the first cost of each copy will be not two dollars plus eight dollars, but two dollars plus eighty cents, forty cents, twenty cents, or even less, according to the number sold. Hence the publisher can afford to sell the work for very much less than fifteen dollars—perhaps for half what each book would have cost him in an ordinary edition. The same conditions hold good in all cases, whether the first cost be ten dollars or one dollar, the essential factors in determining cheapness being large editions and a ready sale.

Still another and often very important reduction in the cost of printed matter, technical or other, can be effected by choosing a form economical for printing, and a more compact yet still legible type; and by dispensing with cloth or other binding, a further very considerable saving can be made. Given, then, a form of publication like the SCIENTIFIC AMERICAN and a large circulation, it is easily possible to furnish, as we do each year, an amount of valuable and timely matter, many times greater than could be afforded for the money through the usual channels of the trade.

The same is shown even more strikingly in the SCIENTIFIC AMERICAN SUPPLEMENT, in which is furnished for five dollars a year an array of useful and instructive matter fully equivalent to fourteen ordinary volumes of five hundred pages each, with something like two hundred engravings to each volume, many of them very large and costly. An examination of the tables of contents given with the two volumes for 1876 will discover the titles of about ten thousand separate articles, a large number of them elaborate memoirs, for which in the ordinary form, in paper, the price would be from fifty cents to a dollar each. In addition to numerous original and timely articles of great value from the ablest American engineers and scientists, the SCIENTIFIC AMERICAN SUPPLEMENT is giving from week to week either a full reprint or a critical abstract of all the best contributions to all the leading scientific and technical publications of the world—matter which cannot be had in any other form for ten times the price we charge for it. The ability to do all this with profit to ourselves hinges on the single condition—a wide and certain market.

Thanks to the co-operation of the thousands who subscribe for the SCIENTIFIC AMERICAN and the SUPPLEMENT, we are able to do what many have dreamed of but despaired of accomplishing, and that is to lay before an increasingly intelligent public, valuable scientific matter at a price which rivals that of the cheap story paper. Relatively, the readers of Science are yet few in comparison with those who content themselves with trash; but their number is increasing, and with them the possibility of printing Science for the million at a price within the means of all.

Our readers will bear witness that, from year to year, as the range of scientific readers has widened, there has been a corresponding improvement in the scope and value of the reading matter and illustrations given in this paper. It is our purpose to maintain the same progressive character in the future, giving our readers the full benefit of the cheapening effect of increased circulation by furnishing, so far as possible, more and better matter for the same subscription price. Thus we make it for the personal advantage of each and every reader to do what he can to enlist the interest of other readers.

NO CONNECTION WITH THE SCIENTIFIC AMERICAN.—We learn that certain parties in Chicago have set up a soliciting business under the title of Munn & Co.

We beg to inform our patrons that the Chicago concern has no connection with the SCIENTIFIC AMERICAN or the publishers of this paper.

[Continued from first page.]

tained close to the plate, and this is repeated until a sufficient length of wire is made to allow the end to be carried to the cylinder and there secured in the vise provided for the purpose. The cylinder, meanwhile, is out of action; but as soon as the wire is fastened to it, the workman presses a treadle, a clutch connects the cylinder and shaft, and the latter slowly rotates, thus drawing the wire continuously through the plate. Should the wire break, the machine is stopped, the end re-pointed, and the operation already described begun again. This continues until the rough rod is all drawn down to a neat cylindrical wire, which, however, is yet considerably too large in diameter. To reduce it, a second drawing through smaller holes is required; and if the wire is to be very fine, sometimes as many as twenty-four drawings are had, annealing in such case taking place between each drawing. The bridge wire of the size before mentioned requires to be drawn but two or three times to reduce it the necessary 0.085 inch.

The next process is illustrated in Fig. 5, and is the zincing or, as it is commonly termed, galvanizing. The wire is led over rollers into a bath of dilute muriatic acid already heavily charged with zinc. The acid bites a clean surface, and it is supposed that some zinc is precipitated on the wire, which better insures the deposition of the melted zinc, through a large bath of which the wire is subsequently led. The zinc covering of course protects the wire from oxidation and effects of the weather. The wire is next led to large reels, Fig. 2, whereon it is made into coils, each containing 840 feet, weighing 60 lbs., and measuring some 4 feet 6 inches in diameter. All the wire is required to be straight wire: that is to say, when a ring is unrolled upon the floor, the wire behind must lie perfectly straight and neutral, without any tendency to spring back in the coiled form. In order to produce this straight wire, the patented process of Colonel W. H. Paine, assistant engineer of the bridge, is used. The wire is led from a point within the galvanizing trough in a straight line, under considerable tension, to a guide sheave or winding drum, which is located at such a distance as to permit the wire to be cooled and set before it is coiled thereon. The size of the drum is such as to cause no permanent bending of the wire.

The turning of the drum is represented as being done by hand in Fig. 2; but of course when the manufacture of the wire is further advanced, and when many such drums are necessitated, the work will be done by suitable machines.

Nothing further remains to be done but to test the finished product to find whether it meets all the contract requirements. The machine for this purpose is represented in Fig. 4. It consists simply of a long scale arm on which the weights are adjusted, and so caused to pull, at a very strong leverage, on the sample adjusted in jaws connected with the arm. Pieces of wire are cut from each coil, secured one at a time between the jaws, and broken. One person, who adjusts the weights, notes the breaking strain; while another, who watches the behavior of the sample, notes the amount of stretch which it undergoes on a suitably arranged scale. For the No. 8 wire the contract tensile strength is 3,400 lbs., and the stretch $3\frac{1}{4}$ per cent. These requirements, we learned, are generally exceeded, as the breaking strain has gone up as high as 4,480 lbs., and averages about 4,000 lbs.; while the stretch is about 4 per cent. A further test is also made by bending the wire in order to determine its behavior under flexion and torsional stress.

There is an interesting process in the way of utilizing waste connected with this wire manufacture which may well be noted here. Of course, in cleaning large quantities of wire, very large amounts of sulphuric acid are needed, and the vats need constant replenishment, as the acid becomes charged with impurities. There is, beside, in a factory of this kind, a great deal of waste metal and scrap of all sorts. In order to utilize both varieties of refuse, the acid is turned into a huge vat and there boiled, by steam, down to a proper density. Into it the scrap metal is thrown, and the whole is heated together. Then the green resulting liquid is run off into tanks and allowed to cool. The acid and iron both disappear; but instead, on pieces of wood suspended for the purpose in the cooling tanks, appears a copious deposit of sulphate of iron (copperas), a substance of commercial value.

Each of the large cooling tanks is capable of yielding some 14 barrels of this product daily.

Some improvements have recently been made at Mr. Haigh's works, introducing automatic cut-offs to each wire block, which materially reduce the labor and form perfect safeguards against accidents to the workmen.

It should be added that Mr. Haigh's facilities for the production of the wire are to be greatly increased. Entire new

of the usual construction, and B the fire box, that is surrounded at the sides and top with a straight and arched boiler section, C. This boiler section or shell, inclosing the fire box, is constructed with a series of holes, *a*, Fig. 2, near the sides of the front wall, so arranged that the scraper may be introduced to the inside of the side wall at any height up to the water level, and the side walls and stay bolts then be readily cleaned by working the scraper. The holes, *a*, are closed by tightly fitting screw plugs when the boiler is in use.

The bottom of the front section, C, is cleaned by the customary handholes, *b*, at the front or rear wall, which are closed tightly by steam-tight plates.

The inside of the rear wall is reached by means of a side opening, *d*, of sufficient length to allow the scraping device to be introduced horizontally between the flues and clear the parts of the rear wall between the same. This opening is closed by a tightly fitting plate attached by stud bolts.

New Test of Salicylic Acid.

Salicylic acid, which is now largely employed for therapeutic purposes as an antiseptic in lieu of carbolic acid, and as a means of preservation for fruit, beer, meat, etc., in order to be efficacious should be absolutely pure and in crystallized form. Impure acid, which almost always betrays itself by the disagreeable taste left in the mouth, may, when constantly used, become dangerous to health. In order to determine the purity of the acid, M. Kolbe advises that about 7.7 grains be dissolved in a drachm and a half of concentrated alcohol, and that the clear solution, placed in a test tube, be allowed to evaporate slowly at ordinary temperature. The salicylic acid deposited will then form a ring of crystals around the interior of the tube. This crystallization is pure and white if the acid is pure and has been repeatedly crystallized; it is more or less yellow if the acid has been simply precipitated. But if it is brownish or brown, the acid examined, although it may appear ordinarily as a perfectly white pure powder, should be rejected as unsuitable for any therapeutic application.

The New Bergen Tunnel.

It has been decided by the Delaware, Lackawanna and Western Railroad Company that the new tunnel under Bergen Hill shall be arched with brick throughout the entire length, 5,200 feet. Of this distance the arching has been completed, except 600 feet. It will give an idea of the work when it is stated that 7,000,000 brick have been laid in the arching. All the shafts have been torn down and will be rebuilt in such a manner that the ventilation will surpass that of any tunnel in the country. The cost of the additional arching will, in the opinion of Mr. Sloan, President of the Delaware, Lackawanna, and Western Railroad, be more than compensated by the security against accidents from falling rock.

Density of Alum Solutions.

The following table will be found useful for ascertaining the percentage of alum present in solution by simply taking the specific gravity with a hydrometer:

POTASH ALUM.		AMMONIA ALUM.	
	Specific Gravity		Specific Gravity
1 per cent.	1.0065	1 per cent.	1.0060
2 " "	1.0130	2 " "	1.0120
3 " "	1.0195	3 " "	1.0180
4 " "	1.0260	4 " "	1.0240
5 " "	1.0325	5 " "	1.0300
6 " "	1.0390	6 " "	1.0360

It will be noticed that a solution of ammonia alum has a slightly lower specific gravity than one of potash alum containing an equal quantity of the salt.—O. Schlütting, in Deutsche Industrie Zeitung.

The St. Louis "Practical Photographer."

This is the title of a new and handsome monthly magazine devoted to the rapidly growing art of photography, edited by J. H. Fitzgibbon. The second number, for February, contains for its principal illustration a photo of the great steel bridge over the Mississippi river at St. Louis, which may be justly regarded as the last wonder of the world. The general contents embrace an extensive variety of subjects. We welcome the appearance of the new periodical, and wish for it every success.

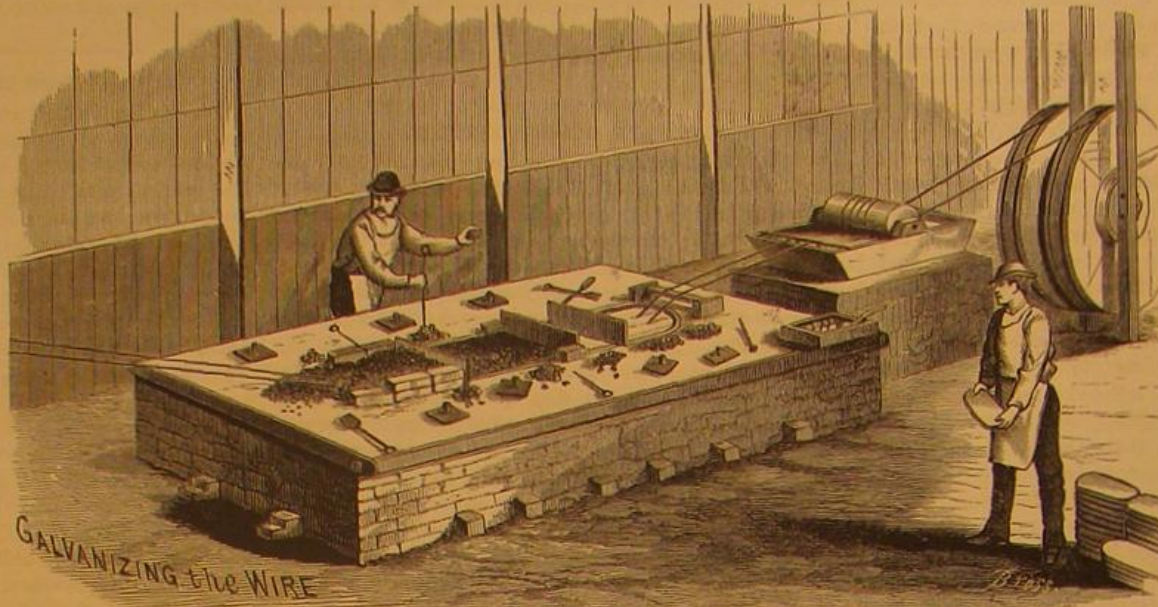


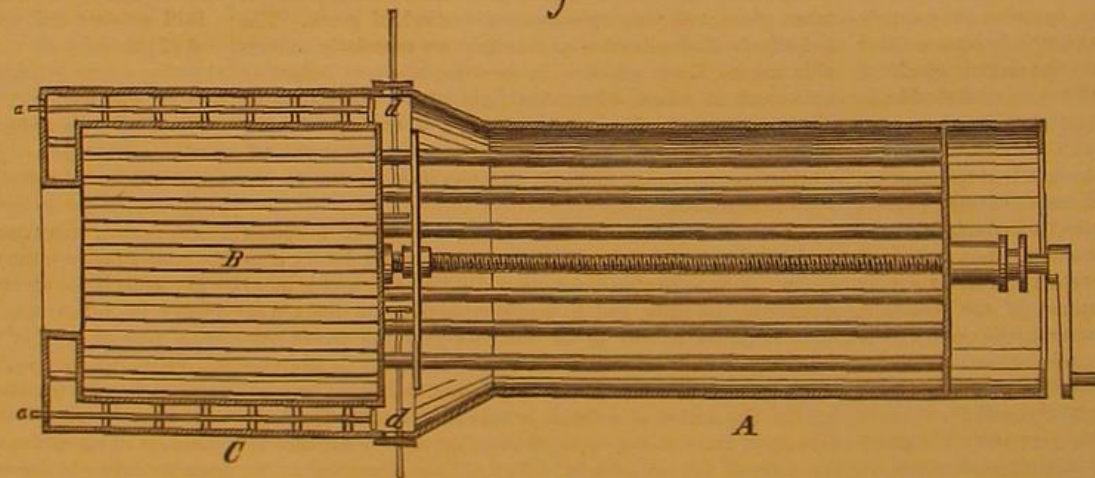
Fig. 5. MAKING THE WIRE FOR THE EAST RIVER BRIDGE.—Fig. 5.

buildings are to be erected, and new and improved machinery added, so that the various processes we have described will be carried on, on a much greater scale than is here indicated.

A NEW BOILER CLEANER.

The danger of the explosion of any boiler in which scale is allowed to accumulate is well known; and many com-

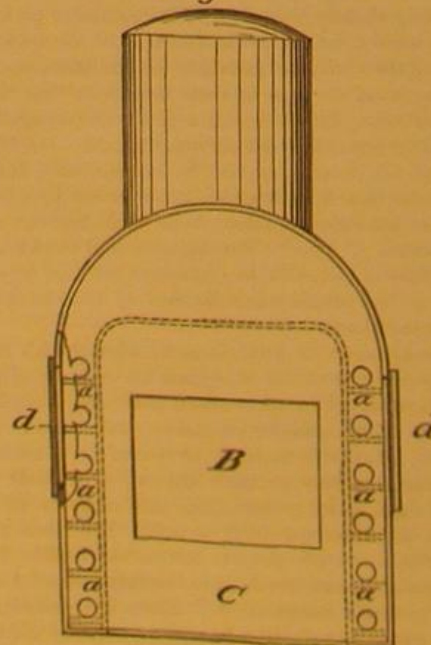
Fig. 1.



CRONIN'S BOILER CLEANER.

pounds to prevent by chemical action the deposition of scale are before the public. But the impurities in water vary so that no chemical preparation can be a panacea; and it is frequently necessary to remove the scale by mechanical means. Mr. Cornelius J. Cronin, of Barnhart's Mills, Pennsylvania, has patented through the Scientific American Patent Agency,

Fig 2.



November 14, 1876, a novel device for preventing the formation of scale in steam boilers, which we illustrate in the annexed engravings. A, Fig. 1, represents a tubular boiler

STREET CARS.

Street railways for passenger cars were first established in the United States about 1850, and in England about ten years afterward. The Boston and Cambridge Railway, commenced in the fall of 1853, was the first in New England. Street cars are usually drawn by horses, but many attempts

Fig. 1.

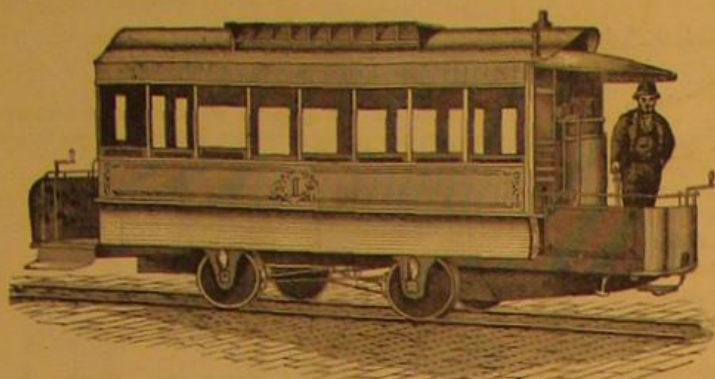


Fig. 2.

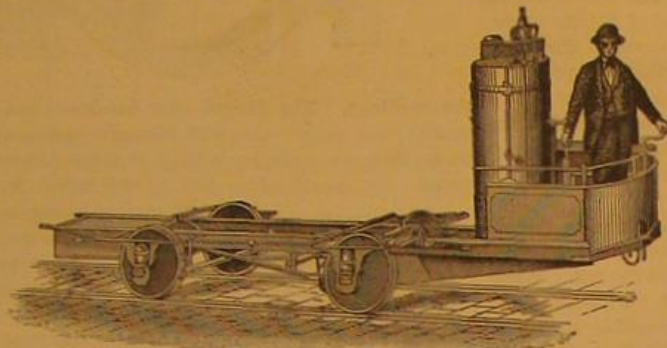
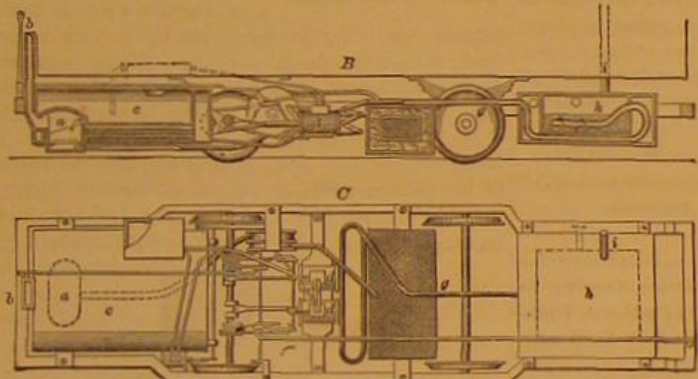


Fig. 3.

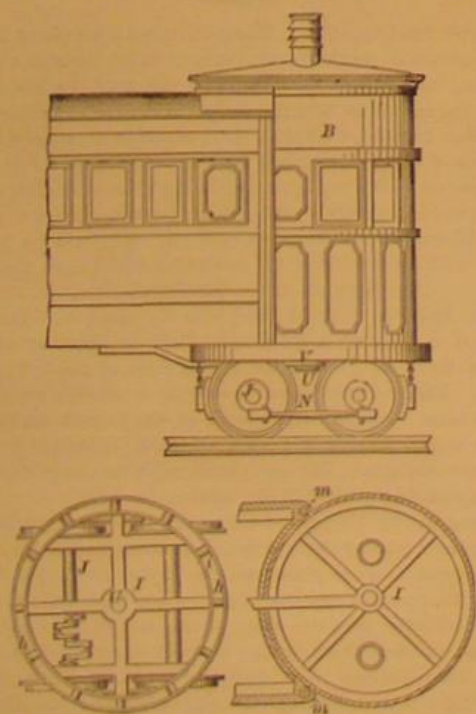


have been made to drive them by machinery. Steam engines, known as dummy engines, have been used with success, but the fire and noise of escaping steam are considered objectionable.

We give herewith several engravings of street car motors selected from Knight's "Mechanical Dictionary."

Fig. 1 is a view of the Baxter steam car, Fig. 2 the truck and machinery of the same. The boiler is upright, and is

Fig. 4.



placed on the front platform; a non-conducting partition prevents heat from entering the car. The engine is below the platform. It is compound and double-acting. In ordinary use, the steam from the smaller cylinder exhausts into the larger; but, in ascending grades, the full pressure of the steam may be made available in both cylinders, greatly increasing the power.

Fig. 3 is the Knapp car; B is an elevation, and C a plan of the motive apparatus. *a* is the furnace, supplied with coal from the platform through the chute, *b*; *c* is the boiler; *d* *d* are the cylinders. The exhaust steam is condensed by a blast of cold air from the fan blower, *f*; *g* is a smoke pipe, terminating in a reservoir, *h*, containing milk of lime, to remove the carbonic acid from the smoke; this also acts as a spark and dust arrester, so that the gas, which finally issues from the pipe, *i*, is invisible, and causes no inconvenience to the passengers or others.

The car, Fig. 4, has a circular cab, B, which contains the dummy engine and boiler, and is supported on a circular platform, I, resting upon the fore truck, V.

There are four sand boxes, with handles brought to the foot boards. There are two exhaust pipes, the end of each projecting slightly upward from the edges of the curtains over the footboards; and by a cock the waste steam is turned into whichever pipe happens for the time to be at the rear end of the car. All the working motion is quite protected from dirt by light boxes which have hinged doors at the sides. The engine is started on its journey with an initial pressure of 200 lbs. to the inch; and owing to the jacketing of the cylinders the loss by radiation is said not to exceed 5 lbs. pressure per hour, allowing the engine to run 40 miles on level lines at one charging of the boiler. Fig. 5 is a longitudinal section of the car, and Fig. 6 is an exterior elevation, also showing the stationary boiler from which the apparatus is charged.

Among other methods proposed for propelling street cars are engines driven by exploding gas: mixtures, for instance, of hydrogen and atmospheric air. Other machines are operated

Figs. 5 and 6

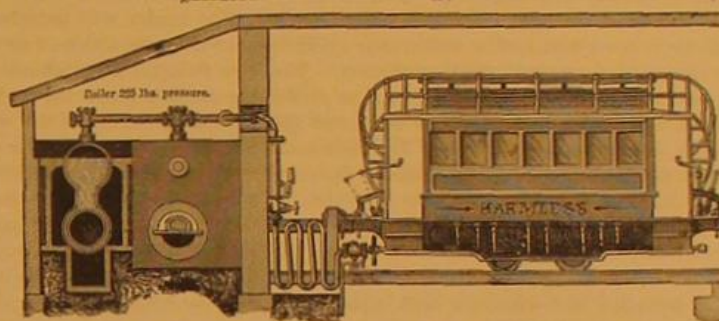
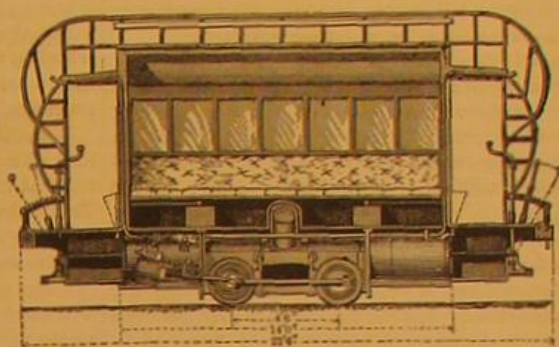
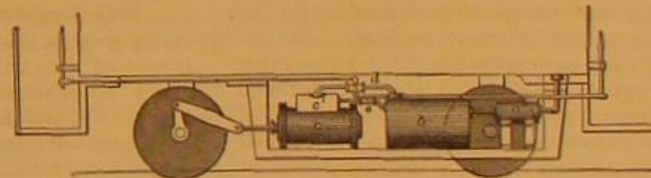


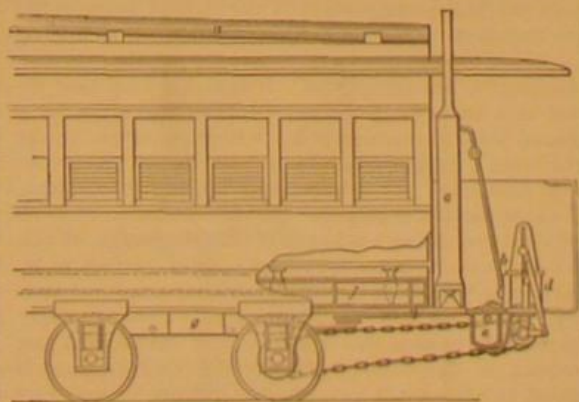
Fig. 7.



and is provided with anti-friction rollers, *h* *i*, upon which the front of the car body, A, rests; the shell of the cab also bears against anti-friction rollers, *m* *m*. A reach and center pin, U, connect the body and fore truck of the car, and the body is supported on a similar pivoted truck, provided with anti-friction rollers, enabling the two parts to turn independently of each other. The front and rear axles of the fore truck are coupled by connecting rods, N, and the rear axle, J, which is cranked, is worked as a driver by a pair of oscillating engines.

Todd's combined dummy and car, Figs. 5 and 6, has a main lower frame 22 feet 6 inches long over the buffers, 7 feet wide over all, and 3 feet high from the rail to the top; and on this frame is placed the 14 feet body of an ordinary

Fig. 8.

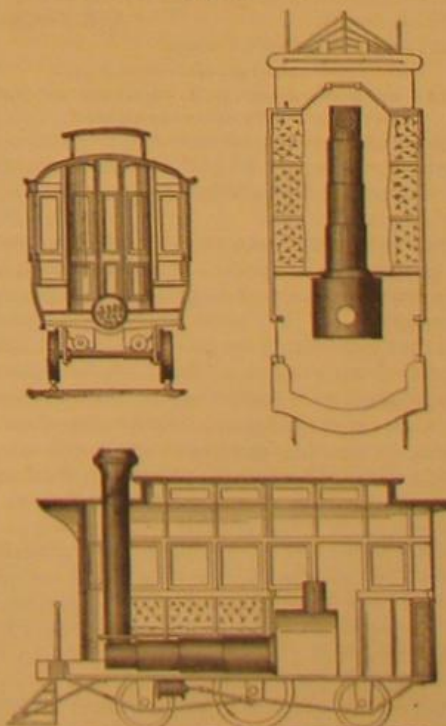


car. In the center of the frame are two receivers, each containing 30 cubic feet of water. Below the buffer beams are screw couplings and stop valves with perforated pipes running right through the receivers. The wheels are 24 inches diameter, placed 4 feet 6 inches between centers. Cylinders are 9 inches diameter and 8 inches stroke, surrounded with large jackets open to the water of the receivers. At each end of the car, outside the dash plate, is placed a brake handle, and on either side of this a regulator and reversing handle, all arranged as shown. These latter handles fit into spring sockets, so as to be changed from one end to the other, principally to prevent any one from behind moving the car.

by carbonic acid gas, which is compressed into a liquid and carried in strong cylinders. Another device involves the use of india rubber springs; another of steel springs; another of ammonia vapor; and there are a large number of patented street car engines utilizing compressed air. To this last class belongs

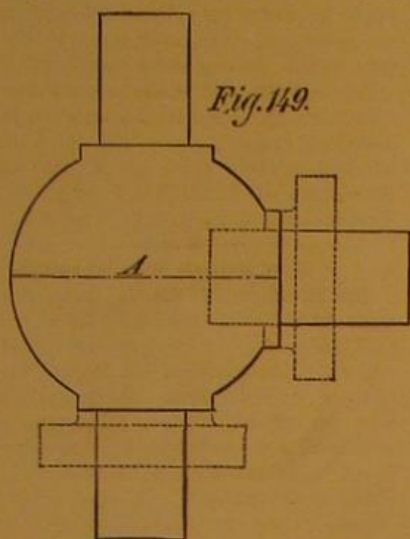
SMITH'S PNEUMATIC ENGINE, which is represented in Fig. 7. Compressed air, contained

Fig. 9.



in a large tank on the body of the car, is admitted to a governor or regulator, *a*, and thence passes to a small auxiliary tank, *b*, underneath; this is connected with the cylinder valve chest, *c*, by two pipes, one of which, *d*, is open and the other, *e*, closed while the car is in motion; but on stopping the car the latter is opened and the former closed, causing the compressed air in the cylinder, *e*, to be pumped back into the

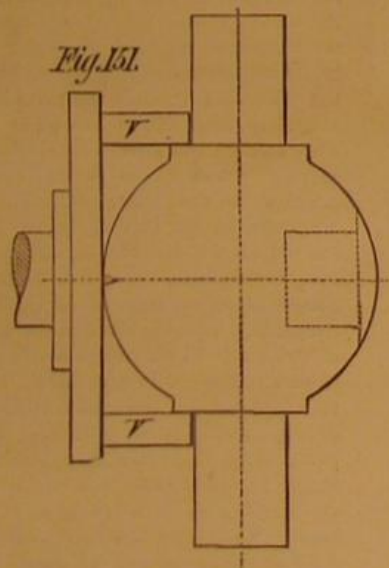
trouble, two exact halves in the pattern, which is very important in a globe valve pattern on account of the branch and other parts, not to mention the moulding. Having turned the body of the pattern to the requisite outline, and made while in the lathe a fine line around the center of the ball where the center of the branch is to come, as shown in Fig. 149, by the line, A, we make a prick point (with a scriber) at each crossing of the line, A, and the joint or parting of the pattern. We then mount the body upon a lathe



chuck, in the manner shown in Fig. 151. A point center should be placed in the lathe and should come exactly even with the line, A. In Fig. 151, V V are two V blocks made to receive the core prints. These Vs are screwed to the lathe chuck, and the pattern is held to them by two thin straps of iron, placed over the core prints and fastened to the Vs by screws. If the chuck and center point run true, the V blocks are of equal height, and the core prints are equal in diameter, the prick point opposite to the one placed



to the center point will run quite true; and we may face off the ball or body to the required diameter of branch, and bore the recess to receive the same. We make the holes in the flanges of the same size as the core prints; but we should not check in the print, because, if a flange with a different length of hub were substituted, it would be a disadvantage. To obtain the half flanges, we take a chuck and face it off true in the lathe; then, with a fine scriber point, we mark the



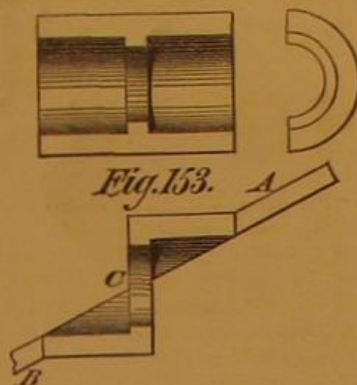
center while the chuck is revolving. We then stop the lathe, and, placing a straight edge to intersect the chuck center, we draw a straight line across the chuck face. We then take two pieces suitable for the half flanges, and plane up one flat side and one edge of each piece. If the flanges are not large ones, they may be planed all at once in a long strip. We place the pieces in pairs, and mark on each pair a circle a little larger than the required finished size of flange. We then fix each pair to the chuck, with the planed faces against the chuck, and the planed edges placed in contact, their joint coming exactly even with the straight line marked on the chuck face, and we may then turn them as though they were made in one piece and to the requisite size.

In Fig. 152, we have a representation of one half of a suitable core box, the other half being exactly the same with the exception that the position of the internal partition is reversed. To get out this core box, we plane up two pieces of exactly the same size and length as the pattern, and of such width and thickness as will give sufficient strength around the sphere, allowing space for the third opening. After

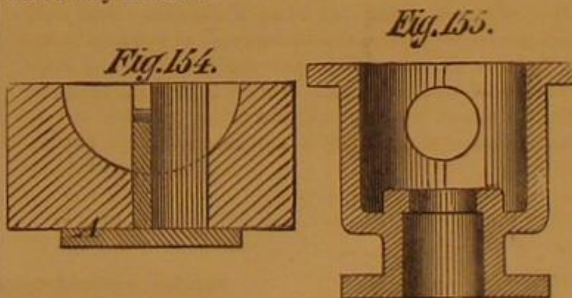
pegging these two pieces together, we gauge, on the joint face of each, lines representing the centers of the openings and the center of the sphere. We then chuck them (separately) in the lathe, and turn out the half sphere. We next place the two halves together, and chuck the block so formed in the three positions necessary to bore out the openings; or if preferred, we may pare them out. The partition (A, in Fig. 152) follows the roundness of the center hole,



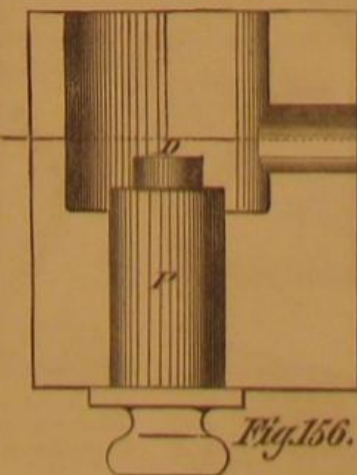
and is on that account more difficult to extract from the core than if it were straight and vertical. When, however, the partitions are of this curved form, the pieces of which they are formed are composed of metal, brass being generally preferred. Patterns have in this case to be made wherefrom to cast these pieces, and they may be made as follows: First, two half pieces, such as shown in Fig. 153, are turned; each



is then cut away so as to leave the shape as shown at C in the same figure, and is then fitted into the spherical recess in the core box, letting each down until both are nearly but not quite level. The two pieces, A and B, in Fig. 153, are then fastened on, and this pattern is complete. When the pieces are cast, they must be filed to fit the core box, and finished off level with its joint face, a small hole being drilled in the center, and a pin being driven through the piece and into the box to steady the corners. We then saw the pieces in halves with a very fine saw.



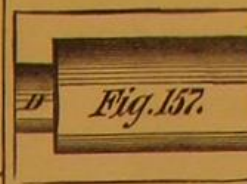
If the partition, instead of following the roundness of the valve seat, is made straight, the construction of the core box is much more simple. In this case, a zigzag mortise is made clear through each half of the box, its size and shape being that of the required partition. Fig. 154 represents a half core box of this kind. A piece of wood, A, is fixed as shown to the partition, to enable the core maker to draw it out before removing the core from the box. The mortise for the partition should be turned out before the half spherical recess, the mortise being temporarily plugged with wood to render easy the operation of turning.



In very large valves (say 10 or 12 inches) a half core box is generally made to serve by fitting the two half partitions, shown at C, in Fig. 153, to a half core box, and keeping them in position by means of pegs, a half core being made first with one and then one with the other in the core box. It is often necessary to form a raised seat in the body of an angle valve, such as shown in Fig. 155, which represents a section of such a body. It is shown with flanged openings, though

in small valves hexagons to receive a wrench would be substituted.

Fig. 156 is a plan of half the core box necessary for forming the raised seat. From this construction, it will be seen that the large core, though solid with the branch core, is not solid with that forming the hole in the seat and the part below it; therefore the core prints on the body pattern must be left extra long to give sufficient support in the mould for the overhanging cores. The loose round plug, P, is made of the size of the outside of the seat and fitted to the box. The part outside the box is a roughly shaped handle to draw it



out by. The diminished part, D, is a print, and into the impression left by it is inserted the core made in box shown in Fig. 157. The print, D, is of the same diameter as the hole in the seat; and the print on the pattern is of the size of the increased diameter

below the seat. Large angle valves are made with half a core box by making a branch opening in the box right and left, a semicircular plug being provided. Two half cores are made with the plug, first in one and then in the other branch opening. The plug, P, should be in this case only half round.

Washington Life Insurance Company.

Life insurance is for the protection of widows and orphans after the death of the insured, while premiums are required in advance. Ability to meet policies issued should be beyond question, because of the nature of the contracts and the time to be fulfilled. Well managed companies owe it to themselves, as also to their policy holders and the public, that official proof of their good management and solidity exists and should be published for the guide of the public. The Washington Life Insurance Company of New York has set a good example by causing an official examination to be made, not only of its practice but its financial standing, by disinterested experts under and by the authority of the New York Insurance Department. The result of this examination reflects credit upon the management of the Washington, and shows it pre-eminently sound, with over five million dollars officially admitted assets, nearly all invested in United States, State, city, and town bonds, and bonds and mortgages; while its total real and contingent liability, including "reserve" for all its risks in force, 4 1/2 per centum of interest, New York standard, are only \$4,386,685.83, leaving a surplus of \$786,685, without counting \$92,000 good, though technically inadmissible, assets, which would increase the actual surplus to nearly \$900,000.

Good management solicits investigation and publicity, while mismanagement fears it. The examination of the Washington shows it not only sound, but its management "able, prudent, and honorable," expressions well worthy the ambition of any company.—Insurance Agents and Brokers' Magazine.

By reference to our advertising columns, the particulars of the official report of the good condition of the Washington Life may be seen.

More Telephone Triumphs.

The Boston *Daily Globe* enjoys the honor of being the first newspaper which has printed a telephonic news despatch. Appropriately enough, the subject of the message is Professor Bell's lecture on his wonderful instrument (illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT of February 10), which was delivered at Salem, Mass., on the evening of February 12. At 10.55, on the same evening, the *Globe* reporter in Salem made a verbal report of the occurrence to the *Globe* office in Boston, eighteen miles away. Not only was the voice of the reporter clearly recognized, but the receivers of the message also heard the applause of the audience which attended the lecture.

Professor Bell's lecture was in itself a wonderful exhibition of the powers of the invention. From his platform, the speaker placed himself in communication with Mr. T. A. Watson, his associate in Boston. The latter then sent the Morse alphabet by musical sounds, which was distinctly audible to the entire audience. The airs played on an organ were transmitted; and on being asked for a song, Mr. Watson complied with "Auld Lang Syne," and finally made a short speech, the words being perfectly distinguishable to all the people present, who broke into prolonged applause, for which Mr. Watson returned thanks. Every experiment was successful, and the invention was subjected to severe tests.

We await, with much pleasurable anticipation, Professor Bell's introduction of the telephone to a New York audience.

Captain Eads' Success.

Captain Eads has received the first instalment, five hundred thousand dollars, in United States bonds, on account of the payment for his Mississippi jetties, which have proved, as we always predicted they would, a grand success. The United States ship *Plymouth* has passed through the line of jetties at low water, and is the first war vessel to traverse the new channel. She drew seventeen feet of water, and the least depth found by the lead was eighteen feet. The passage of the upper jetties was made by the ship under full steam power in 8 minutes and 17 seconds. Between the jetties there is a channel twenty-four feet deep and two hundred feet wide. At the head of South Pass there is a minimum depth of twenty-seven feet. On the charts of 1873 the last-mentioned sounding was but fifteen feet; and at the mouth of the Pass, at mean low water, the lead showed but three, four, and seven feet.

THE "LITTLE SPEEDY" CORN SHELLER.

We illustrate in the annexed engravings a new and handy little machine for shelling corn, which, judging from the inventor's statement of its capabilities, is quite certain to meet with a ready welcome from farmers and poultry raisers. It is claimed to shell from ten to twelve bushels of ears per hour. It adapts itself to large and small ears, and is equally effective whether the latter be green or dry. It does not break cobs or corn, is strongly constructed of metal, is not liable to get out of order, weighs but eight lbs., and is easily attached to the grain receptacle by inserting the wedge, shown at A, in the perspective view, Fig. 1. The working parts of the device are represented in plan, Figs. 2 and 3, and in section, Fig. 4.

The upper portion, B, of the machine is movable, and is rotated about a vertical axis by the bevel gearing and crank shown. The lower part is stationary, so that in this portion the cob is held immovable while the grains are stripped from it by a device placed in the revolving upper part. The holding apparatus is shown in Fig. 2. C are sharp-edged wheels upon swinging arms, which are held up to the cob by the springs, D. Said arms are mutually braced and caused to adjust themselves simultaneously by the curved pieces, E. The construction of this arrangement, as well as its relation to the stripping device, Fig. 3, will be clearly understood from Fig. 4. The strippers are pivoted in the upper portion of the machine, and have springs, F, to hold them to their work; and their inner extremities are suitably fashioned and sharpened for quickly detaching the grain. They also, and for the purposes already mentioned, are mutually inter-braced.

The machine can be operated by any one, without instruction. The ears are inserted above and held in the hand until seized by the holding device. The wheels on the latter, revolving, allow the cob to pass downward, but of course prevent its turning; while the stripper, as the ear descends, removes the grains. There is no necessity of touching the ear after it is once gripped; and thus, while the right hand turns the crank, the left hand is free to feed in the corn as quickly as may be.

For further particulars, regarding agencies, purchase of rights, etc., address the inventor, Mr. Curtis Goddard, Alliance, Stark county, Ohio.

A MACHINE SALESMAN.

Among the ingenious devices for gathering small change from visitors to the Centennial were several curious mechanical toys, which the inventor placed in the halls of the principal hotels near the grounds. Each consisted of a case having a glass front through which a miniature scene was visible, the trees, houses, figures, etc., being neatly painted and cut out of pasteboard. Over the box was placed a request for the visitor to drop in a five-cent piece at a slit in the side and witness the performance which would thereupon take place. When the coin was inserted, on its passing into a receptacle beneath, it struck and released a detent; clockwork was thus allowed to act, and the figures were set in motion to represent a trotting race, fox chase, or some similar proceeding. The device had places for advertisements; and what with his returns for displaying them and from the very many five-cent pieces which entered the till, we were informed that the enterprising exhibitor cleared quite a large sum of money.

The invention herewith illustrated, while being somewhat on the same principle as the above, is a decided improvement thereon, as it gives the donor of the coins a return for his expenditure in the shape of a photograph card or picture, which is prominently displayed, and which he is induced to purchase by the announcement that on his inserting so many pennies into the slit the object will fall into his hand. It is impossible to remove the card until the requisite number of coins is inserted, nor can the mechanism be operated by any instrument introduced in the slit, so that the "machine salesman" is automatically honest. The construction of the invention is clearly represented in the sectional view, Fig. 2. On the top of the till or money chest is a hollow column, A, which supports the box in which the cards or photographs are displayed, said box having a glass face. Entering the column near its base is the money conduit, which extends upward spirally and, for the sake of symmetry, has an orifice at each side of the column, A. As a coin is dropped into this tube, it descends; and just before it enters the column, it strikes the end of a pendulum lever, B, which is suitably counterweighted to hold it up to the tube orifice, and which is forked above its pivot to engage a toothed wheel, C, Fig.

3. This arrangement is similar to the escapement in clock trains. The wheel, C, has as many notches as there are coins required to be introduced to cause the removal of one card. On the shaft of the escapement wheel is a ratchet wheel and pawl, also a cam wheel, D; and said shaft is actuated by a cord wound about it, which connects with a spring, at E, Fig. 2.

The cam wheel, D, has a shoulder, against which bears the

notches. As each coin introduced swings the lever but once, it is evident that six coins must be inserted in order to cause a complete revolution of the wheel shaft and one retraction of the spring bolt. There may be a greater or less number of notches as desired, as it is evident that by this means the price asked for each card is secured.

The invention may be used for distributing advertisements, or it might be employed for selling newspapers which could be uniformly folded and inserted. It also might be useful for collecting fares from street car passengers, giving each person a ticket in return, which the conductor might collect.

Patents in the United States and foreign countries have been secured through the Scientific American Patent Agency. For further particulars, address the inventor, Mr. William Alexander Brice, care of R. Clifford Poulter, 4A Middle Temple Lane, London, E.C., England.

New British War Steamers.

The Dreadnought, double turret ship, lately went out of Portsmouth harbor for a preliminary trial under way of her machinery, which was under the sole control of Mr. Robert Humphrys, of the contracting firm. Everything passed off with the greatest success. The blast was not once used, nor was it considered necessary to remove the ashes to increase the draught. The engines easily realized sixty-nine revolutions a minute, while the power developed was considerably over the contract power of 8,000 horses. The speed obtained was about fifteen knots an hour. The ship was so sensitive that she readily obeyed the slightest touch of the helm. Six hours' trial was made in very boisterous weather. In running up and down the measured mile course the ship was on several occasions timed, when it was found that a mean speed of 14½ miles had been obtained. This was highly satisfactory, but even better results will be obtained when the mile trial is made. The draught of the ship was only 21 feet 11 inches forward and 24 feet 6 inches aft, whereas her estimated load draught when ready for sea is 26 feet 8 inches forward, and 27 feet 2 inches aft. As the trial was not only for the purpose of enabling the contractors to obtain the covenanted horse power out of the engines, but also for the purpose of ascertaining the consumption of coal in proportion to power, the boilers were easily fired in

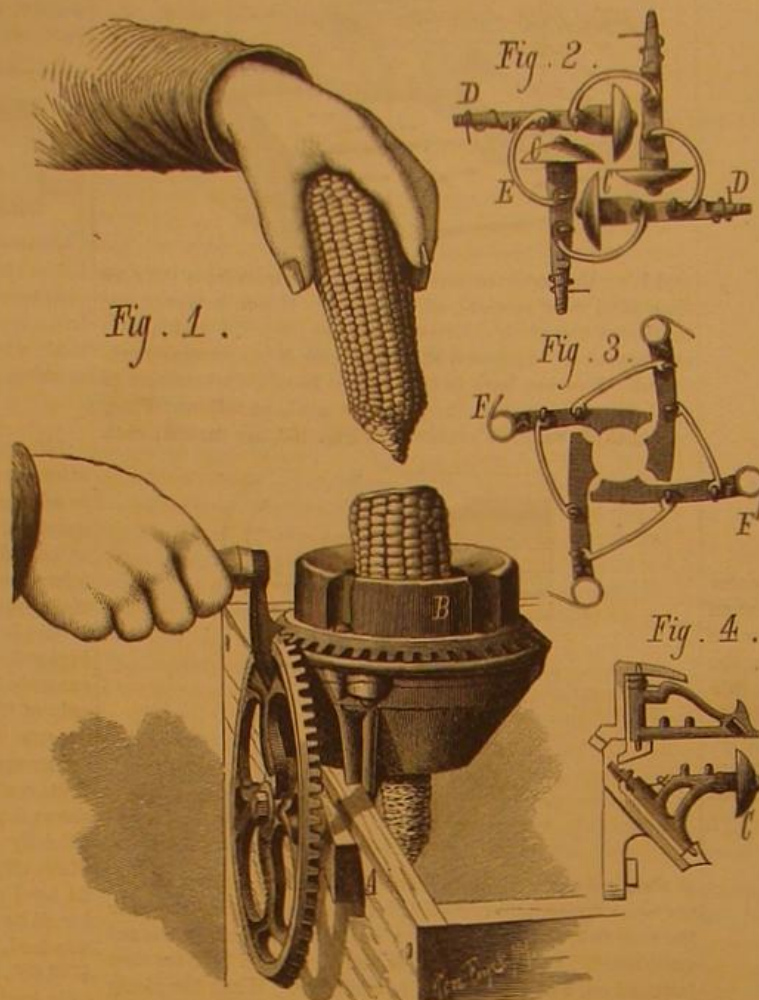
order to keep down steam. This was rendered all the more necessary in consequence of the boisterous character of the weather, for no sooner did the ship give a lurch or indulge in a roll, which she did whenever she went about, than the spring safety valves lifted, and the steam escaped with a rush. With smooth water, consequently, it is very probable that even better data would have been obtained.

The Thunderer, double turret-ship, was also tried recently at Portsmouth in boisterous weather. The great difficulty experienced was to prevent the engines developing superfluous power, there being neither hot bearings nor priming, nor trouble of any kind, to impair the working of the engines during the six hours. For the first four half hours the revolutions were purposely kept down; but when the blasts were applied, the arrears of power were so rapidly worked up that it was subsequently necessary to ease the machinery somewhat. Even with all the care exercised, the power exerted on the 6th, 9th and 11th half hours exceeded 6,000 horses. The uniformity exhibited in the workings of the engines was remarkable. The difference in the total means of revolutions of the two pairs of independent engines was only 0.17 per minute. The amount of Nixon's steam navigation coals consumed during the six hours was 48 tons, or 8 tons an hour. This represents an expenditure of 3.14 lb. per indicated horse power per hour, a result which may be regarded as highly satisfactory from an economical point of view, considering the amount of useful work performed.

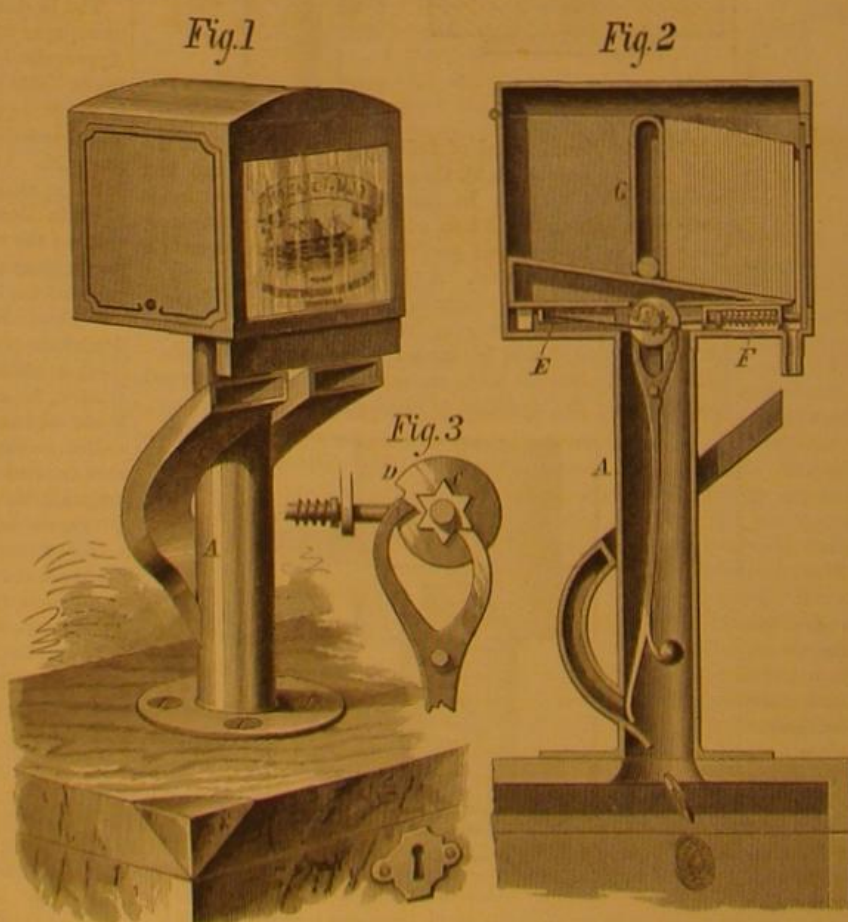
Testing for Boracic Acid.

Mud obtained from the bottom of a borax lake in California was found to contain a large amount of organic matter and sodium carbonate; besides these were found iron, alumina, lime, potash, and silicic, phosphoric, and boracic acids. Owing to the very large amount of soda present, it was difficult to test for boracic acid; but this was done at last by use of Mr. Hies' glycerin test, which we described at length on page 180 of our volume xxxiv., the ordinary methods having in this instance failed entirely to reveal the presence of this acid.

SAPOLIO contains (besides organic matter) soda, iron, alumina, lime, and hydrochloric, sulphuric, carbonic, and silicic acids.



GODDARD'S CORN SHELLER.



BRICE'S ADVERTISING MONEY BOX.

roller on its lower portion. In this way, as the retracting of the bolt allows one card to fall out, another is at once pushed forward in its place against the glass.

It will be observed that the escapement wheel has six

THE HARPY EAGLE.

Sitting motionless on the ground in the corner of the eagles' cage, in Central Park, New York city, is a curious bird which, at first sight, visitors mistake for an owl, and wonder why it is confined among the more noble birds of prey and apart from its own species. The creature rarely stirs from its favorite corner. When food is offered, or when some one of the eagles ventures to approach it too closely, it erects a tuft of feathers on the back of its neck, and twists its head about with a rapidity that shows it, despite its sleepy attitude, to be keenly on the alert. The eagles, even the huge bald-headed monarchs of the air, cherish a wholesome respect for the formidable beak and huge talons, and permit the uncommunicative stranger to continue its ponderous thinking without intruding on its meditations.

The bird is a harpy eagle (*harpia destructor*), and is probably, next to the condor, the most dangerous and ravenous bird of prey indigenous to the New World. It inhabits the tropics between Mexico and the southern part of Brazil, and abounds in great numbers in the warm regions in the interior of South America. In size it is smaller than the condor, but larger than the true eagle, and stands as a kind of connecting link between the latter and the buzzards. The characteristic features of the bird are well shown in the engraving presented herewith. The beak is strong and curved, and the tail long; and the wings are of medium size. The back, wings, upper chest, and neck are grayish black, the tail is black with whitish cross bands, the lower chest and abdomen are white, and the claws yellow.

Unlike the condor, the harpy avoids high mountains where the air is rare and cold, and dwells in dense forests or on the shores of large bodies of water. Its food is small animals, especially monkeys. Regarding its eggs or its breeding habits, but very little is definitely known.

Boiler Explosions.

A correspondent who signs himself A. O. K., thinks that E. G. A. undervalues the average engine tender, and states that, although men in charge of stationary engines are frequently illiterate, their practical knowledge, gained by experience, should protect them from the charge of ignorance. He admits that there are many men employed in this important position who are unqualified to assume its responsibility; and it is the engagement of such men which renders the use of automatic alarms, etc., necessary; and he cites the case of a recent explosion which would certainly have been prevented if such an alarm had been attached to the boiler.

Capital and Labor.

The best and sweetest friend of the laborer is economy. Save a little every day, lay it by, and it will soon become self-accumulating, by the safe and generous principle of compound interest. It is astonishing, with such a habit once formed, how soon the laborer may find himself enjoying all the pecuniary facilities which he has been in the habit of envying in the capitalist. We know that such a course involves self-denial, no indulgence in liquor, no sacrifice to superfluous fancies, no riotous living; but yet it does admit of all necessities and the intelligent cultivation of the mind. Indeed, this last purpose should never be lost sight of. If we know how to spend less than we receive, we have the philosopher's stone, says the stoic. Anything which is not absolutely needed is dear, no matter what the price may be; or, in other words, nothing is cheap which is superfluous.

Extreme measures defeat themselves. If, by any extraordinary combination, workmen should succeed in establishing five hours per day as the legal representative of a day's labor, is any intelligent person so blind as to suppose, for a single moment, that the laborer has really and pecuniarily benefited himself, though he gets as much for his five hours as he did formerly for ten hours of faithful work? The truth is very simple; he who runs may read. The man's dollars,

which he receives for circumscribed production, are worth just so much less as the amount of labor which he gives for them is diminished, and he will inevitably find their purchasing power to be in that exact ratio. Money is but the circulating medium; his labor is the real criterion of value. The loss of five hours, more or less, as the case may be, is just so much loss of real wealth in the world; and so long as the workman lives he is as much a loser as the capitalist who employs him. Of course five hours will not produce so many shoes, hats, or potatoes, consequently it will require more of those dollars to cover his feet and head and feed him. A suit of clothes will cost him just so much more in proportion as his limited industry shall diminish the value of his dollar.

All associate interests, to be lasting, must be upon an equitable basis. The bargain that is one-sided and unreasonable can never be made to stand; all the legal documents that could be drawn upon that basis would be as naught. The laws of compensation are inevitable, and the rule of justification will come in, by and by, and assert itself. Em-



THE HARPY EAGLE.

ployers and employed, master and men, are equally amenable to this great and good law of Providence. Be sure there is always a third, silent party to all of our bargains.—*American Cultivator.*

Postage Stamp Frauds.

In reply to a paragraph recently published in these columns, suggesting the importance of discovering some new invention by which the fraudulent washing of postage stamps can be prevented, we have received many replies. A variety of novel plans for accomplishing the desired end have been presented to us, together with several very old ideas. For the benefit of those of our readers who may still be studying upon the subject, we would say that the following plans are old, and time spent in their re-invention is wasted:

1. The printing of the postal stamp in ink that washes off when moisture is applied to the face of the stamp.
2. Cancellation of the stamp by means of indelible ink.
3. Cancellation by means of a cutter stamp that cuts the face of the stamp.
4. Coupon stamps, one portion of which adheres to the letter envelope, while the other portion or flap is ungummed and is torn off as a cancel in the post office.
5. Translucent stamps gummed upon the face, and secured face down upon the envelope, so that, if the stamp is removed by moisture, the ink leaves the stamp and adheres to the envelope.

The spurious 5 cent piece which has recently been extensively circulated was found to be composed chiefly of tin and antimony, with an appreciable amount of copper.

Planing Mill Machinery.

Mr. F. H. Morse says, in continuation of his article in the *Northwestern Lumberman*, published in our last week's issue:

Following up the history of the planing machine after Bentham's patents of 1791 and 1793, we come to that of Joseph Bramah, granted in 1802, which related to the transverse, or what is better known in this country as the Daniels planer. This is in fact the only true planer, or, in other words, the only one which produces a perfectly plain surface; but its use in this country is very limited as compared with the parallel planer, it being employed only for making lumber perfectly true, or "out of wind," as it is termed.

From 1810 to the time when the Universal Exhibition was held in London, in 1851, the building of planing machinery in England made but little progress, and it might almost be said that this branch of engineering science lay dormant in that country for forty years. In 1844, William Furness, of Liverpool, bought nearly all the machines manufactured by C. B. Rogers & Co., of Norwich, Conn., conveyed them to England and there patented them. Little benefit, however, was ever derived from these ventures either by himself or his country, as they were not at all adapted to the English trade. From 1830 to 1855 American mechanics and inventors made many improvements in the style and the construction of machines for planing wood, among which the great Woodworth and Woodbury patents are the most noticeable. As they are doubtless familiar to every planing mill owner and operator, it is unnecessary for us to describe them here.

For the past fifteen years the aim of manufacturers has been to perfect the parallel planer, and to-day it is without doubt the most perfect woodworking machine in the country. As it is the style chiefly used in our planing mills, these remarks will be mainly confined to this class.

Under this head we will first notice that somewhat peculiar style of machine known as the chain bed planer, invented first about twenty years ago by Farrar, whose purpose was to avoid the Woodworth monopoly. It is undoubtedly the most extensively used of any one side or single planer built, and the principle is frequently employed for double or two cylinder machines with good results where the material worked is not less than $\frac{1}{8}$ or $\frac{1}{4}$ inch thick; for thinner than this they give some trouble, as the last board put in has to push the preceding one

through between the dead plates and bottom cylinder; and if there is not considerable end surface to the boards, they slip past each other, causing much annoyance and sometimes endangering the safety of the machine. One great advantage gained by the use of this style of feed is that lumber can be planed in almost any condition, even if wet or covered with ice or snow—a quality which roll feed machines do not possess. For single side planers we would recommend for general work the chain feed as superior to any other; but for two-cylinder machines, unless used entirely upon heavy work, the roll feed is the best. Of these two classes there are some excellent machines built by our American manufacturers.

In regard to the care of a chain feed planer, we remark that, in starting a new machine, much attention should be given to the wearing parts of the bed and its bearing bars to prevent abrasion as, if this evil once commences, it can never be stopped. Powdered plumbago (black lead) mixed with oil is the best lubricant that can be used to prevent it. The bearing bars beneath the bed should be faced with highly tempered steel; the traveling bars should be made of chilled iron, the straps of the best grades of Norway or Swedish iron, and the rivets of steel. Great care should be exercised in the manufacture of these parts, especially such portions of them as are exposed to wear, as they are often required to work under heavy pressure, covered with dust and with but little chance for proper lubrication; and, if they are not well constructed and cared for, they will prove a continual source of trouble and expense.

Next in order comes the matcher. This has undoubtedly been made in a greater variety of forms to accomplish the same result than any other woodcutting machine in use. There seems to be nothing like a standard for any one of its parts in existence; each builder designs his machine seemingly with no other purpose than to make it as much unlike that of his predecessor in the business as possible. At least such is the opinion one would naturally form from an examination of the different patterns which are offered for sale in this country. They are built with two, four, six, and eight feed rolls, from four to fourteen inches in diameter, as extremes, the large ones sometimes fluted and the small ones with smooth surfaces, and *vice versa*. We find cylinders varying from four to ten inches in diameter, some with two, some with three, and some with four knives, which are attached in divers ways. In one style they are inserted in the cylinder with their cutting edges projecting past its turned surface; in another they are keyed to the cylinder, and in a third bolted upon it. Again in some machines the cylinder is round, as its name would indicate, and in others rectangular and triangular. The cylinders, too, are made of various materials, the most common of which are wrought iron, cast iron, and brass. In matcher side cutter heads, we find that the same dissimilarity prevails. They are made to carry from two to five cutters. These are in some cases solid, and in others in sections; in one machine placed with the beveled side of the cutter out, or next to the work, and in another in the opposite positions; sometimes straight, and frequently with an edge forming a quarter of a circle, and all these different classes are at work on the same kind of wood and under like conditions.

From all this diversity it would naturally be inferred that the manner of constructing a planing machine was of minor importance, or had not received the attention it deserved; but there are, notwithstanding, machines built which are very nearly perfect; and if an operator understands what is demanded for different kinds of work, and under different circumstances, he will have no difficulty in procuring a flooring machine that will almost exactly meet his requirements.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT BOBBIN AND SPINDLE.—*OLIVER PEARL et al. vs. THE OCEAN MILLS et al.*

[In Equity.—Before Shepley, J.: Decided January 2, 1877.]

Reissued Letters Patent, No. 6,995, were granted to the complainants September 1, 1874, for an "improvement in bobbins and spindles for spinning machines." The bill in this case is brought for an alleged infringement of the reissued letters patent.

Held by the Court: Prior to the invention of Pearl unsuccessful attempts had been made to reduce the weight of the ring spindle and bobbin in general use, and thus diminish the amount of power required to run them. The patentee effected this desideratum by making the blade shorter than the bobbin, which was provided with a bearing therefor in the center. The bobbin was made light and a plug or bushing inserted in the upper end to strengthen it. The upper bushing forms no function in the combination of the bobbin and spindle, and the words "the described bobbin," occurring in the claims, must be construed not solely with reference to the words in the specification, but with reference also to the limitations in the context of the claims.

When, in the specification of the original patent, the inventor describes a new and useful combination of a number of ingredients, performing, in combination, certain functions less than he has claimed, he may in the reissue claim such combination of the less number which he has described, suggested, or substantially indicated as his invention, but failed to include in his claims.

A reissue need not describe the invention in the exact language of the original, but may contain a more full and exact description of what was therein imperfectly described.

More change of form or location in a mechanical structure is not the subject of a patent without showing that some new or materially improved result is obtained.

The greatly improved result attending a change in the form or location of parts, when viewed in connection with the failure of the many experiments previously made to accomplish similar results by mere structural changes, has a great tendency to prove that they involve some functional difference beyond mere mechanical perfection and adjustment.

[*Benjamin F. Thurston, D. Hall Rice, and Charles E. Pratt, for complainants; Chauncey Smith, James J. Storror, and William W. Swan, for defendants.*]

NEW BOOKS AND PUBLICATIONS.

THE ART OF PROJECTING. A Manual of Experimentation in Physics, Chemistry, and Natural History, with the *Porte-Lumière* and Magic Lantern. By Professor A. E. Dolbear, Tufts College. Illustrated. Boston, Mass.: Lee & Shepard.

The book whose title we have above is one which has long been called for, and which well supplies a want which has been felt for many years. During the last fifteen years the magic lantern and solar microscope have been gradually developing from what might be very appropriately called their infancy, when they were found almost only in the nursery as toys for children or elsewhere as means of mere amusement. During those years these instruments have been occupying an ever wider and wider field in the school room, the lecture room of the college, and the public lecture hall, and a mutual influence has reacted between these means of illustration and the methods of instruction for which they were best fitted; by which the character of such oral instruction has been modified and developed, and its enlarged requirements have called for and obtained a constant enlargement in the capacities of these instruments, until to-day we find in what the author of the above work calls "the standard lantern of the country," namely, the "College Lantern," manufactured by Messrs. George Wale & Co., of Hoboken, a complete outfit, by which an extended course of instruction in Science can be illustrated with a fulness and brilliancy that was not dreamed of a dozen years ago. The art of projection has thus come to be a matter involving much of detail in reference to the adjustment of apparatus and the management of experiments, and yet beyond the meager directions contained in the catalogues of manufacturers, nothing in a collected form has been published on this subject. Isolated papers have, it is true, appeared in various periodicals, and we among others have published many such; but such scattered information in no way fills the want which every experimenter and instructor feels of a handbook which shall give him full directions, systematically arranged, for every part of his work, and which shall supply him with suggestions for the subject as well as the method of his illustrations. All this the volume before us supplies in an admirable manner. It opens with clear and concise directions for making, at little cost, such a simple *porte-lumière* as should answer the requirements of any one not able to procure a more perfect instrument. The darkening of the room and arrangement of the screen are then described. Next follows the description of artificial sources of light, including the electric light, the oxyhydrogen, the oxyacetylene (so called), the magnesium, and finally oil and gas lights. Lanterns are then described, and next lenses, and then the subject of "projections" in general is extensively treated, including the ordinary projection of images of transparent objects or pictures with a lens, the projection of shadows from large pieces of apparatus, the projection with the microscope or by reflection from opaque objects, and the use of the vertical lantern of President Morton. What we have noticed so far occupies the first 45 pages of this book, the remaining 115 pages being devoted to the description of countless beautiful and instructive experiments to be performed with the instruments above described. These experiments are classified and made easy

of reference by arrangement under the following heads: Physical experiments (that is, in molecular physics), acoustics, light, heat, magnetism, electricity, and chemistry. The fulness of this collection is very remarkable, and we are quite sure that an experimenter might occupy himself daily for a year if he only repeated once every experiment the details of which are here given. One of the merits of this collection is that it not only gives the author's own experiments, but embraces all that have been published on the subjects involved. As the author is not writing a history of the art, he is quite excusable for omitting all reference to the authorship of the various experiments which have been published by others; but any one interested in the subject will recognize many which have first appeared in this journal, and will thus recognize how much the "art of projection" owes to one of our frequent contributors.

THE NEW FORMULA FOR MEAN VELOCITY OF DISCHARGE OF RIVERS AND CANALS. By W. R. Kutter. Translated by L. D'A. Jackson, A.L.C.E. Price \$5. New York city: E. & F. N. Spon, 446 Broome street.

Mr. Jackson is already well known to hydraulic engineers through his "Hydraulic Manual," a very excellent practical work which has already run through several editions. The new book, which he has translated from a series of papers by Herr Kutter, will, we think, also prove of much value to the profession. Mr. Jackson points out that all "the old velocity formulae both for open channels and for pipes have been proved to have no claim to general application; and as a consequence of the dearth of hydraulic observations of modern date, the hydraulician is recommended to use variable coefficients of mean velocity of discharge, to be chosen in accordance with the circumstances of each special case." The new formula of Herr Kutter, however, is based on the experiments of D'Arcy, Bazin, Ganguillet, Humphrey, and Abbot, and on his own investigations, and hence is considered to be of great practical importance, inasmuch as it supercedes the unreliable formulae above referred to. The text of Mr. Jackson's work, which bears the marks of careful editing, relates to flow in open channels generally, and flow in open channels in earth. The book contains numerous tables, besides plates.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CULTIVATOR.

Thomas R. Landon, Sladesville, N. C.—This improved cultivating plow for cotton, corn, and other plants, is so constructed that it may be readily adjusted for use as a scraper, a sweep, and as a dirter, as may be required. The rear ends of standards are bent to the rearward, to form feet or have feet attached to them to strengthen them, to enable the plow to be more easily held, guided, and controlled. The rear ends of the feet are bolted to the lower ends of the rear standards. The upper parts of the standards are bent inward at right angles, are slotted longitudinally, and are secured to the beam by a bolt, so that, by loosening the bolt, the rear standards may be adjusted, as required, to correspond with the adjustment of the forward standards, and to cause the plows to throw more or less dirt, as may be desired. To adjust the plow as a double dirter, the standards and their attached plow plates are exchanged.

IMPROVED SULKY PLOW.

Charles Reed Conway, Midway, Wis., assignor to Jane Eliza Conway, of same place.—In this sulky plow, the draught is applied to the sulky, instead of being applied directly to the plow beam. The wheels are made large, and revolve upon the journals of the axle. To the middle part of the axle is attached the tongue, which is strengthened by the braces or bounds, and to which is attached the double tree. The standard is made higher than usual, so that the plow may not be liable to clog with rubbish. The plow beam passes through slots in hangers attached to the tongue in front and rear of the axle to keep the plow in line, and enable it to be guided by the sulky. The draught strain upon the plow is supported by a pin that passes through the beam in front of the forward hanger, and the sulky is kept from moving back upon the beam by a pin passed through the said beam in the rear of the said hanger. Rollers are placed upon the pins to bear against the hanger, to diminish the friction as the plow beam moves up and down within the slot of the said hanger.

IMPROVED TURF AND GRUBBING COLTER.

Samuel M. Lovell, Shady Grove, Va.—This invention furnishes an improved colter for cutting turf or sod, to enable it to be turned by the plow, and to cut off roots that may be in the ground and that would obstruct the plow, and which shall be simple in construction, easily kept in order, and of light draught.

IMPROVED FRUIT CRATE.

Roderick G. Ross and Francis A. L. Cassidy, Wilmington, N. C.—This invention is an improvement in the class of folding fruit and vegetable crates, and relates particularly to the mode of hinging the top and bottom of the crate to the bent portion of the rods by which the sides are pivoted together, and also to the means for both securing the cover and bottom closed, and holding the crate distended.

IMPROVED ANIMAL TRAP.

Zachariah J. Anderson, Dallas, Texas.—This invention consists in the combination of a hemispherical cage, a central standard, and a base piece, so arranged that the cage may slide on the standard, and may be held at the top of the standard by a trigger that engages with a ring at the top of the standard. The trigger is tripped by a chain to which bait is attached. The circular base piece of the trap may be made of any suitable material. It is rabbeted at its edge to receive the upper portion of the trap, and is bored centrally to receive a standard, which is secured thereon by nuts that are secured on the rod, and clamp the base piece. An eye is formed at the upper end of the rod, for convenience in handling, and also for receiving the trigger that supports the cover or cage. The hemispherical cover or cage is made of wire, and is provided with a cap or top piece of sheet metal, which consists of two concave pieces attached to the top of the cage, having their concave surfaces placed together, and each provided with a central aperture that fits loosely on the standard. A short section of tube attached to the lower piece forms an additional guide for the cage. A trigger is capable of hooking into the eye. The lower end of the trigger is bent to form nearly a right angle with the upper part, and is connected to a chain that is provided with a bait hook, and also with a guiding ring that slides on the standard. A dog is jointed to the top piece and is capable of clamping the standard, so that the cage cannot be raised without first turning the dog back. There is a handle for raising the cage. The trigger, when the trap is set, hooks into the eye. Any attempt to remove the bait from the hook trips the trigger, allowing the cage to fall upon the base piece. The dog prevents the imprisoned animal from raising the cage.

IMPROVED CORN PLANTER.

Thomas C. Young, St. Charles, Iowa.—The supporting frame of this corn marker is revolved by two horses and a driver. It rests on broad hind wheels and on curved furrowing pieces that are arranged in front of the seed boxes. The wheels are placed stationary on a square axle, and are coupled or uncoupled by a clutch mechanism that is moved along the axle by means of levers operated from the driver's seat. The seed boxes may be worked separately or jointly, according as one or both clutches are thrown into gear with the wheels. When one box only is required to drop, the opposite clutch mechanism is thrown out of gear, and when both are desired to be interrupted, for turning or otherwise, both clutches are thrown out of gear with the wheels. To the sliding sleeve, operated by the lever, are applied diametrically extended arms that curve at the outer ends. These arms revolve with the axle when the clutch is thrown into gear, and engage the rectangularly bent ends of the curved rods of a rock shaft, so as to raise and drop the same, and operate thereby, by fixed diametrical arms, the top and bottom slides of the seed-dropping tube. The slides are so arranged that when one opens the seed-dropping tube the other closes

the same, which produces alternately the filling and discharging of the tube. The planter is thrown in or out of gear with the wheels when the revolving arms are in nearly horizontal position, the marker rods being thereby also in a position so as not to interfere with the propelling of the planter.

IMPROVED GRAIN DRILL.

James R. Roe, Fairville, Mo.—This drill is so constructed that it will not clog with trash, will adjust itself to an uneven surface of ground, will sow the seed evenly and uniformly, and may be easily operated. It contains a number of new features in its mechanical construction.

IMPROVED THRASHING MACHINE.

George H. H. Miller, Oregon City, Oregon.—The novel feature in this machine is the feed table, which is placed upon the forward end of the frame and is secured in place adjustably by bolts, so that it may be moved forward or back, according as the stalks of the grain may be longer or shorter. To the table are pivoted two feed rollers, the lower one of which is ribbed or corrugated. The journals of the upper feed roller revolve in slots, so that it may rise to adjust itself to the thickness of the grain, and it is held down to its work by spiral springs. The feed table is also provided with an endless belt carrier for feeding purposes.

IMPROVED ROTARY STALK CUTTER.

Orson D. Johnson and John F. Bracket, Mount Palaski, Ill., assignors to themselves and C. C. Mason, of same place.—This is a new machine for cutting stalks into pieces, so that they may be plowed under to fertilize the soil, and not impede the operation of plowing. A drum presses the stalks down and then knives arranged in slots in the periphery of the former are vibrated longitudinally to cut off the stalks. Attachments are provided for raising the drum when desired.

IMPROVED PEANUT CLEANER.

Daniel R. Rivers, Centerville, Tenn.—This consists of a hopper and cylindrical perforated sheet metal revolving screen, having longitudinal rows of large holes to let the stones and dirt out.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SPRING BACK FOR WAGON SEATS.

John W. Wood, Owatonna, Minn., assignor to himself and C. Schoen, of same place.—This is an improvement in springs for connecting the back of a wagon seat with the arms. The back and arms have hitherto been connected by a curved plate spring, or the arm itself has been made in the shape of a coiled plate spring, or the arm has been made movable, being held by a surrounding coiled spring. These springs are found in practice to be often fractured in frosty weather by a sudden jar; and in order to avoid this, as well as to make a cheaper spring, the present inventor constructs this connection of rubber, making it flat at each end, so that it may be readily fastened between plates at the arm and back, and preferably make it stouter in the middle, to lessen its liability to break at that point.

IMPROVED AUTOMATIC SEWER TRAP.

John Peter Schmitz, San Francisco, Cal.—A vertical perforated partition divides the cesspool into two compartments. The street gutters discharge into one compartment, and the water passes through the perforations into the other, leaving the solid matters behind. A weighted valve closes the mouth of the sewer, but it is opened (to allow escape of water) by a float which is raised when the water accumulates in the second compartment.

IMPROVED SAW SET.

Christopher Heinen, Leavenworth, Kan.—This improves the construction of the saw set for which letters patent were granted to the same inventor August 8, 1876, to enable the upper die to be more firmly held in place, and the saw plate to be more easily and accurately guided to the dies. The general construction is such that the saw plates are securely and firmly held, and will be moved squarely across the dies, so that the teeth may be accurately and evenly set.

IMPROVED WAGON END GATE.

Theodore L. Block, Sidney, Ill.—A cross bar retains this gate rigidly in position until, by lifting and withdrawing the bar, the gate sections fold in the center, and are, on detaching the side hooks, readily taken off for dumping or removing the load. The pressure of the load on the inside of the end gate assists the taking off of the same, as it facilitates the swinging of the gate sections on their hinge connection. The gate may thus be easily locked to the wagon body and detached with great convenience, without requiring separate cross rods or other detachable fastening devices.

IMPROVED DOOR CHECK.

Hiram Shunk, Davenport, Iowa.—This is a stop for holding doors or shutters open or shut; and it consists of a spring formed from a ribbon of steel, the extremities of which are attached to the wall, and the center portion bent into a threefold loop forming a spring clamp, which engages with the outside of a loop or knob attached to the door, retaining it with sufficient force to prevent the door or shutter from closing by a pressure of wind or other slight cause. The clasp thus formed presents rounded ends, which readily slip over the loop attached to the door, and press the smaller part of it with a force which retains the door, but which may be overcome by pulling the door. The ends of the ribbon forming the clasp are formed into ears, through which screws pass for securing it to the wall. The stop not only answers the purpose of holding the door, but it also serves as a buffer which prevents the door from striking the wall as it is thrown open.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HAT-BRIM-LURING MACHINE.

Ambrose Hill, Yonkers, N. Y.—This is an improved machine for luring the brims of hats, which shall be so constructed as to enable the work to be done well, and at the same time very quickly; and it consists in the combination of a hinged frame, spring, shaft, pulley, fly wheel, luring wheel, connecting rod, and treadle with each other, and with the frame for luring hat brims; and in the combination of the adjusting bar, the adjustable rest bar, and the detachable rest with each other, and with the frame for supporting hat brims while being lured.

IMPROVED MOTIVE POWER.

William W. Corey, Lisbon, N. H.—This is an improved mechanism for applying power to a hand car and to other mechanisms; and it consists in an improved motive power, formed by the combination of the four levers and the four connecting rods with each other and with the machinery to be driven. The form of the levers may be varied, as the particular use to which the power is to be applied may require.

IMPROVED RAILROAD SWITCH.

Ferdinando Luchini, Natchitoches, La.—In this switch the switch rail is operated by devices located upon the car. When the car is upon the main track and is going in the direction in which the switch rails point, the flange of the car wheels will push back the switch rail. When the car is passing from the main track to the side track, or from the side track to the main track, no movement of the switch rail is required.

IMPROVED DUST GUARD FOR SEWING MACHINES.

Albert A. Capeling, Rochester, N. Y.—This invention consists in an improved guard, cover, or case for the works of sewing machines, more especially for the Howe, Weed, and other machines having the stitch regulator located underneath the table. The guard completely encloses the works, and has a spring-closed door for permitting access to the regulator. The driving band runs through eyeleted openings.

IMPROVED VALVE SEAT.

Jacob F. Cook, Rockville Centre, N. Y.—This improvement consists in providing a valve seat of leather or other elastic or yielding material, placed in a channel cut in the bottom of the pump cylinder around the valve opening, or placed in a channel in an annular plate, which may also contain the packing for the lower end of the pump cylinder, and to which the valve may be attached. The object of this invention is to provide a valve seat which shall not readily wear, and which will permit the valve to close tightly, and which may be readily repaired. In applying this invention to new pumps, in the process of manufacture the valve seat or lower portion of the pump cylinder is grooved around the valve opening, and in it the rubber or leather valve seat is placed.

IMPROVED GRADING MACHINE.

Irven Coppock, Alba, Mo.—This is a machine to be employed for farming purposes, grading streets and roads, cutting ditches of all kinds, breaking ground for railroad cuttings, etc., and loading it at the same time directly on a wagon running in connection therewith; and it consists of an adjustable main frame supporting a plow that is raised and lowered thereon by suitable mechanism, and which throws, by a shovel or scoop-shaped mould board, the earth on an endless belt that is placed at suitable inclination, and driven by pulley and chain connection with the axle of the main wheels.

IMPROVED LOCOMOTIVE SPRING.

James Jenkins, Cortez, Nev.—In this invention the upper spring contacts with, and rests with its ends upon the ends of the lower. Median clips, employed to embrace the edges of springs, are connected by a spiral spring and internal flexible connection; while clips prevent lateral displacement between the middle and ends. Guide straps allow a free and independent movement to each of the springs upon the other, but not in a lateral direction.

IMPROVED LUBRICATOR.

George W. Gageby and William James, Johnstown, Pa.—This lubricator is for automatically lubricating the cylinders of engines; and it consists of two valves oppositely arranged upon the ends of a common stem, and provided with seats upon opposite ends of a chambered tubular conductor that connects the oil cup and steam chest, and is so arranged that steam pressure from within the steam chest closes the valve against the seat on the lower end of the tubular conductor, and a removal of the pressure from the steam chest allows the valve to drop and permits the lubricant to enter the steam chest.

IMPROVED KEY HOLE GUARD FOR LOCKS.

Calvin H. Corvill, Stockton, Cal.—In this invention the casing of a door lock is applied to the door by recessing the same from the inside to the thickness of the lock, so as to leave the door strong enough, and without being weakened to the same extent as by the common mortise lock set in from the edge of the door. A face plate closes the lock from the inside, and is attached to the door by fastening-screws. The sliding latch bolt is guided in the casing and operated by turning the knob spindle in either direction, being engaged by extensions of the guide socket of the knob spindle, the extensions bearing against the lugs of the recessed interior part of the latch bolt. The latch bolt is acted upon by a spiral spring, that throws the same instantly forward when the knob is released. The outer section of the latch bolt is screwed into the wider interior section, and may thereby be readily detached for the purpose of reversing the external section of the latch bolt according to the side of the door to which the lock is to be applied. The external section of the latch bolt is guided in a suitable metal lined recess of the door, the guide recess connecting the edge of the door and the lock casing. The spiral spring is placed outside of casing, and around the exterior section of the latch bolt, between the casing and the enlarged end of the latch bolt, which arrangement of bolt section and spring reduces the width of the casing, and admits the carrying back of the lock from the edge of the door, leaving solid wood where it would otherwise have to be cut away. A pivoted guard plate swings at the inside of the casing adjoining the wood, and closes, when placed in position by its operating pin, the lock against the introduction of a key or instrument from the outside. The pin swings in curved slots of the casing and face plate. The guard plate forms an additional safeguard against the opening and picking of the lock from the outside. The lock is, therefore, of special advantage for outside doors, hotel, and such other rooms that are desired to be secured from the inside.

IMPROVED APPARATUS FOR INTRODUCING POWDERED FUEL INTO FURNACES.

George K. Stevenson, Valparaiso, Chili.—The object of this invention is to introduce powdered or granular fuel, such as coal, coke, or similar hydrocarbons, to furnaces adapted thereto in such a manner as to insure a more perfect combustion and more intense heat than heretofore; and the invention consists in connecting the fuel tube with furnace by a sleeve and tube, the latter of which is provided with a twisted plate that is made adjustable, as hereinafter described. The fan heretofore used exclusively in the attempts to introduce powdered fuels has not given satisfactory results, on account of the uncertainty of the blast of the fan, except at a given high velocity, which circumstance has been the cause of either their failure or of greatly diminished value.

IMPROVED ATMOSPHERIC GAS ENGINE.

Joseph Wertheim, Bornheim, Prussia.—This invention relates to an improved combined atmospheric gas engine, in which the explosive force of a suitable gas and air mixture and the atmospheric pressure are utilized as motive powers; and it consists, mainly, of a cylindrical explosion dome, connected by a siphon pipe with a reservoir. In this pipe, but at its lower part, is a paddle wheel, arranged in a casing with curved chutes, on which the power of the explosion in the dome and of the atmospheric pressure created by the vacuum therein is exerted by means of water or other liquid. The explosion may be produced by a suitable mixture of illuminating gas and air that is admitted into the explosion dome, and ignited by a slide valve with an igniting mechanism. The explosion forces the liquid, through a double valve arrangement of the siphon pipe, paddle wheel, casing, and connecting channels, into the liquid reservoir at the end of the siphon pipe, and back again by the vacuum formed in the dome and pipe, imparting, by the forward and return motion, a continuous rotary motion to the paddle wheel. The liquid valves control the escape of the gases from the explosion chamber, in connection with the return of the liquid, by means of a slide valve and interior pendant float valves, any mechanically escaping liquid being returned by a small collecting chamber and pipe to the liquid reservoir. The regulating device is operated in connection with the fly wheel of the paddle wheel shaft, interrupting temporarily the explosions in the dome when the speed is too fast.

IMPROVED COMBINATION TOOL.

Isam U. Malphurs, Gainesville, Fla.—This is an ingenious combination of monkey wrench, gimlet, screwdriver, and pipe tongs or nippers. The lower end of the wrench bar forms one jaw of the tongs, the opposite jaw being pivoted to said bar. The end of the pivoted jaw handle is fashioned out into a screwdriver, and the gimlet is attached to the back of the movable jaw of the wrench.

IMPROVED COTTON CHOPPER.

John H. Gileland, Peak's Hill, Ala.—The new feature in this machine consists in two levers, which are pivoted, near their lower ends, to each other and to a cross bar of the frame, so as to work upon each other like the part of a pair of scissors. In the adjacent faces of the lower ends of the levers are formed half-round notches, which, when the said ends are closed upon each other, form a bearing for the forward journal of the chopping shaft, which may consequently easily be detached.

IMPROVED FRICTION CLUTCH.

Samuel Peppard, Okaloosa, Kan.—This is an improved device to take the place of cranks and pawls for transferring motion, which shall have no dead point, and will act at once when the power is applied. The side or face of the wheel or other object to be driven is made conical, to correspond with the faces of conical rollers, which revolve loosely upon the journals of an axle. The middle part of the axle is widened and has angles formed upon its opposite sides. The axle has a hole through its center, through which a shaft passes. The hub of a disk, to which power is applied, revolves upon the shaft. The face of the disk is made slightly conical, and has inclines formed upon it, so that when the disk is turned slightly in one direction it will be wedged by the rollers between the wheel and the ring, so as to carry the said wheel with it in its revolution.

IMPROVED CLAMP FOR HOLDING RATCHET DRILLS.

Louis Beland, North Springfield, Mo.—This is an improved apparatus for holding and feeding ratchet drills employed in drilling fish plates while in place on the rails. It consists of a clamp formed of two parallel bars of iron or steel, which serve as ways for a sliding nut, through which the clamping or feeding screw passes. The said bars are connected at each end with hooks of peculiar form, which are capable of engaging with the lower side of the rail. The nut carrying the feeding screw is capable of being adjusted to any number of holes within the limit of the length of the parallel bars.

IMPROVED CAR COUPLING.

Oliver Crum and Milton Crum, Monsey, N. Y.—This car coupling couples in reliable manner without danger to the attendant; and the drawhead has an inclined lateral locking piece. A swinging top hook is raised or lowered for uncoupling and coupling by a swinging bridge operated by a lever arm of the shaft of the coupling hook, so as to uncouple simultaneously the coupling. The interlocking hooks are readily detached in case one of the cars is thrown off the track. The drawhead also has considerable side play, and is capable of resisting more fully the concussion of the cars.

IMPROVED CHUCK FOR METAL-TURNING LATHES.

Jay H. Harris, Sacramento, Cal.—This chuck consists of a pair of jaws that may be made to project more or less beyond the lathe center, and which may be closed tightly on the shaft by a nut, which closes them by following their inclined sides. Dogs are placed eccentrically in the ends of the jaws, which prevent any slipping of the work. This device is quite simple, and is well calculated firmly to hold shafts and other objects to be turned.

IMPROVED DEVICE FOR DRAWING PULLEYS FROM SHAFTING.

Henry F. Casterline, Grand Detour, Ill.—In repairing shafting it is frequently necessary to remove the pulleys; but these after long usage often become set very tightly, so that to take them off involves the expenditure of considerable time and labor. The present invention suggests an ingenious device for the purpose, which consists of swinging hook levers that are forked and curved inwardly at the ends, which spring over the pulley. The levers are pivoted to a traveling screw head that serves to pull the pulley by a screw shaft. A loose pin is clamped into the socket end of the screw, and may be taken out and exchanged for others of different lengths, so as to bear on the shaft end and fit the lever hooks to the pulley, admitting the device also to be used as a jack screw by putting a plate at the center of the screw head.

IMPROVED COAL-HOISTING APPARATUS.

Guiseppe Pacl, New York city.—The object here is to hoist coal, bricks, and other articles from vessels directly into the carts by utilizing the power of the horses pulling said carts. There is an inclined endless belt, with step-shaped parts, to be operated by the cart-horse for rotating a drum, on which the hoisting rope is wound. The cord runs over guide pulleys of a supporting frame and of a bucket-conveying carriage, that locks and unlocks a fixed button in automatic manner to convey the load or lower bucket. The work of the endless stepping belt is stopped or interrupted by a lever actuating a double clutch and brake mechanism of the winding drum shaft. A weighted lever and swinging hub-locking standard secures the cart in stationary position while the horse is working.

IMPROVED TUBE SHEET AND FASTENING FOR TUBES OF STEAM BOILERS.

Daniel Hess, Greenville, Miss.—The object of this invention is to enable the defective fire tubes of steam boilers to be removed with convenience and dispatch, and without injuring the tube sheets. To this end, the patentee countersinks the holes or apertures in the tube sheets to receive screw nuts, which are applied to the ends of the fire tubes for securing or fastening them to the tube sheets.

IMPROVED SHACKLE.

Henry W. Dilg, Portland, Oregon.—This invention consists in constructing the shackle of two parts or curved bars having a loose jointed or detachable hinge connection at one end, and one of them made of angular form at the other end, whereby it is adapted to be locked to the companion bar.

IMPROVED MOUNTING FOR PORTABLE ENGINES.

Robert M. Beck, Westminster, Md.—This invention relates to an improved mounting for portable engines, designed with a view to simplicity, cheapness, and substantial construction; and it consists in the improved means of supporting the boiler and its engine upon wheels, and strengthening and bracing the same in its attachment.

IMPROVED CAR WHEEL CHILL.

William Wilmington, Toledo, O.—The object of this invention is to cast a wheel with such an arrangement of the chilled portion of the tread as would give the greatest wearing qualities, and at the same time preserve such form and amount of unchilled surface to the tread as will entirely, or to a necessary extent, relieve the tension which is the result of casting wheels with the entire face of the wheel chilled to a uniform depth. The improvement consists in constructing the chill with an inner recess at the outer edge of the portion forming the tread, and with a number of transverse grooves, running from said recess across the inner face of the chill, both of which grooves and recess are to be filled with sand or non-chilling material to conform to the face of the chill preparatory to casting the wheel.

IMPROVED WROUGHT IRON BRIDGE.

William H. Miller, Carversville, Pa.—This consists of a truss made of six-sided frames of iron placed upright in a line and clamped together. The top and bottom chords are provided and the structure is stayed with plates and braces in a manner calculated to make a light and strong bridge, capable of sustaining great weight, and being very stiff against lateral vibration.

IMPROVED STUMP PULLER.

Joseph Richter, Jordan, Minn.—This invention consists in the combination of a shaft, ratchet wheels, two pairs of pawls, connecting rods, chains, and holding pawls with each other and with the frame; in the combination of the cords or chains and the hooks with the pawls, the connecting rods, and the levers. When the rear ends or handles of the levers are raised, the weight of the rear pawls will hold both pawls in gear with the ratchet wheel; and when the rear ends or handles of the said levers are lowered the weight of the rear pawls will hold both pawls in gear with the ratchet wheels. By operating the levers, the shaft will be turned, winding up the chain, and drawing the stump. The shaft is held from being turned back by the resistance of the stump when the levers are being raised to make another stroke by the pawls, which engage with the teeth of the ratchet wheels, and are pivoted to and slide upon a rod, attached to the rear posts

of the side frames. The outer ends of the pawls project to serve as weights to hold their engaging ends against the teeth of the ratchet wheels, and as handles for sliding them away from the said wheels.

IMPROVED CAR COUPLING.

Charles G. Case and Daniel Gould, Davenport, Iowa.—This consists in a swinging and spring cushioned coupling hook, provided with an upwardly projecting shoulder connected with a top shoulder in the opposite drawbar by a swinging cam. When the cars approach each other the coupling hooks enter their corresponding cavities, and may then be locked by side levers. The uncoupling is also readily accomplished by swinging the cams down so as to release the hooks from the top shoulders of the drawbars.

IMPROVED COTTON PRESS.

Charles T. Mason, Sumter, S. C.—This consists in the arrangement, in a suitable frame, of two screws, each provided with a right and left hand thread, and two followers or platens, between which the cotton is pressed, supported upon, and moved in opposite directions by the said screws. The object is to throw the entire pressure of the followers on the compressing screws and thus obviate the necessity of making heavy and expensive press frames, and also to increase the rapidity with which the press may be operated.

IMPROVED AUTOMATIC BRAKE LOCK.

Garhard H. Roling, Bellevue, Iowa.—This wagon brake is operated automatically in going down hill by the neck yoke, and released by the strain on the whiffletrees when on level ground. The alternating application and release of the brakes by the automatic action of the horses, according to the nature of the ground, is thus produced in effective and reliable manner. The brake is also automatically released whenever the wagon has to be moved backward.

IMPROVED CRACKER MACHINE.

John Rannie and Alexander Rannie, Palmyra, N. J.—This machine is designed especially for use in the manufacture of what are known in the trade as "soft" goods, such as ginger snaps, lemon snaps, bon-bons, fancy dessert biscuits, etc. It may, however, be used with advantage for the manufacture of any kind of crackers. The construction is such as to prevent the dough from adhering to and clogging the cutters, to indicate the exact thickness of dough that is passing from the feed rollers to the cutters, to stamp the dough with various devices before it passes to the cutters, to enable the scraps to be readily separated, and to prevent the cakes of dough from turning over as they pass from the feed apron to the pans upon the delivery apron.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED TUNING PIPE.

William G. Cook, Jersey City, N. J., assignor to himself and D. M. Read, New York city.—The object of this invention is to furnish an improved reed instrument, which shall be so constructed that it may be adjusted to sound any note of the scale, and which may be used as a tuning pipe and as a toy musical instrument. The invention consists in the combination of the slotted sliding bar, having an index plate formed upon its outer end, the lever, and the pivoted fulcrum bar, with the slotted frame, the reed, and the case.

IMPROVED OIL STOVE.

Jacob M. Chamberlain, Albany, N. Y.—This stove, for burning kerosene and other oils, consists in the arrangement of an oil reservoir, provided with a space for water upon its upper surface, and an oven, and flues and dampers for controlling the direction of the smoke and utilizing the heat. It also consists in a vessel of peculiar construction for heating or cooking purposes.

IMPROVED REVEL.

Albert Devoe, Oneonta, N. Y.—This is an improved extension brace rule, by which the bevels at both ends of a brace, and the mortises for a brace, may be readily laid out at any angle of the same, the brace rule being also conveniently used as a mitring and try square. It is composed of sliding and slotted main pieces, that are connected by a guide and clamp screw, and provided with graduated end rules, which are adjusted on the main pieces by additional clamp screws.

IMPROVED BALE TIE.

John L. Sheppard, Charleston, S. C.—The buckle is approximately hook shaped, and pivoted to the band. The free end of the band is looped around the bent free arm of the buckle. In effecting the lock, the buckle is turned on its pivot, so that the loop of the band will slide under the bent end of the buckle arm. The tie is simple, strong, easily manipulated, and cheap.

IMPROVED UMBRELLA.

Emerson Folsom, Toledo, O.—This improved folding or telescoping umbrella or parasol may be readily arranged into small and compact shape for being conveniently carried, packed, or stored, or drawn out for use as a common umbrella or parasol, the mechanism being of simple, yet strong and durable, construction; and it has a telescoping stick and ribs that are locked by spring catches when drawn out for use, in connection with the runner and tip holder.

IMPROVED TYPE WRITER.

William H. Snider, Angus, Ontario, Canada, assignor to himself and Jonas T. Bush, of same place.—The object of this invention is to so improve the key levers for type writers that either a considerable reduction in the number of keys may be made, or the application of the keys be enlarged to a considerable extent, so that the speed of the type writer may be increased and the working of the same facilitated. The invention consists of a compound key lever, obtained by attaching a steel spring, with a type at the movable end, to the rear end of the same, and arranging one or more levers on the key itself, so that by depressing the key either the letter of the spring or the combination of spring and key letters be formed.

IMPROVED PAPER BOX.

Richard H. Foster, Gloversville, N. Y.—This invention relates to packing boxes for that class of gauntlets that are provided with stiff wrists; and it consists of a square box provided with internal corner pieces or blocks, and with a central elevated table at the bottom of the box, and a removable piece that is received by notches in the inner corners of the blocks, the object being to provide a box in which gauntlets may be packed without injuring the stiff portion of the wrist. The box and the corner pieces may be made from pasteboard, wood, or other suitable material. The advantage claimed for the invention is that gauntlets having stiff wrists may be packed in boxes of this description without injury to their form.

IMPROVED FEED BAG FOR HORSES.

George C. Booth, New York city, assignor to himself and Robert Gibson, of same place.—The mouth of this feed bag is attached to a band or hoop of wood or iron, to which is hinged a cover for closing the bag, and which, when the bag is in use, acts as a stay or brace for holding the bag in the required position, being hooked into the hame or breast straps of the harness. There is a peculiar arrangement of cords for sustaining the bag, by which it is prevented from swinging, and is held steadily. It is claimed that the bag is always in the position required for feeding; it throws no impediment in the way of breathing; it can be readily attached and detached; and it folds compactly with or without the feed contained. The annoyance to the horse of inhaling the dust of the feed is entirely obviated, and the head is relieved of the weight of the bag, giving freedom of motion to the horse's head, avoiding the wasting of feed by the movement of the head.

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More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 141.

Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

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It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

J. O.K. should read our directions for kalsomining on p. 133, vol. 34.—J. P. H. and F. M. S. will find some excellent directions for polishing wood on p. 315, vol. 30. For French polish, see p. 11, vol. 32.—A. E. R. will find a description of a caloric engine on p. 66, vol. 34. For cutting glass bottles, see p. 36, vol. 36.—E. J. and W. P. H. will find something on cleaning wool on p. 114, vol. 36.—R. R. will find directions for depositing silver on metals on p. 299, vol. 31.—J. C. should read Anichinloss on "Link and Valve Motions," to be obtained of D. Van Nostrand, 23 Murray street, New York city.—E. B. will find directions for making printer's rollers on p. 283, vol. 31.—M. E. G. will find a recipe for a bronze dip on p. 8, vol. 36. For a varnish for bronzed work, see p. 65, vol. 32.—N. will find directions for making hydrogen on p. 341, vol. 27.—L. W. V. D. will find on p. 204, vol. 28, directions for preserving natural flowers.—J. L. S. is informed that the garden box is the well known tree from which boxwood is obtained.—L. G. will find the definition of a horse power on p. 33, vol. 33.—W. B. E. will find directions for making a calcium light on p. 219, vol. 30.—A. F. B. will find something on bronzing door knobs on p. 283, vol. 31.—H. H. should apprentice himself in a good machine shop.—J. S. M. will find something on decalcomanie on p. 275, vol. 34.—S. J. T. will find directions for making impression paper on p. 333, vol. 31.—E. N. T.'s idea of light is the correct one. See p. 308, vol. 30.—J. P. F. will find a recipe for a writing fluid on p. 106, vol. 27.—W. A. M. will find a recipe for a rosewood stain on p. 154, vol. 30.—J. H. W. will find an article on refitting leaky cocks and plugs on p. 182, vol. 1, SCIENTIFIC AMERICAN SUPPLEMENT.—S. H. will find directions for making malleable cast iron on p. 138, vol. 29.—T. W. P. will find instructions for chasing a double thread off 1 inch pitch on p. 21, vol. 31.—J. C. G. can fasten ivory to wood with glue.—S. R. S. will find a recipe for copal varnish on p. 298, vol. 26. Fine gun stocks are French polished; see p. 11, vol. 32.—O. W. M. will find directions for silver plating without a battery on p. 299, vol. 31. For nickel plating, see p. 183, vol. 34.—T. H. will find directions for transforming cider into vinegar on p. 106, vol. 32.—C. H. B. can silver plate brass without a battery by following the directions on p. 299, vol. 31. For a gilding process, see p. 116, vol. 32.—P. J. will find directions for bronzing on brass on p. 51, vol. 33.—E. D. H. will find directions for preparing skeletons on p. 75, vol. 28.—B. E. C., A. J., W. C. F., R. B., S. J., F. H., C. A. K., R. T. W., F. W. H., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) M. S. T. says: We have a pump with 2 inches bore, 12 inches stroke. She has a 2 inch suction pipe discharging into a 4 inch discharge pipe and raises the water 60 feet before it empties. Are there not 2 inches more weight or 2 inches more water working in her discharge valves than she ought to have? A. No. The large pipe is an advantage, as it diminishes the resistance due to friction.

(2) L. C. F. says: Is there a varnish, and what is it, by which a bright copper kitchen boiler can be kept bright? A. Use a solution of light-colored gum anime and Venice turpentine in spirits of turpentine.

(3) A. M. C. asks: What preparation will take out the yellow stains in linen, caused by water running down a smoke stack where soft coal is burned? A. Rub well with a cloth moistened with oxalic acid and a little dilute hydrochloric acid, and rinse thoroughly in cold water.

(4) T. J. asks: How can I proportion silicate of alumina and silicate of potash to paint on brick or stone? How can I put a polish on them? A. Boil for one hour 1 part of water glass (silicate of soda or potash) in 6 or 7 parts of water, decant the liquid and mix it thoroughly with 2 parts of kaolin. The coating of this substance does not require polishing.

(5) W. H. T. says: Having seen several inquiries as to what would keep petroleum or kerosene from penetrating leather, etc., perhaps the following may be worth publishing: Mix glycerin and common glue, and apply to the leather by soaking or otherwise before the petroleum, etc., has been in contact with the leather. Before adding the glycerin, prepare the glue as usual with carpenters, and add glycerin as flexibility, etc., may demand.

(6) F. F. says: It is clear that the effects of cold on iron are not generally understood; otherwise, no one would build bridges out of solid metal. I have noticed that, in winter, when I dropped a heavy solid wrench, it would break in two like glass; but a wrench made of pipe would never break, no matter how cold it might be. If bridges were made of pipes, and had, for extra security, a wire rope on the bottom to stay them, they would be light, elastic, and durable, and much cheaper than the present ones.

(7) R. O. W. asks: Why does the wheel of a gyroscope while in rapid motion resist a force which tends to move its center in any direction other than in a straight line, except when moved in the plane of its revolution? Can you tell where an explanation may be found? A. The theory of the gyroscope has been admirably illustrated by analysis; but though many popular articles have been written to explain it, we have seen very few that give the reader much idea of the matter. One of the most recent, however (in the second volume of Johnson's "Cyclopedia"), is so simple and complete as to leave little to be desired. We could not easily give a synopsis of the explanation in these columns, and refer you to the work above quoted, where we think you will find satisfactory information in regard to your queries. See also p. 91, vol. 31.

(8) H. R. G. asks: A few days ago, a man drew a Derringer pistol of No. 44 caliber and shot another. They were, at the time of the shooting, about one foot apart. The pistol ball only penetrated the man's heavily overcoat, and fell to the ground, having only severely bruised the man. Does a pistol ball gain in velocity and force within a certain distance from the muzzle of the pistol, and then begin to lose its motion, or does it begin to lose its motive power the very instant it leaves the muzzle? A. It loses power from the instant it leaves the muzzle.

(9) J. L. asks: In the Gramme electric machine, what should be the diameter of the iron of which the ring, 5 1/4 inches in diameter, is made? A. About 3/4 inch.

(10) J. S. M. asks: How will a journal box for a lathe, of Babbitt metal instead of brass, work? A. It would not work so well as a brass box, but would answer.

What is the best substance for grinding glass for lenses? A. See p. 363, vol. 31.

(11) T. T. R. says: I wish to know if malleable cast iron will answer for electro-magnets when it is desired to excite and destroy the magnetic force very rapidly. A. Wrought iron is preferable, but cast iron can be made to answer very well in small magnets.

(12) A. D. C. & Co. say: We wish to encase some hams in cloth. Please inform us how to paint the cloth. A. Many cover the hams with clean white cotton cloth, and use no paint; but the cloth is oftener coated with a lime whitewash, sometimes colored with a little turmeric. In large packing establishments, the cloth is simply passed through crude pyroligneous acid (wood vinegar), and the ham sewed in before the cloth is quite dry.

(13) W. B. E. says: 1. I desire to make an oxyacetylene light, as powerful as that used at the late Centennial. Can I use alcohol for the flame? If so, what size and shape must the flame be? A. The so-called oxyacetylene lamp cannot be made to yield as brilliant a light as the oxyhydrogen under any conditions. In the oxyacetylene lamp, the wick may be contained in a round or flat tube placed close to the lime, and the jet of oxygen is made to pass through the flame in the same manner as with an ordinary blowpipe. 2. What must be the diameter of the outlet of the oxygen pipe? A. The orifice of the oxygen jet is about 1/16 to 1/8 of an inch diameter. 3. Of what kind and how large must the reflector be? A. Use a hemispherical reflector of silver plated copper, about 18 inches in diameter.

(14) N. A. W. says: I read as follows: "The reason that salted meats cause scurvy is that the salt abstracts the potash; and if potash is sprinkled on the food as one sprinkles salt, the difficulty is averted." Does chemistry substantiate this? A. As to the true cause of the malady, the opinions of authorities seem to differ widely. It has not been demonstrated that salt meat is the immediate cause of scurvy, nor that scurvy is even attributable to the disproportionate quantity of soda over potash salts in such meat. There are communities that subsist almost exclusively on salt meat, and yet are free from scurvy. It is claimed by some authorities that the disease is due to the absence of fresh vegetables. This, in the main, would seem to be the true solution; but it is well known that in North Wales there are communities where epidemics of scurvy are not rare, the people living altogether on vegetable diet. The later writers on this subject assume that the disorder is due to the joint action of exposure and to general want of nutritious food in greater variety. Lime juice has been heretofore considered a specific for this disease; but the reports of the late polar expedition do not substantiate this assertion.

(15) J. W. W. says: 1. I have tried without success to make liquid indigo blue (sulphate of indigo). It looks all right when it is first made; but soon the indigo precipitates, leaving the liquid as clear as spring water. Can you give me a recipe for the above which will hold its color? A. You should have stated how you prepared the sulphindigotic acid. Heat the indigo in a suitable glass vessel with a quantity of strongest oil of vitriol for an hour or so. Then allow to cool, and dissolve in hot water and neutralize the excess of sulphuric acid with carbonate of ammonium. The indigo should be added to the acid in excess before heating. The stronger the acid employed, the lower is the temperature required for the reaction. Fuming (Nordhausen) sulphuric acid will accomplish the result without the application of heat. 2. Are the various aniline dyes poisonous in such quantities as are necessary to color liquors, such as peppermint, etc.? A. These dyes are not all poisonous.

(16) W. C. T. asks: 1. I want a metal that I could melt in an iron ladle, that will be a little harder than pewter. I took some thin sheet brass, lead, and tin, and put them together in the ladle. They all melted, but when they got mixed, the alloy began to burn with a blue flame and burnt away, leaving a white powder. Please explain. A. Both tin and lead when exposed while at a high temperature in contact with the air rapidly oxidize; and if the conditions last long enough, the whole of both metals will become converted into oxides. When lead is oxidized or burned in this way it always colors the flame blue: this is a characteristic reaction of the metal. Copper under the same conditions tinges the flame a lively green. You should not expose your alloy at so high a temperature. Cover the surface of the molten metal with some sal ammoniac. 2. What is the best paring sand for small patterns? A. Use the best plumbago (graphite).

(17) J. D. Jr., asks: Is there any metal or combination of metals that will expand in cooling, that can be made as hard, say, as Babbitt metal? A. Yes. The alloys of bismuth and antimony with lead and tin expand to some extent at the moment of solidification. This is owing to the crystalline arrangement of the molecules that takes place in these metals under such conditions. Within certain limits, all the metals expand by increment of heat, and contract by loss of heat. Try the following: Antimony 1 part, bismuth 2 parts, lead 1 part, tin 4 parts.

(18) H. B. S. says: 1. Please tell me how to limit the deposit of copper in electrolytic impressions of seals, etc.? After the face of the seal is well covered, the metal begins to pile up on the edges in hard round masses. A. Varnish such parts of the casts as are not to be deposited on, and use moderate battery power. 2. Is there any simple manual I can buy giving information on such points? A. Sprague's "Electricity: Its Theory, Sources, and Applications," is one of the best.

(19) J. A. asks: How can I cement rubber to earthenware? A. Melt together equal parts of asphalt and gutta percha, and stir well together. It is used

hot. The cement, when set, is very strong, is water-proof, and resists the action of corrosive fluids.

(20) D. S. asks: How can I keep the worm out of hickory timber? A. Sprinkle or (better) wash the wood with pyroligneous acid (crude wood vinegar) containing creosote. This will destroy the insects, and preserve the wood, in a great measure, from decay in damp air.

(21) B. B. T. asks: Are there any animalcules in ordinary spring and well water? A. Most spring and well waters contain some form of animal life, but not all. It is difficult, however, to find a sample of water that is wholly destitute of life or the undeveloped germs.

(22) S. E. S. asks: Is there any substance, not poisonous, that can be put into a thick gum arabic paste to keep it from shrinking in size, and yet not get harder than India rubber, still to get sufficiently dry in one day to handle and cut the next, the gum being cast in moulds? A. There is nothing that will accomplish this.

How can I get a solution of subnitrate of mercury? A. Pour 1 part of nitric acid of specific gravity 1.2 on 1 part of mercury, in a porcelain dish, and let the vessel stand for 24 hours in a cool place; separate the crystals formed from the excess of mercury and mother-liquor, and dissolve them in water mixed with one-sixteenth part of nitric acid, by trituration, in a mortar. Filter the solution and keep the filtrate in a bottle with metallic mercury covering the bottom of the same.

Will an ink from bichromate of potash attack steel pens? A. Not to any extent.

(23) J. S. asks: Is there any method or process for casting India rubber without using a vulcanizer, so that when taken from the moulds the rubber will be hard but elastic, and appear white? A. No.

(24) C. A. H. asks: What ingredients besides cast iron cuttings do you use in making miniature volcanoes? A. Gunpowder, charcoal (in powder), nitrate of potash, sulphide of antimony, sulphur, and sometimes nitrate of strontium, which gives a crimson glow to the flame.

(25) B. M. S. asks: Can asbestos be applied on an ordinary blanket so as to make it fireproof, and still leave the blanket pliable? A. Yes, but it might be unpleasant to use a blanket so prepared as bed clothing. It would not be difficult to produce a blanket, the warp or wale of which should consist of asbestos fiber. Asbestos ground in oil and other vehicles is employed as a fireproof varnish, or paint.

(26) W. H. C. asks: With what preparation can I harden an alloy of equal parts of tin and zinc to any degree of hardness without injuring its casting qualities? A. This is not feasible.

(27) W. H. R. says: I want to bore a hole of 1/8 of an inch caliber; what sized drill, in 16ths, 32ds, or 64ths must I ask for to do this with? A. You cannot get a drill of the size you want that will be measurable in the denominations you name. The nearest you can get will be a 1/4 inch, which will be 1/8 inch too small. Since, however, the hole is always larger than the drill, it may answer.

(28) C. R. asks: Please inform me if an oscillating engine of the same proportions as a slide valve engine, working at a similar pressure, will have as much power? A. Everything else being equal, yes.

(29) E. A. V. asks: How can I face cast iron with cast steel? A. The steel is placed in the mould, and the molten cast iron is let run through until it gets the steam hot enough to weld, when the outflow of the cast iron is stopped, and the inflow is continued to fill the mould.

(30) W. C. D. says: 1. I am fitting up a 5 inch center foot lathe without back gear, and I want the mandril (which runs in boxes) to project about 1 inch outside the boxes on the left hand end of head stock, to mount small pulleys on to drive overhead apparatus. By what means can I keep the mandril up to its work with the least friction? A. Make the end of the spindle flat, and provide a flat-ended adjusting screw, putting a disk of leather between the two.

(31) S. A. H. says: 1. I frequently make small brass castings to be used in experiments, and am unable to make the brass run freely, and the castings are honeycombed, the metal appearing to have been oxidized. I melt the brass in a crucible in a stove, with bituminous coal. Should I put any flux on the metal? A. Your difficulty probably arises from not letting the air out of the mould. Add the zinc after the other metals are melted, and use broken glass as a flux. 2. Brass articles, such as cheap telescope mountings, etc., seem to have a good finish which is not ground and polished. Are they simply burnished after making smooth as possible with the chisel? A. Files and emery paper will answer this purpose. 3. How shall I make the best lacquer for brass mountings? A. See p. 242, vol. 34.

(32) J. S. asks: 1. How can I forge a hand hammer? What is the best shape for the steel before punching, to make a nice eye? A. Punch the eye the first thing, and do the forging afterwards. 2. Which is the best way to lay planer knives with cast steel? A. Use borax to facilitate the welding.

(33) R. G. asks: Would a valve gear that would open and close the ports with a much quicker movement than the ordinary eccentric, and throw precisely alike during the inner and outer strokes of the engine, be valuable? It will cut off at any point of stroke desired, or it will wire-draw; and it is reversible? A. Yes, if it is simple in construction.

(34) H. M. S. asks: How can I properly temper the face of an anvil that has had the temper taken out by being in a burning building? A. Heat the face, and harden in a copious supply of water.

(35) S. H. asks: Is there anything I can mix with the sand that comes near the casting in moulding that will give the casting a hard surface and not weaken it? A. We know of nothing for this purpose.

(36) W. J. McG. asks: 1. What is the eccentricity of the moon, and of the primary planets? A. The following is the eccentricity in miles: Mercury

7,434,000, Venus 492,000, Earth 1,618,000, Moon 13,000, Mars 13,463,000, Jupiter 23,810,000, Saturn 49,000,000, Uranus 85,062,000, Neptune 140,000,000. 2. Has our distance from Aleyone been estimated or determined? A. The nearest estimate is that it would take light at least three years to traverse the distance. 3. Is there any appreciable amount of heat derived from bodies outside of our solar system? A. No.

(37) P. B. G. says: There is a floating transparent mass which floats over the pupils of my eyes. In looking at a white object the mass looks like a knotted spider's web; in looking at a dark object, or reading, it seems like a blur. A. From your too general description we should judge your trouble was conjunctivitis, that is, a floating mucus, caused by inflammation of the lining membrane of the eyelid. The remedy for this is an astringent wash, alum water, or something of that nature.

(38) J. R. asks: What are the exact proportions of the ingredients used in making oxygen gas, for the calcium or lime light? A. For oxygen, heat strongly in a capacious retort of copper or iron, 4 parts chlorate of potash and 1 part peroxide of manganese, well mixed together. Wash the gas well as it comes over. A pound of this mixture should give you about 25 gallons of the gas. 2. What is the best way of making hydrogen to mingle with oxygen? A. Hydrogen is usually prepared by the action of diluted sulphuric acid (1 of acid to 7 of water) on scraps of zinc. This gas should also be well washed before using. Scrap iron and a less dilute acid are occasionally employed, instead of zinc, in manufacturing the gas on a larger scale.

(39) H. C. asks: 1. How much water should I take to dissolve 1 oz. nitrate of silver? A. It will dissolve in 5 oz. water at 52° Fah. and in 6 oz. of boiling water. 2. How much to dissolve 1 oz. tartaric acid? A. Tartaric acid is soluble in 4 parts of water at 60° Fah., and in 5 parts at 212° Fah.

(40) S. L. asks: Can tannate of caffeine be made from pure caffeine? A. The tannate of caffeine may be obtained as a beautiful white precipitate, if an aqueous solution of caffeine is added in excess to aqueous tannic acid. An infusion of tea, by its tannin, also precipitates solutions of caffeine.

(41) S. K. asks: What is the proportion of a saturated solution of bromide of potassium? A. This depends altogether upon the temperature at which the solution was saturated. The solubility of the salt increases as the temperature is warmed. Bromide of potassium is soluble in 1.87 parts of water (by weight) at 32° Fah., in 1.35 parts at 60°, and in 0.98 parts of water, at 212° (boiling point).

(42) W. F. K. asks: 1. Is there to your knowledge any soap made entirely of vegetables? A. There is no soap of this kind. 2. What is put into soap to harden it? A. After the saponification is finished, the soap is coagulated by the addition of common salt. The precipitated soap is then pressed, cut into form, and dried. This gives hard soap.

(43) E. N. W.—Saffranine ($C_{21}H_{20}N_4$) is prepared commercially by treating crude aniline oil with nitrous acid gas, and then with arsenic acid or bichromate of potash.

(44) P. C. & Co., ask: In packing ice in walls 10 inches thick, will coke dust or ordinary cinders be equivalent to sawdust? A. If the coke dust is as porous as charcoal dust, it may answer the purpose. In the absence of sawdust, carpenters' shavings are sometimes used.

(45) J. M. asks: 1. How long will it take ash and maple to season well? A. About 2 years. 2. Would it be better to season them in sheds or in the open air? A. Let them be covered at top. 3. Why is spruce used in preference to other soft woods for pianoforte sounding boards? A. We presume, if so used, it is because it is a tough wood, less likely to split than most woods. 4. Which is the next best wood to spruce for sounding boards? A. Perhaps white wood or pine. 5. How long will spruce take to season well, if cut $\frac{1}{4}$ inch thick? A. Six months or so, not to dry, but to season. 6. Which is the stronger, brass or cast iron? Cast iron for your purpose, probably.

(46) E. A. B. says: I notice that A. C. L. makes inquiries in regard to laying a pipe. If he were to use an earthen pipe of considerable larger diameter than the lead pipe, enclosing and retaining the lead pipe in the center of the earthen one by means of spiders placed at suitable distances, thus causing an air space to encircle the lead pipe, would not this form a better protection than if sawdust alone were used? A. The suggestion is a good one for the purpose indicated, provided the air space is hermetically sealed at the outlets. But it will not compensate for want of depth when the pipe is laid in the ground.

(47) R. M. asks: What shall I do, or cause to be done, to stop the serious leaking of five tin roofs, on properties erected last year? The tinman used the best tin, but, as is usual here, the joints are not soldered; but the sheets are raised at the edges two inches or so and pressed together and then turned over slightly. The roofs are rather flat. The seams run from the gutter to the peak of house. The consequence is that when the snow is melting, the water backs up into the seams and flows into the room beneath, doing much damage. The tinman says the seams cannot be soldered now they have been painted. A. In this city the tin is always soldered, except upon steep roofs. The conditions you mention try roofs very much. Perhaps you can remedy it in a measure by tightening the seams, and giving them a coat of rubber paint.

(48) C. F. J. asks: What will remove pimples and black worm specks from the face? A. Take rose water 3 oz., sulphate of zinc 1 drachm; mix. Wet the face with it, gently dry it, and touch it over with cold cream, which also gently dry off.

What is the chemical name for Paris green, and what are its constituents? A. Paris green (Schweinfurt green) is the aceto-arsenite of copper. In 100 parts it contains: Oxide of copper 31.29; arsenious acid 58.65; acetic acid

10.66. Its composition may be formulated as follows: $(C_2H_3O_2)_2 \{ Cu_2O_2 + 3(CuO, As_2O_3) \}$.

(49) C. A. M. asks: 1. How can I harden Canada balsam without interfering with its color? A. It is hardened to some extent by heating for a short time. 2. How can Canada balsam be rendered colorless? A. It may be bleached by exposure to sunlight. 3. Is there any other transparent substance that can be worked in as soft a condition, or as easily, and afterwards hardened without losing its transparency? A. There are several other gums and balsams (compounds of certain resins with various essential oils) that may be substituted for the Canada balsam—such as balsam copaiba, balsam tolu, gum benzoin, and Venice turpentine, also good collodion. Canada balsam, however, generally gives the best satisfaction.

(50) F. B. says: I want to keep a hot bar such as they have in restaurants. I do not want to use gas, and I cannot put in a stove because I have not got a chimney. How can I do it? A. There are small stoves in the market arranged to burn kerosene oil. If you could provide suitable means of ventilation in your rooms one of these might answer the requirements.

(51) E. W. M. asks: How can a suitable white paint for paper water pails be made? A. Zinc white (oxide of zinc) in oil is the least objectionable paint practically available for this purpose that we know of.

(52) D. says: I copied from a book number of your paper a recipe for an acid blister for curing sprains, ringbones, etc., in horses. I used it according to directions for curb, and believe it has cured it, but I cannot get the sore to heal or the hair to grow over the place. The recipe is as follows: Take oil seneca 14 oz., oil rosemary 5 oz., oil lavender 3 oz., oil turpentine 9 oz., and pyroligneous acid 4 oz. Mix well together and place in an earthen vessel, then add and stir in gradually sulphuric acid 1 pint until effervescence ceases. Shave off the hair and apply once a day to the affected part. Keep the part perfectly dry for two weeks, and rest the animal for a month. A. Wash the sore night and morning with pure water containing a little salicylic acid, and cover with a clean cotton cloth, between the folds of which a little of the dry acid has been rubbed. This will purify the sore and protect it from the attacks of insects. If this fails, it will be necessary to treat the animal constitutionally.

(53) B. K. D. asks: If a steam pipe 100 feet long is connected to a boiler with an ordinary valve at 30 feet from the end, which is securely plugged, will there be as much pressure at the further end of the pipe as there is between the boiler and valve, allowing the valve to be only one fourth open? A. Yes.

(54) F. B. asks: What size of engine is required to drive a skiff 18 feet long by 4 feet broad, and what size of screw is required? I want to keep her at as light a draught as possible, and get a speed of from 10 to 15 miles per hour. A. You will be obliged to devise special machinery for any such speed as you speak of, and you must determine the necessary data by experiment.

(55) J. B. W. asks: What size of wheel should be used for a boat 100 feet long and of 30 feet beam, drawing 10 feet of water? I have a non-condensing engine, 26 inches in diameter of cylinder and 30 inches stroke? A. You can use a propeller of from $9\frac{1}{2}$ to 10 feet diameter, and of 15 to 18 feet pitch.

(56) W. M. K. asks: At what angle to the line of direction should a plate, in passing through water, be placed, to secure the greatest pressure sideways, with the least resistance to its forward motion? A. As we understand your question, the angle does not make any difference in the pressure on the sides. Possibly, however, we do not get your idea. What difficulties or objections are there to using nitroglycerin as a motor by exploding it in a cylinder? A. The principal objection is that it would generally be necessary to provide a new cylinder after each explosion.

Is there any chemical compound, safe to use, which will decompose slowly, producing considerable heat? A. We think that you will find that wood and coal are the best compounds.

(57) A. R. says: I wish to discharge under 36 feet head 100,000 gallons of water per minute through a circular iron pipe, placed at an angle of 45° to the horizon. What should be the diameters of the upper and lower ends of the pipe? A. We are not sure that we get the idea. If you will send a sketch, showing the arrangement, we will endeavor to answer your question.

(58) R. V. J. says: I am running two boilers, one at a time, for the purpose of heating a large building. If I pump water to the first gauge, in a few minutes it will run up and fill the glass and all the gauges. Do you know of any remedy? A. Probably the rise of the water is due to the construction of the boiler or the manner in which the steam pipe is attached; but we cannot answer positively, from the data sent.

(59) G. W. asks: With what velocity will air enter a vacuum? A. About 1,300 feet a second, if there is no resistance from friction, etc.

(60) H. G. W. says: 1. Is the most powerful battery the best for electro-plating? A. No, but different solutions require different powers. 2. What sized battery will it take to goldplate a watch case? A. A one gallon cell will answer. 3. Will it take more battery power to silverplate? A. Better use two of the above named cells.

(61) E. D. W. says: 1. I am constructing a line of telegraph $\frac{1}{4}$ of a mile in length, and have three relays, each relay has $\frac{1}{4}$ of a lb. of No. 30 silk covered wire. Will they be suitable for that distance, and will No. 15 galvanized wire answer for my main line? A. Larger wire, say No. 23, would be better adapted to so short a circuit. No. 15 wire for the line will answer. Use two wires. 2. Will you please send me directions for making a cheap battery for my main line with the above three instruments in circuit. A. Place a disk of copper, to which a gutta serena covered wire is soldered, in the bottom of a jar, and suspend a piece of zinc with

a connecting wire in the upper part; after which fill the jar about $\frac{1}{2}$ full of water to which has been added about half a pound of sulphate of zinc. When this is dissolved, drop a few crystals of blue vitriol on the copper disk. Five or six cells will be required.

(62) G. L. P., Jr., says: 1. The ports in a small brass cylinder are out of place. Is it possible to have them filled with brass, so that they may be cut out again? A. Yes, by burning in. 2. Could plaster of Paris be used for cores in casting brass? A. Yes, but it is apt to cause air holes. 3. Would a common house furnace give heat enough to melt brass? A. Yes. 4. What is the best brass alloy for small castings? A. Copper 10, tin 5, zinc 2 parts.

(63) J. T. F. asks: How can the surface of a pane of glass be softened so as to receive any impression, and then harden again? A. This is not feasible, except by a uniform softening of the whole pane in a suitable furnace.

(64) H. F. A. says: I wrote some time ago for directions to electroplate insects, and I ask the following questions: 1. What are the proportions of nitrate of silver and wood naphtha for the dip? A. Make a saturated solution. 2. How shall I treat with ammonia? A. Dip the articles in aqua ammonia. 3. How do you vaporize mercury in order to expose the article? A. By heating, but great care must be taken not to breathe the fumes.

(65) J. H. M. asks: Can you tell me how many cells of a carbon battery (4 inch jars) are necessary for the production of the electric light? A. About 40 or 50 cells.

(66) J. N. asks: 1. Will the pressure in a boiler ultimately raise the water from the bottom, so that the plates will get red hot, generate a gas, and cause an explosion? A. If there is plenty of water, and the boiler is reasonably well designed, the water will not be driven from the plates. We know of no good evidence in favor of the generation of the gas. 2. When I was second engineer, we had a force pump of which the check valve spindle was too short. I told the first engineer that it would not be safe, but "he knew his business." On going to start the engine, I found no water at the gauges. I lifted the steam valve, let out the steam, took an iron rod, wrapped a cloth round it, and found only 6 inches of water in the boiler. The fire was damped. I brought some one to see it, who soon made a great change. If I had moved the fire first, I am afraid I should have been moved pretty quickly. Please give me your opinion. A. When the water is low in a boiler, and you do not know where it is, the safest thing to do is to haul the fire if it can be done quickly, or if not, cover the fire over with ashes, and allow the boiler to cool somewhat, before raising the safety valve or admitting water. 3. I have been where several boilers have been connected together, all being fed with one pipe from the force pump. The fires of the middle boilers were urged until they were very hot, and the side fires slow. Then the middle boiler would empty itself into the side boilers. Can you explain? A. Boilers should always be so connected that such action would be impossible. This precaution is only neglected by the reckless or ignorant.

(67) L. B. says: Please tell me how I can find out how many lbs. of steam passing through a 2 inch feed pipe into a 10 x 18 inch cylinder is equal to a horse power? A. The steam per horse power per hour may vary from 20 to 100 lbs., according to the character of the engine. The horse power is the product of the effective pressure in lbs. per square inch, the area of the piston in square inches, and the speed of the piston in feet per minute, divided by 33,000.

(68) J. A. W. says: Will you explain why a certain load located at a distance from a certain power should show more resistance when so attached than it would when more closely located and attached, or, to be more explicit: Why does a train of cars so made up with empty cars in front of the loaded cars pull harder than the same train would with the loaded cars ahead of the empty cars? I know this to be fact. A. If you can conveniently send us the data on which you base your opinion, please do so, together with such observations as have been made in regard to the behavior of the train, especially of the empty cars, when made up in the different ways mentioned. As you state your question, we have not sufficient information to form a decided opinion.

(69) C. A. R. asks: How can I clean deer's antlers without scraping them the roots, where the horns are so rough? A. Try a little fine pumice powder moistened with strong alkali. Rub well and wash with water. Or use muriatic acid, free from iron, in place of the alkali.

(70) W. S. says: I have a conservatory in which the plants droop and die from (I believe) the effects of carburetted hydrogen gas escaping from the pipes in the street adjoining and oozing through the soil in the house. I have complained to the officials in charge of the public gas supply, but they only scout the idea and do nothing. Can you suggest any chemical or other appliance whereby the bad effects of the gas might be neutralized? A. If this is, in reality, the cause, the trouble may be alleviated to some extent by sprinkling the floor with dry slaked lime and charcoal in powder; but the only practicable and effectual way to overcome the difficulty will be to rectify the cause, as there is nothing practically available that may be employed as an absorbent or antidote for the gas.

(71) S. A. C. asks: Please tell me the dimensions for a poultry house for 800 hens, and the way to build it? A. Make the building two stories in height; inclose it with matched boarding; also board it on the inside of the studding, and fill in the exterior frame with sawdust, tan-bark, or clay. If a part of the barn on the south side of the hay-mow can be partitioned off for the purpose, so much the better; or the poultry-house may be erected against the south side of the barn as an extension thereto. Provide an open stairway from the first to second story for self and fowls; let the floor of the first story be of the natural earth, and that of the second story of matched plank. In the first story provide plenty of glass windows on the south, the east, and

the west sides; and in the second story about one half the number of similar windows; provide several of these windows to open for ventilation and protected with wire cloth. Under the stairs in first story place boxes, in which quite young chickens may be brooded over night, secure from rats and other vermin; also, make cages in the corners, in which hens inclined to set at improper times may be placed and fed. Near these provide a box, always filled with sand, lime, and ashes, for the fowls to wallow in. In the second story, on the north side, make boxes for the hens to lay in and set in, with the entrance for the hen on the rear side and the place to take the egg out in front. Plenty of gravel and pounded bones should be given them at all times, with an occasional meal of meat in winter. Overhead the roosts are to be placed, of rough poles, 1 or 2 inches in diameter, with the bark on. Thus provided, the hens will continue to lay, if furnished with meat occasionally, all winter. A place for doves or pigeons may be made in the roof of the building, if desirable.

(72) S. B. M. asks: If you think it possible to re-tin fruit cans after they have been used and rusty, will you tell me the best mode of re-tinning them? My idea is to first cleanse with acid, and then dip in molten tin. A. Your method is a good one. Cover the tin bath with a layer of molten wax to keep the hot tin from contact with the air.

(73) J. F. K. & Co. ask: Is there an improved tool for turning up crosshead wrists? A. We know of nothing but the clamp with serrated teeth.

(74) D. D. asks: How can I use a lamp in a magic lantern so as not to cover much of the reflector? A. The reflector should be set so that the light reflected from it shall come to a focus in the flame of the lamp, then it diverges with the light from the flame, and the two enter the condenser under similar conditions. Or you can have the body holding the oil on the outside of the lantern, and the oil carried to the burner through a pipe.

(75) A. O. asks: How can I find the magnifying power of a microscope? A. Place under the microscope some definite measure; then look, with one eye, in the microscope, and with the other look at a rule placed the same distance away on the outside. With a little practice, it will be seen how long the one division in the microscope appears to be on the rule outside. In the same manner the apparent diameter of the field may be determined; that is, if 1 division inside covers 100 divisions outside, then the power is 100, etc.

(76) W. E. N. says: What size of steam engine can I run with a boiler 16 inches high and 12 inches in diameter, made of $\frac{1}{2}$ inch copper, bound at every 4 inches with bands $\frac{1}{2}$ inch thick and $1\frac{1}{2}$ inch wide. The heads are $\frac{1}{2}$ inch thick. A. You can make an engine $1\frac{1}{2} \times 3$ inches, if the boiler steams well.

(77) D. H. L. asks: Would there be any danger in eating water melons raised from the seed of a melon which had been poisoned in the stem? A. No.

(78) A lady writes to know what is the matter with her greenhouse. The plants drop their leaves as soon as the heat is raised in the house. The gardener attributes it to the paint on the pipes. The rose house, she thinks, was kept too close during the summer, so that the red spiders became very numerous. But the greenhouse trouble is of another kind. A. See if the gas main is not near the greenhouse; the effect of coal gas in any form would be as described. If the paint used on the pipes has any gas tar in its composition, it is sure death to the plants, and should be all scraped off. Plants will sometimes be several years in recovering from the effects of it. The rose house should be left open during the summer.

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

S. H.—The stones found in the coffee are small quartz pebbles.—F. G. K.—You failed to number or otherwise designate your specimens. One of them is trap rock, with bright specks of pyrites. The one full of holes is a piece of quartz discolored by sesquioxide of iron. Besides these, there are a piece of slate, a sample of clay containing a considerable percentage of iron, and an iron garnet.—T. S.—It is galena, sulphide of lead. It contains, when pure, 86.6 per cent of lead, and 13.4 per cent of sulphur. The specimen you send is much mixed with earthy minerals and pyrites. It would require an analysis to determine the available quantity of lead.

COMMUNICATIONS RECEIVED.

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

On a Human Clock. By J. F. B.
On Spiritualism. By R. S. H., by T. B., and by B. C. H.
On the Moon's Rotation. By D. S.
On Wrought Iron Bridges. By J. E. G.
On Postage Stamps. By J. W. S., and by H. W. B.
Also inquiries and answers from the following:
J. M.—M. M.—O. H. H.—L. P. K.—C. R.—E. B. W.—W. J. S.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells rotary nail-cutting machines? Who makes the best coal gas apparatus for hotels, large houses, etc.? Who sells steam blowers? Whose is the best mariner's compass? Why do not makers of paper-making machinery advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal."

which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

January 23, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York City.

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To the Editors of the Evening Journal:
Having caused a personal examination to be made of the condition and affairs of the Washington Life Insurance Company of New York, as of the 31st day of December, 1876, by Hon. John A. McCall, Jr., Deputy Superintendent, duly appointed by me for that purpose, and deeming it for the public interests that the result of his investigation should be published, I herewith enclose his report for publication.

Very respectfully yours,

W. SMYTH,
Acting Superintendent.

ALBANY, January 23d, 1877.

Hon. William Smyth, Acting Supt. New York Insurance Department:

I respectfully report that in accordance with the provisions contained in your appointment No. 362, dated December 26th, 1876, and with the assistance of Messrs. Ballard, Willis and W. H. Smyth, I have completed an examination of the Washington Life Insurance Company of New York City.

The very satisfactory condition of the company as exhibited below is attributable to the management of its affairs by able, prudent and honorable men. It gives me pleasure to state that in a minute and exacting investigation I find nothing to condemn, but, on the contrary, much to commend.

Complete schedules of mortgages, deferred premiums, and real estate investments as of December 31st, 1876, being the date of examination, have been placed on file in the department.

The following are the assets and liabilities:

ASSETS.		
Real estate		\$159,284 80
Bonds and mortgages		2,334,252 79
Cash in bank and office		116,654 18
Accrued interest on investments		53,071 26
Loans on policies within their value		19,109 46
Net uncollected and deferred premiums		180,429 95
	Par Value.	Market Value.
U. S. 6's, registered	\$510,000	\$581,400
N. Y. State 7's, regis'd	100,000	100,000
N. Y. City 7's, regis'd	990,000	1,188,500
N. Y. City 5's, regis'd	122,200	122,200
Brooklyn 7's, regis'd	200,000	209,000
Brooklyn 6's, regis'd	100,000	107,000
Kingston City Coupons, bonds	11,000	11,000
	\$2,063,200	\$2,359,100
Agents' balances		43,592 92
Total assets		\$5,265,495 96
Deduct items not admitted :		
Mortgages taken for debt	\$10,838 81	
Value of real estate over department appraisal	37,784 80	
Agents' balances	43,592 92	
		92,216 53
Total admitted assets		\$5,173,278 83
LIABILITIES.		
Net value of outstanding policies		\$4,337,644 00
Unpaid losses and encumbrances not due		43,306 82
Premiums paid in advance		2,988 51
Unpaid dividends to stockholders		346 50
Salaries, rent, &c		3,000 00

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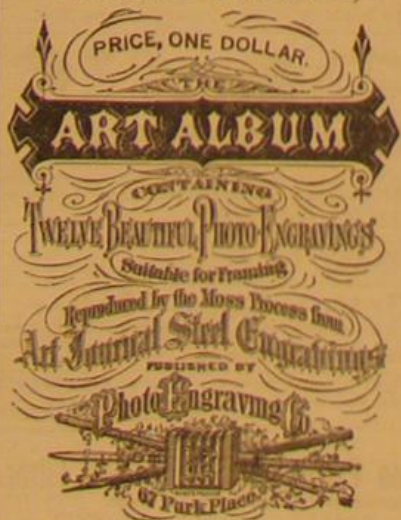
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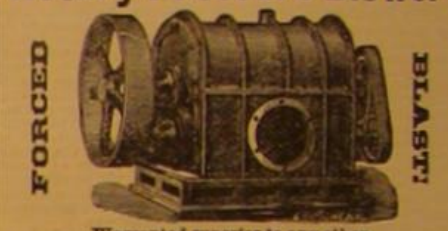
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THE EAST RIVER BRIDGE.

For the first time in the history of the world a bridge now spans the East River. The cities of New York and Brooklyn are connected; and although the connection is but a slender one, still it is perfectly possible for any venturesome mortal to make the transit from shore to shore with safety. The completion of the foot bridge marks the beginning of the era of active work on the superstructure of the great fabric. We have already explained how the heavy wire ropes, on which the ten cradles are suspended, were brought over from anchorage to anchorage. The cradles on the main span are nearly 48 feet long; and they are suspended at such a deflection that the main strands, while being made, will be within easy reach of the men who are to regulate the wires. They are constructed of oak, and the center of the floors is made in part of iron rods, so as to admit of the free passage of the wind, and thus reduce oscillation. In order to give access to these cradles, the temporary foot bridge, above referred to, and of which an excellent idea can be obtained from the engravings presented herewith, has been recently constructed.

Two designs were made for this part of the work: one providing for a bridge in a low position at the level of the floor of the main bridge; the other 60 feet above, at the level of the cradles and strands. Both positions have their advantages and disadvantages. From the low foot bridge, the regulation of the strands in the cables can be more easily accomplished; but access to the cables could only be had by means of long vertical rope ladders, difficult and dangerous to climb. The intermediate cradles would have been almost inaccessible. Provision for safety against storms could per-

haps be equally well made in both cases. The important consideration, however, which led to the adoption of the high position, was the accommodation of the shipping, as the low foot bridge would have at once formed a barrier above the water, while the high one is fully 210 feet over the river. This distance will be maintained for a year or more,

on the cables, with two inch spaces between the slats for the free passage of the wind. The slats are held in place by longitudinal strips, 3 by 1½ inches, to which they are fastened by round clinch nails. These strips are secured to the cables by U-shaped stirrups, plate washers, and nuts. The floor was laid in sections of from 12 to 16 feet in length at a time.

Chief Engineer Roebling does not hesitate to express his belief that this frail structure may be disabled more than once by violent gales before the main cables are completed. Its principal security against the wind is a pair of inverted storm cables, assisted by a number of underfloor stays in the main span. In the land span, the guys lead directly to the anchorages in the ground. The ropes are all secured together laterally. It is of but little moment how much the cradles may sway about in the middle of the span; but all great waves must be checked before they reach the towers, where alone the ropes can be injured. This is done by the underfloor stays and by securely fastening the ropes to the masonry. The inverted parabolic storm cables serve rather to prevent the foot bridge being carried away bodily.

We are indebted for our information to the report of Engineer Roebling, and to the courtesy of Assistant Engineer W. H. Paine.

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THE FOOT BRIDGE OVER THE EAST RIVER, NEW YORK.

Fig. 2

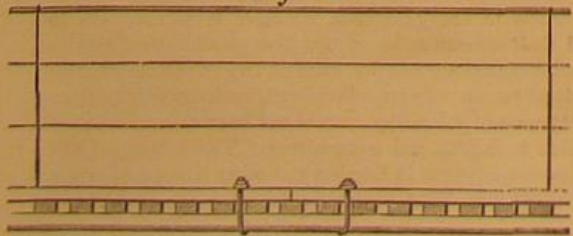


Fig. 3

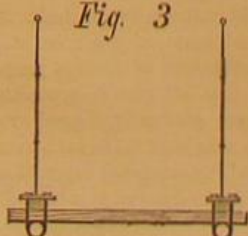
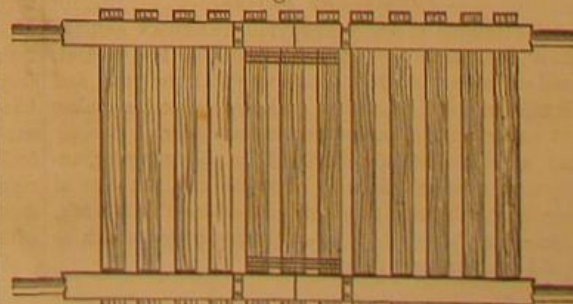


Fig. 4.



when the lowering of the cable strands will slightly curtail it. The construction of the foot bridge is clearly shown in Figs. 2, 3, and 4. It is made of oak slats 3 by 1½ inches, laid directly

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- LESSONS IN MECHANICAL DRAWING.** New Series, No. 6. By Professor MACCORM. With several illustrations.
- AGRICULTURE, HORTICULTURE, ETC.**—Discovery of an Effective Remedy for the Grape Vine Disease.—Loss of Shade Trees in Cities.—Structure of the Mushroom.—Cheap Greenhouses and How to Heat them. By PETER HENDERSON. With 2 engravings. The author is one of the most experienced florists. In this valuable practical paper he illustrates clearly how to heat single and double greenhouses with the least expense; gives the plans for the flues and the full costs for construction of the houses.
- NATURAL HISTORY, MICROSCOPY, ETC.**—Pollen. By W. G. SMITH. Being a Microscopical Examination of the Pollen of various well known flowers and plants. With 34 illustrative figures. A valuable and interesting paper exhibiting the beautiful forms of pollen grains, their most prominent characteristics, of especial interest to florists, indicating the plants best suited for hybridization, etc.—Practical Value of the Microscope.

PUBLISHERS' NOTICE.

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

Instead of a notice being printed on the wrapper, announcing that a subscription is about to end, the time of expiration is now denoted in the printed address each week, so that the subscriber may see when the period for which he has prepaid is about to expire.

LEMURIA, THE LOST PARADISE.

In our review of Mr. Alfred Wallace's new conclusions relative to the geographical distribution of animals, we noted his very important statement that the study of the present habitations of both animals and plants may add greatly to our knowledge of the past history of our globe. In fact, the chief deduction which Mr. Wallace draws from his extended investigations is that such study may reveal to us, in a manner which no other evidence can, which are the oldest features of the earth's surface, which the newest, and which have sunk beneath the ocean and thus been blotted out for ever. It will be seen, therefore, that in the study of organic life we are brought face to face with one of Nature's own records. As in the rocks she writes of the birth of new continents and new islands, and of the time when, and the conditions under which, these mighty additions to the earth's surface were made: so in the habits of organized creatures she conceals the history of her destructive work. By the aid of such knowledge as to past organic mutations as the geological record supplies us with, we can determine the probable birthplace and subsequent migrations of the more important genera and families; and in this way, while reaching a conception of that grand series of co-ordinated changes in the earth and its inhabitants, whose final result is seen in the forms and geographical distribution of existing animals, at the same time we embark on a quest of lost lands.

It is a remarkable fact that traditions substantially agreeing with the Biblical account of the Deluge exist among every known people on the earth. Among the Hindoos, Greeks, Chinese, Mexicans, Peruvians, Feejee Islanders, the legends are closely similar; and it is but recently that, from the clay tablets of the Chaldeans, the late Mr. George Smith deciphered still another account of a great flood. It is besides true that, among a great many peoples, there are traditions of countries which no longer exist. Even on old Venetian maps the lost island of Atlantis, lying west of the Azores, prominently figures. The Greek geographers mention the island; and its sea kings, tradition says, invaded Europe and Africa, but were defeated by the Greeks and their allies. Whether that land was a myth, or whether it was America, is an open question (in view of Dr. Schliemann's discoveries, it is perilous to pronounce any ancient legend baseless); but this aside, the story goes that the Atlantes became so desperately wicked that a deluge swallowed up their island. Biblical critics, or at least the majority of them, have long since recognized the fact that, unless the supposition of a series of the most stupendous miracles be made, the theory of the Deluge covering the entire earth must be set aside; and, in lieu thereof, the view is preferred that the flood covered only the small area forming the basin of the Euphrates and Tigris rivers, which then was the sole region occupied by the human race. If, however, we couple the two traditions, namely, deluges and lost lands, there will appear a probability that all relate to similar phenomena, which are the subsidence or overflowing of islands or portions of continents by the sea. Therefore it might be a more scientific view of the Flood to ascribe it to this well understood natural action than to venture so violent an hypothesis, even on the Mosaic account, as that, 1656 years after his creation, man was still confined to the little region in Mesopotamia.

In the whole range of deductions reached by the study of the distribution of animals, there is none more striking than that which proves that a vast continent once existed extending from the island of Madagascar to Ceylon and Sumatra. Examination of the fauna of Africa and of Madagascar shows that in Africa, especially in the east, there is an abundance of large ungulates and felines (elephants, lions, etc.), all of types now or recently found in India and Western Asia. Again, the fauna of Madagascar is wanting in all the larger and higher African forms, and has a wonderful resemblance to that of Malaya and South America. We are, therefore, sure that Madagascar must have been separated from Africa before the assemblage of large animals, above referred to, had entered. There is proof that, during early tertiary times, a continuous sea, from the Bay of Bengal to the British Isles, completely cut off all land communication between Central and Southern Africa on one side and the great continent of the eastern hemisphere on the other; so that Southern Africa and Madagascar were then united, and the latter island helped to form the great continent over which the tribe of lemurs were distributed. There is geological evidence, in Ceylon and South India, all going to show that those physical divisions were bounded on the north by a considerable extent of sea, and hence probably formed part of a great southern continent. If we suppose that this hypothetical land occupied the whole area now inhabited by lemuroid animals, we must extend it to Burmah, South China, and the Celebes.

Having established the possibility of the existence of this last continent, Lemuria, we need follow geology in the person of Mr. Wallace no longer, but pass to Herr Peschel's views of the great importance of this hypothesis to the history of our race. Peschel, in his chapter on the first home of humanity, states that all oceanic islands, when first discovered by European navigators, were uninhabited; and from this and other considerations, he concludes that the first human beings were inhabitants of a continent. Then, by examining into the resemblances of various peoples, he logically reaches the view that all our race, starting from a common habitat, may have gradually ranged over all continents and peopled them. He next takes each grand division of the earth in turn, and, by studying its zoological forms and their changes, he seeks to determine which division was

the probable cradle of humanity. The basis of his inquiry is the fact that the more highly integrated creatures are the newer, the less perfectly integrated, the older; and measured by this standard, Australia and South America are speedily eliminated from the question. North America has remained primitive in the second highest order of mammalia. Our continent has no tailless ape; and it is where the highest animals appear—the chimpanzee, the gorilla, and the orang—that we must also look for man. Searching through the Old World, the lowlands of Siberia are geologically too recent; while if Europe had been the starting point, we should have found fossil men, as we have fossil apes. In Southern Asia, British India has been studied geologically with great minuteness; and judging from the types of mammals found, our primordial parents cannot be localized there.

The inquiry is now narrowed down to Lemuria, a continent, Peschel asserts, required by anthropology; for we can then conceive that the inferior populations of Australia and India, the Papuans of the East Indian Islands, and lastly the negroes, would thus be enabled to reach their present abode by dry land. Such a region would also be climatically suitable; for it lies in the zone in which we now find the anthropomorphous apes. The selection of this locality, Peschel points out, is far more orthodox than it at the first glance might appear; for we here find ourselves in the neighborhood of the four enigmatic rivers of the Scriptural Eden—in the vicinity of the Nile, the Euphrates, the Tigris, and the Indus. By the gradual submergence of Lemuria, the expulsion from Paradise would also be inexorably accomplished. To this may be added that ecclesiastical writers, such as Lactantius, the venerable Bede, Hrabanus Maurus, Kosmos Indicopleustes, and also the anonymous geographer of Ravenna, placed the Scriptural Paradise in Southeastern Asia, and some explicitly state that it was on a detached continent, and that the ingenious maps of the middle ages exhibit the first parental pair on a land surrounded by sea, lying beyond India. This explains how Columbus, after the discovery of South America, taking it for an insular continent lying southeast of the mouth of the Ganges, wrote home to Spain: "There are great indications suggesting the proximity of the earthly Paradise, for not only does it correspond in mathematical position with the opinions of holy and learned theologians, but all other signs concur to make it probable."

Herr Peschel's hypothesis need not disquiet those who prefer to believe that Paradise was nearer to the eastern lands of the Scriptures. Its value, its author states, is that "it challenges a geological investigation of Madagascar, Ceylon, and the island of Rodrique, as well as deep sea soundings in the Indian Ocean, to ascertain whether vestiges exist of the higher points of vanished Lemuria."

CITY ARCHITECTURE.

There is a widely extended discussion now going on as to the merits of the better class of houses built in these days. Dr. Richardson attacks them on sanitary grounds, and his condemnation is as sweeping and as unreasonable as that of Mr. Ruskin; and the only remedy which these gentlemen propose for the people of Great Britain is to sweep away every dwelling from one end of the island to the other. Such exaggerated statements come naturally from the lips of Mr. Ruskin, whose aestheticism does good by inculcating a taste for correctness and purity in style and for genuineness and thoroughness in work; but Dr. Richardson has more utilitarian aims, and such wild propositions serve only to repel people from the consideration of the many sensible suggestions which he has made. Although it may be theoretically true that a kitchen should be at the top of the house, it is not necessary to destroy a dwelling that has one at the bottom; and the people who live in modern houses are not so contemptible, either physically or morally, that their homes should be demolished at the instance of these architectural reformers on account of their unsuitability for habitation. Architects and hygienists would do much more for their contemporaries, and for art and science too, if they would show us how to make the best of what we have; to ventilate thoroughly our basement kitchens rather than to tear down our houses; to lead our sewer gases away from our houses rather than to pull down one side of the structure to build a gas shaft; in short, to improve the homes we must live in rather than to dream about those we might have if the world were created to-day, and everybody began existence with unbounded wealth.

Of the comfort and wholesomeness of the better class of American houses it is impossible to speak too highly. The ventilation is generally well provided for, and the heating is equable, and the temperature moderate; dryness in the cellars is an object which our architects spend much pains to achieve, and usually ample light is admitted into the front and back rooms of our houses. But our readers will at once see that we speak of the houses found in the better quarters of our large cities; and our tenement houses in crowded neighborhoods, and many of the flimsy frame structures in rural districts, are scarcely capable of improvement without razing the entire structure. The evils in the first are due to heavy taxation, which compels landlords to crowd their tenants on to the smallest possible area, and to the inability of tenants to pay rents for large apartments. But there is no reason why large buildings, each accommodating a great number of families, should not have every necessary provision for health and convenience. The houses of the building corporations in London and other European cities, which have been built especially to solve the problem of

health and comfort in crowded neighborhoods, have a lower death rate than many districts where the inhabitants are wealthy and the number of people to the acre small; and this alone shows that the exceptionally great mortality in New York and other large cities is not due solely to density of population.

But the chief faults in city architecture are to be found in the smaller and cheaper houses. Although many of these are well provided with modern contrivances for saving labor and adding to the convenience of their inmates, they are characterized by two bad practices, namely, disregard of hygienic laws and flimsiness of construction. The excellent system of heating by furnaces placed in the basement is vitiated by making the heaters too small, so that they are overdriven in cold weather, and the air passing through them becomes too dry, thus rendering the lower rooms of the house unhealthy; and it has been shown by the experiments of General Morin, Director of the Conservatoire des Arts et Métiers in Paris, that air currents in contact with red hot iron become absolutely poisonous. It is safer, says Mr. James C. Bayles in an excellent paper on city architecture in the *International Review*, to keep the temperature of the surfaces of a heating furnace below 500° Fah. Again, by faulty construction, many of these furnaces carry carbonic oxide and sulphurous gases into the apartments.

Ventilation is a subject on which much has been written, and yet it is little understood. That provided by the open fireplace is nearly perfect; and difficulties on this subject are found mainly in small houses heated by hot air. Draughts of air in such houses are frequently kept out with weather strips, and air is only admitted by chance opening of doors. The plumber's work is another defective element in these houses; and the dread zymotic diseases which arise from sewer gases bear terrible witness to the truth of this statement. These diseases cause nearly 30 per cent of the total mortality of New York city. And the difference between good and bad plumbing, says Mr. Bayles, is so slight as to escape the notice of any but a trained expert, and here the responsibility of the architect becomes of the utmost importance.

The want of solidity in the building of cheap houses is the cause of the destructiveness of fires in this country. Mr. Bayles averages our annual losses by fire at \$100,000,000. Structures in which cheapness was the only consideration of the architect are in many places so numerous that solitary buildings considered fireproof are destroyed by the fierceness of the conflagration which rages round them. That this can readily be remedied is shown by the example of many European builders, whose cement floors and well plastered woodwork are unflamable, and in whose houses fire seldom spreads beyond the room in which it originates.

THE WORKING OF PATENTS IN CANADA.

A section in the patent law of Canada requires that the manufacture of the invention or discovery must be commenced within the realm within two years from the date of the patent, or the latter becomes void. Another clause in the same section declares that a patent shall be void if, after the expiration of twelve months from the granting of a patent, the patentee or assignee causes to be imported into Canada the invention for which the patent is granted. A clause was subsequently added, however, granting the Commissioner the privilege of extending the time for introducing an invention beyond the two years if application is made to the Commissioner not less than three months previous to such expiration, and if ample evidence is adduced that it has been beyond the patentee's control to comply with the two years' requirements.

Some parties who took patents two years ago have supposed that it was sufficient to hold the patent by importing into the country various parts of the entire machine, and putting them together in a Canadian manufactory. The able Commissioner, Mr. Taché, decides that such importation does not accord with the spirit or intent of the law; but in a case which recently came before the Commission, he rules "that the respondent having refused no one the use of his inventions, and that the importation, assented to by him to be made, being inconsiderable, having inflicted no injury on Canadian manufactures and having been so countenanced, not in defiance of the law, but evidently as a means to create a demand for the said inventions, which the patentee intended to manufacture, and did, in fact, offer to manufacture in Canada, he has not forfeited his patents."

It is evident from this decision of the Commissioner that he intends to construe the laws in a spirit of liberality towards the foreign patentee when it can be done without prejudice to the interests of Canadian manufactures.

THE BLUE GLASS DECEPTION.

An open letter addressed to us by General Pleasonton, of blue glass notoriety, has appeared in the columns of an evening journal of this city. The missive relates to our recent criticisms on the writer's alleged discoveries. It is altogether too lengthy for reproduction here, nor is such publication otherwise necessary, inasmuch as it clearly shows that its author has not perused our articles with any degree of attention, or else that he totally misapprehends the nature of the facts and arguments we have advanced.

The main point of General Pleasonton's letter is an objection to our use of the word "deception," a term which we employed, advisedly, since we believe that General Pleasonton deceives both himself and the public: a view which we can hold without casting the slightest imputation on the gen-

tleman's personal integrity. General Pleasonton, then, in support of his theories, triumphantly claims that they must be well founded, because "the highest scientific authority in the country"—to wit, the Commissioner of Patents—has granted a patent on their application. That the above official is *ex officio* the greatest of American scientists will be amusing news to our readers. It raises the question as to who is the highest scientific authority now, the Commissioner who signed General Pleasonton's patent or the present incumbent, or which one of the numerous gentlemen who have adorned that office for brief periods in the past. Besides, to claim that, because something is patented, it is necessarily scientifically sound and of major importance, betrays but a small acquaintance with inventions in general. The Patent Office does not indorse any device. The patent is simply granted on *prima facie* evidence that the idea is new and useful; and in endeavoring to extend the benefit of the protection to inventors, the examiners favor the latter, or should do so, in the highest degree, acting favorably whenever there is a possibility of the existence of even a germ of some future better conception. As it is, the Patent Office rejects very many more applications than it ought to; and on the other hand, it is constantly erring, often egregiously, in granting absurd claims. "Because the Commissioner of Patents, in allowing General Pleasonton's patent, made a very sorry blunder (which, by the way, we are inclined to think is chargeable to the examiner, as of course the Commissioner knows nothing of the immense majority of patents to the documents of which his signature is appended in advance), certainly the General cannot convince sensible people that his abnormal theories obtained any indorsement."

The remainder of General Pleasonton's letter is but a re-affirmation of his interpretation of his alleged results; and the assertion that blue glass alone does not produce the beneficial effects claimed, but that they are wholly due to "associated light." Associated light in his grasp came through one eighth blue glass and seven eighths clear glass. Sunlight through blue violet glass, spectroscopically examined, as we previously explained—and a distinguished physician of this city has since corroborated our statement by further experiment—is nothing but sunlight diminished in intensity. Therefore General Pleasonton's claim now is based on pure sunlight, one eighth of which is diminished 90 per cent: in other words, sunlight weakened $\frac{1}{8}$ in intensity, according to Mr. Gaffield's data, elsewhere noted. As General Pleasonton devotes a considerable part of his letter to informing us on what we based our own criticisms—a favor on his part quite unnecessary, as well as wholly mistaken in its premises; and as a still larger part is given up to mere assertion, mingled with curious misunderstandings of our very plain statements, we think that no further notice of his epistle is required. For the benefit of sundry blue-glass-crazed contemporaries, we would add, however, that we see no necessity of repeating the large number of experiments—some dating back two centuries—which very positively disposed of the whole subject, even if by not doing so we earn the imputation of closet theorists. Our long experience in dealing with circle squarers, perpetual motionists, Keely motor people, and now blue glass adherents, besides all the other deceptions rife in the mechanical and scientific world, enables us to bear such animadversion with unruffled equanimity.

POINTED LIGHTNING RODS.

The important question as to the proper form of lightning rods occupied the minds of many savants some 75 years ago, and filled part of the scientific journals of that period. It has lately been renewed, and, as formerly, there are defenders and antagonists of the pointed rods. It is argued by the latter that the object of a lightning rod is not to attract the thunderclouds to the building to be protected, and induce discharges there; and it is claimed that long, upward-projecting lightning rods do this very thing, and that, although they are a protection in one sense, giving a ready path to the discharges, they become a source of danger by attracting the electrically charged clouds, and making discharges more frequent. Let us test this reasoning by the well known laws of electricity.

The amount of electric attraction depends on the extent of the attracting surfaces, and on their distance. If a series of clouds, say of a square mile in extent, floats over the earth's surface, these clouds being charged with positive electricity, they will induce, in that part of the earth's surface within the attractive influence, negative electricity. This charge will increase as the distance decreases, as the clouds follow the direction of the attraction; until at last, when the distance becomes small enough, an explosive discharge takes place, the stroke of lightning consisting in the simultaneous discharge of positive electricity from the cloud to the earth, and of negative electricity from the earth to the cloud. The manifestation of light and heat is the simple result of the neutralization of the two electricities, and will be greater in proportion as their quantity and intensity were greater.

Looking at the subject exclusively from this point of view, all that appears necessary is to provide a ready path to the electric discharge, such as a rod made of good conducting material, of sufficient capacity to be uninjured by the strongest current, and well connected with the ground, so as to establish at the moment of discharge a perfect communication between the cloud and the earth, which, previous to the stroke of lightning, were charged with opposite kinds of electricity. If we consider the function of elevated points on lightning rods we find that Benjamin Franklin was correct when he recognized the gradual absorption or discharge of

electricity as the main duty of lightning rods. Projecting points do not attract the thunderclouds; but elevated portions of the ground, as well as trees and houses, when in conducting communication with the earth, become charged by induction, and then exert attraction, whether there are pointed rods in the vicinity or not. The latter will, by their property of silent gradual discharge, serve to diminish the electric tension; and in place of being a source of attraction they will diminish this attraction, and take from the impending discharge a great deal of its violence.

We must, therefore, come to the conclusion that elevated points are desirable as upper terminals of lightning rods; and experience fully verifies this conclusion by practical results. One of the oldest instances took place in the tower of the cathedral of Siena, in Tuscany, which had been very frequently damaged by lightning. In 1776, a lightning rod was erected; but the people objected, and some of the priests called it an impious contrivance, invented by a heretic; but when it was found that the tower was rarely struck, and that once during a heavy thunderstorm the stroke followed the lightning rod without doing the least damage, the heretical contrivance came into proper esteem. The starlike terminations of some lightning rods are injurious. Faraday has proved that a single point discharges and absorbs electricity faster than a bifurcated or trifurcated terminal; if more points are added, still slower becomes the discharge, by their mutual interference; until at last, when the top is surrounded with an infinite number of points, a ball is the result, and the silent discharge ceases altogether.

But the upper pointed terminal is not the main part of the lightning rod; because it may be omitted altogether, although it is better to attach it. The main part is the ground connection; and as this is out of sight, it is often shamefully neglected. Much ignorance prevails in this respect also; hence it frequently happens that the electric current leaves the rod, to enter the house and pass off by the gas, water, or sewer pipes; and in its course it sometimes causes considerable damage. A connection with a water course, a well (not a cistern), or at least with the moist ground, is not imperatively necessary. If the soil is silicious and naturally dry, it is best to drive some pointed iron bars into the ground in such places as they are most likely to reach moisture, and connect all their upper ends with the conducting rod. The rule that requires a conducting surface equal to that of the roof to be protected, to be buried in the ground, given by some would-be authorities, has no foundation either in theory or practice. It is not the electric charge of a roof which has to be disposed of, but that of a cloud over it; and the latter has sometimes an extent of several square miles. All reported failures of lightning rods may be traced to defective connections, especially ground connections. Rods that are faulty from the outset are often made useless by subsequent neglect: as we found some years ago at the village of Gilboa, Schoharie county, N. Y. The church was situated on a hill, and quite exposed; the under end of the lightning rod, which in its upper end was connected with the spire, was pulled out of the ground, and lay on a pile of firewood in the rear of the church. If this church had been struck and burnt down, it might have been pointed out as an example of the utter uselessness of lightning rods.

Excitement the Stimulus of Business.

There are a numerous class of men who live almost entirely upon excitements. In a calm dispassionate flow of life and business they are stupid and powerless; but stir up the placid sea until it surges with violence, and they are then ready for a mission—armed and equipped for the toil of life. Such minds are the martyrs of this age of enlightenment—the life they lead is a consuming one, and vitality is spent with a prodigality more than heroic. The requirements of business are making this method of living more imperative, and without it success is beyond a reach. Half a century since the rivalries now experienced in all departments of human industry were then unknown. A new order of mind and new energies are called into requisition. The business man of the last generation would hardly be recognized by the prevailing caste. Flesh and blood are capable of enduring many hardships, but the delicate nervous organization, its accompaniment, breaks down at length under the incessant tension. Disregarding the friendly premonitions of temporary illness, the exhausted mind holds on its work by the necessary and agreeable stimulus of fresh excitements, until a sudden reaction crushes its vigor, and then comes on the weakness, satiety, and sorrow of hopeless infirmity.

It is not without a shade of melancholy that we notice in almost every daily journal the record of a faltering in the ranks of business men. This successful merchant or manufacturer has impaired his health by overwork, which means too much nervous excitement, and he starts for Europe in the hope of building up his health on a broken foundation. Another professional man is aroused from his dream of ambition with the frightful conviction that phthisis has fastened its deadly grasp upon his vitals, and the grim images of weakness and decay henceforward fill his vision. There has been an alarming increase of disease within a few years, having its origin in the causes we have named, and the effect of it should be to produce greater moderation. What if the profits are less? They can be continued longer and life made happier.

There is no necessity for this waste of life—it is a sheer delusion, the effect of a foolish ambition. Better accept the heritage of poverty or a moderate success than the infallible necessity of an early disease.—*Hunt's Merchants' Magazine.*

CURIOSITIES OF GLASSMAKING.

The manufacture of glass dates back to the remotest antiquity. In the Metropolitan Museum of Art, in this city, are glass bottles and vases exhumed from the ancient tombs of Cyprus, which were probably manufactured forty centuries ago; and in some of the tombs of Egypt are abundant representations of Theban glassblowers (Fig. 1) at their

Fig. 1.



work. It is a well authenticated fact that whole streets in ancient Tyre were occupied by glass factories; and for some centuries glass is said to have constituted almost the only, or at least the prominent, article of trade of that great commercial city. It was during the reign of Nero, so far as we can discover, that the first perfectly clear glass, resembling crystal, was manufactured. Pliny states that the Roman emperor gave a sum equivalent to two hundred and fifty thousand dollars of our money for two cups of ordinary size, and that rich articles of glass were in such general use among the wealthy Romans as almost to supersede articles of gold and silver.

Fig. 2.



The history of glassmaking is attainable in so many standard works that it is not deemed necessary to trace it here to any extent beyond what is needful for the description of the most famous productions of ancient and mediæval glass makers, which are represented in the accompanying engravings. The Portland vase, represented in Fig. 2, was found, about the middle of the sixteenth century, inclosed in a sepulchral chamber under the

Fig. 3.



Monte del Garno, near Rome. It was ornamented with white opaque figures, in bas-relief, on a dark blue transparent ground. It is supposed that the whole of the groundwork below the handles was originally covered with white enamel, out of which the figures were sculptured. In the style of a cameo, with most astonishing skill and labor. The vase was purchased by the Duchess of Portland (whence its name) at a price exceeding \$9,000. Several copies of it were made by Wedgwood. While on exhibition in

London, the original was accidentally thrown over by a visitor's cane striking it, and was broken in fragments. The pieces, however, were afterwards fitted together with remarkable accuracy, but of course the value of the object was greatly lessened.

Next in order of importance is the Naples vase, Fig. 3, which was exhumed at Pompeii in 1839. It is about 12 inches high, and 8 inches wide, and is of the same style of manufacture as the Portland vase. The figures and foliage which form the design are representative of the harvest season, and

are produced in bas-relief raised on a delicate white opaque glass overlaying a transparent dark blue ground, the raised portions being evidently carved by hand. It is supposed that in this, as in the Portland vase, the blue glass was covered with enamel; but the difficulty of tempering the two bodies of different specific gravity, so that they should withstand the work of the sculptor, must have been very great.

Fig. 4.



The Strasburgh vase, Fig. 4, was found, in 1825, in a burial casket disinterred near the fortifications of Strasburgh. It is made of white glass, enveloped in a curious network of red glass. About the rim are portions of the name MAXIMIANVS AVGVSTVS, a Roman emperor who died at Marseilles A.D. 310.

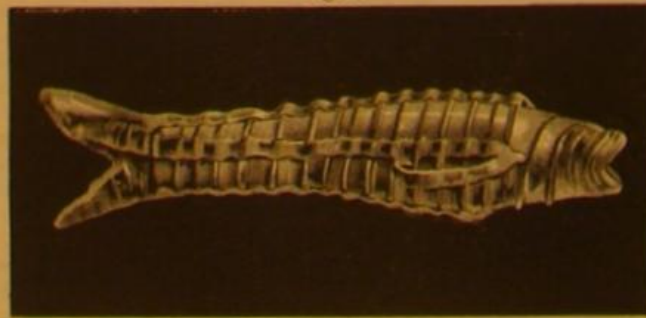
Fig. 5.



Fig. 5 represents ancient Greek glassware. The forms are probably the prototypes of many of the commonest designs now in use. A vessel of glass in the form of a fish is shown in Fig. 6. This is attributed to the first Christians. The Greek name for this fish commences with the letters X and ρ of the Greek alphabet, which characters (ch and r) are also the first two in the word "Christ." For this reason the two Greek letters in monogram were adopted as the Christian symbol, and the vessels holding oil used in the sacrament of baptism were made in the shape of a fish.

A very curious vase, found in France, and probably made by the Romans during their occupation of Gaul, is represented in Fig. 7. It is a cup of yellow moulded glass, and originally was in two pieces. On the sides are raised figures of gladiators, each figure having a name inscribed above it. Similar vessels, decorated in like manner, have been found in England; and it is believed that they constituted the prizes offered in gladiatorial combats.

Fig. 6.



The cup of transparent glass depicted in Fig. 8 is of uncertain origin, although the fabrication is very remarkable. It was found in France in 1862, and is of a dark green color, the inscription being raised in white enamel. It probably dates from the sixth century.

The romance of glass making centers about Venice, which city for a long period held the monopoly of supplying all Europe. So useful were the glassmakers at one period in Venice, and so considerable was the revenue accruing to the Republic from their manufacture, that, to encourage the

men engaged in it to remain at Murano, the island where the factories were located, the Senate made them all burghesses of Venice, and allowed nobles to marry their daughters. An old writer, describing the Venetian industry, says: "The gentlemen of the great glass houses work only twelve hours, but that without resting, as in the little ones, and always standing and naked. The work passes through three hands. First, the gentlemen apprentices gather the glass, and prepare the same. It is then handed to the second gentleman, who are more advanced in the art. Then the master gentleman takes it, and makes it perfect by blowing it. In the little glass houses, where they make coach glasses, drinking glasses, crystals, dishes, cups, bottles, and suchlike sort of vessels, the gentlemen labor but six hours altogether, and then more come in and take their places. And thus they work night and day."

Specimens of Venetian glass are represented in Fig. 9. These are yet made in Murano, where there are whole streets of furnaces. They say there "that should any one transfer a furnace from Murano to Venice, or to any of the assembled islands, or to any other part of the earth, to use the same materials, the same workmen, the same fuel, and the self-same ingredients every way, yet they cannot make crystal glass in that perfection for beauty and luster as at Murano. Some impute it to the circumbient air, which is purified and attenuated by the concurrence of so many fires that are in these furnaces day and night perpetually, for they are like the vestal fires, never going out." The interior of one of these old glass factories, reproduced from a wood engraving of the sixteenth century, is represented in Fig. 10.

Among the workers at the Murano furnaces originated the quaint old notion of the salamander, the fireproof monster.

It was believed that at certain times this wonderful being issued from his abode in the furnace fire, and, as opportunity offered, carried back some victim to his fiery bed. The absence of workmen, who sometimes departed secretly for foreign lands, was always accounted for by the hypothesis that, in some unguarded moment, they had fallen a prey to the salamander. Visitors, too, whose courage could sustain them, were directed to look through the by-hole to the interior of the furnace, and no one failed to discover the monster coiled in his glowing bed, and glaring with fiery eyes upon the intruder. Some gallant knights in full armor, it is said, dared a combat with the fiery dragon, but always returned defeated: the important fact being, doubtless, then unknown or overlooked that

Fig. 8.



Fig. 9.



steel armor, being a rapid conductor of heat, would be likely to tempt a more ready approach of the fabled monster.

A belief was long prevalent that glass drinking vessels, made under certain astronomical influences, would certainly fly to pieces if any poisonous liquid were placed in them; and sales of Venetian glass vessels of this kind were made at enormous prices. Another idea existed that vessels of a certain form, made in a peculiar state of the atmosphere and after midnight, would allow a pure diamond to pass directly through their bottoms. Various articles, such as colored

goblets, were thought to add to the flavor of wine, and to detract materially from its intoxicating quality.

In 1486, Emperor Nicholas, of Austria, established near Vienna glass works for making glass after the Venetian system; and from that time forward the industry greatly increased in Austria and Bohemia. In the seventeenth century the Bohemian workmen began to make a new product, called the "Wilkomm," Fig. 11, in white or green glass, painted in enamel with armorial bearings, figures of birds and animals, etc. This was the beginning of the famous

Fig. 10.



Bohemian glass manufacture. The fabrication of the Wilkomm ceased early in the eighteenth century, but attempts are now being made to revive it.

The growth of the Bohemian glass industry was much encouraged by the Empress Maria Theresa, who gave privileges to all glassmakers who immigrated to the Austrian dominions; and the vast deposits of pure quartz in the Böhmerwald and the Riesengebirge became the principal seats of the trade. As the trade grew, the Bohemian artists gradually freed themselves from Venetian influence as to form and decoration; and although their designs were somewhat heavy, the colors and decorations were varied and artistic. The use of a cutting wheel for engraving glass was a great aid to the art, and was a German innovation. The products of Bohemian glassmakers were prohibited from introduction into France up till 1860, and specimens became of exceptional value in that country, and possessed the usual pleasant flavor of forbidden fruit.

Fig. 11.



Artificial Ivory.

We find in our French contemporaries two new processes for the manufacture of this material. The

first consists in dissolving two parts of pure india rubber in thirty-six parts of chloroform, and saturating the solution with pure ammoniacal gas. The chloroform is then distilled at a temperature of 165° Fah.; and the residue, mixed with phosphate of lime or carbonate of zinc, is pressed into moulds and dried. When phosphate of lime is used, the product is said to possess in a remarkable degree the peculiar composition of natural ivory.

The second process involves the use of *papier maché* and gelatin combined. Billiard balls of this substance cost about one third the price of genuine ivory balls, and are claimed to be quite as hard and as elastic as the latter. They may be thrown from high elevations upon pavements without injury, and will withstand heavy blows with the hammer. The composition is known as Paris marble, and may be used for raised ornamentation of ceilings, or prepared so as to imitate fine varieties of marble.

Planing Mill Machinery.

We quote from a third article from the pen of Mr. F. H. Morse, published in the *Northwestern Lumberman*, the following remarks (see pages 115 and 135 of our current volume for the previous extracts):

It is pretty generally conceded by experienced mechanics that there is no machine in use the bearings of which require more attention than those of the planing machine. The very high rate of speed at which the spindles are necessarily run, the sudden and severe strains they often receive, and the fine dust which collects upon every part, absorbing the lubricants and impeding their free operation, renders it vitally important that constant care should be exercised to keep them in proper order, that they may run without heating and produce smooth work.

Spindles should be made of rolled or cast steel, cut from the bars and properly shaped in the lathe, but should never be put into the fire. Steel is superior for this purpose in many important particulars, though until quite recently wrought iron was almost exclusively used. Steel is much more homogeneous than iron, and for this reason may be turned more nearly to a cylindrical form, a condition which has much to do with the production of bearings that will remain cool under high speeds. A spindle that lacks uniformity as to hardness may by grinding—though not by filing or turning—be made so nearly round as to answer well for moderate speeds; but when put in motion at a rapid rate, the ends of the fingers applied to its surface will reveal the irregularity in its shape, proving that it is totally unfit to be used for quick running machinery. Good steel is not only more easily reduced to the proper shape, but on account of its superior stiffness the spindles may be made about one third smaller than where a weaker metal is used, thus greatly diminishing the friction and also their liability to heat the bearings. Its greater strength is another point in its favor. According to Templeton, the difference between wrought iron and cast steel as regards their torsional and cohesive properties is as follows, the table showing the results obtained from experiments with one inch round and square bars, in pounds avoirdupois:

	TORSION.		COHESION.	
	ROUND BAR.	SQUARE BAR.	ROUND BAR.	SQUARE BAR.
Wrought iron.....	12,063	15,300	43,881	55,872
Cast steel.....	29,111	26,880	105,454	134,276

From this exhibit we find that the torsional strength of the steel is nearly 75 per cent greater than iron, and its cohesive strength nearly 140 per cent greater.

The bearings for spindles should as a rule be of brass; but with the exception of one or two firms, manufacturers use only Babbitt metal, which, on account of its cheapness and the ease with which it may be replaced when worn out, will doubtless always be in favor. As nearly the same rules that govern the use of one are applicable to the other, we confine our remarks chiefly to those made of the last named material.

The length of bearings is a matter of much more importance than their diameter, and our best builders now make them of ample size in this direction. How to mould a bearing properly is something which every operator should thoroughly understand, and it will not be out of place perhaps to give some hints as to the best way of performing the operation.

While almost any mechanic can mould a bearing in some style, there are but few who can do the job properly, that is, so that it will not heat, and enable the machine to produce good work. It is often, and in fact most always, the case that, when a planing machine is started up, just after the cylinder bearings have been newly fitted, smooth work cannot be turned out, while it is just the time when it would naturally be expected that the machine was in the best of order; instead, it makes the surface of the lumber uneven, or wavy, as it is termed in planing mill parlance. The usual remedy—if remedy it may be called—is to let them wear down, operators seemingly entertaining the impression that they will be all right after a few days' wear. This practice is decidedly erroneous and goes to show that the mechanic does not understand this branch of his business as well as he should. A new bearing can be kept just as cool, and need cause no more irregular work to be turned out, than one which has been in operation a week or a month.

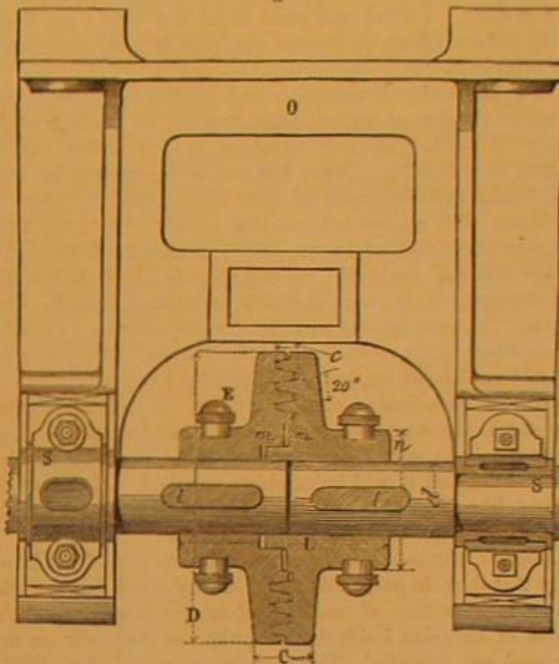
The method of moulding cylinder bearings most commonly practised is to place the cutting cylinder as nearly as possible in its proper position (that is, parallel with the bed of the machine) and pour the lower section of the bearing first; then, after the requisite amount of packing or lining is put on, the upper half is bolted down, and then poured. By this

process one side of the shaft or spindle is surrounded with hot metal while the other remains comparatively cold, and every mechanic of ordinary intelligence knows the result of such treatment; it must certainly spring the shaft and probably ruin it. Some mechanics say that when the other side comes to be poured it will spring back into its former shape, but this idea is too fallacious to need contradiction. If a bearing made by the above described method is examined carefully, it will be found that the spindle bears only upon the ends of the journal. Bearings for slow moving shafts can be moulded in almost any way, and yet be made to answer the purpose; but for machinery which must be run at an extremely high rate of speed too much care cannot be exercised in their construction.

A NEW FRICTION CLUTCH FOR SHAFTING.

We extract from the Belgian *Bulletin du Musée* the annexed engravings of a novel shafting connection, the construction of which is quite simple. On a bracket, O, Fig. 1, are the two journals, S, through which pass the ends of

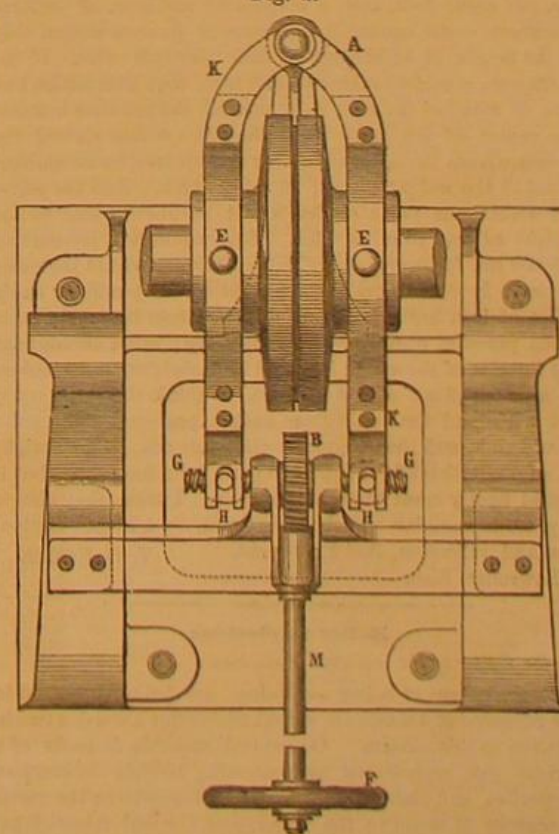
Fig. 1.



the shafts to be coupled. To these extremities, the acting parts, *m*, of the clutch are attached, and on each face of the latter are rings, V-shaped in cross section, which, when the faces are approximated, interlock. One part of the clutch has a tongue, *l*, which enters a groove in the opposite part and thus serves as a guide. It will be seen that, when the two parts are brought closely together, the friction between the opposing rings will cause the motion of one shaft to be transmitted to the other.

The movement of the clutch into or out of action is effected by the hand wheel, F, and shaft, M, Fig. 2, which

Fig. 2.



turns a screw engaging with a helicoidal wheel, B. On the axis of the latter are cut two screws, G, oppositely threaded, on which travel nuts, H. On the nuts are lugs which enter the crotched ends of the levers, K. These levers are attached by bolts, E, to the parts of the clutch, and are connected together above at A, at which point there is a supporting arm. By this device moving shafts may easily be coupled without stopping them.

Communications.

On the Shape of the Earth.

To the Editor of the Scientific American:

In your paper of February 3d, you published an extract from a lecture by Professor Roscoe, in which the opinions of Mallet and Sir William Thomson are quoted to show that the center of the earth is not necessarily in a state of fusion, as I think several eminent geologists, and especially Sir Charles Lyell, always held. But it has been taught for many years that the shape of the earth, being an oblate spheroid, was very strong evidence, if not positive proof, that it had once been in a melted state. This doctrine has become a dogma in the seminaries of learning, and in the textbooks; and it has been entertained by many of the most profound natural philosophers for more than a hundred years. I have seen it in the writings of Professor Tyndall and Professor Draper, also in Humboldt's "Cosmos."

Notwithstanding this array of authority, is it not well to inquire whether the conclusion is correct? I do not propose to discuss the origin of the earth, or to argue that its interior is not now in a state of fusion. But I hold that its shape proves nothing as to its origin, or the present condition of its interior. I think the earth could not retain any shape very different from the present one, even if it were composed of solid iron.

It is known by all architects and engineers that there is a limit to the size of arches, depending on the strength of the material used. An arch spanning several inches can be made of soft putty. Many feet can be spanned by an arch of brick, and hundreds of feet are spanned by steel in bridges. But no one believes that an arch over Lake Erie, or over the Straits of Dover, would sustain itself, no matter what material was used. So that there is a limit to the size of any large body, beyond which gravitation exceeds cohesion. The most minute particle of water assumes a globular form when not in contact with other matter. Putty or jelly would act like water, but would require a larger quantity to overcome the cohesion of the particles. A body the size of the earth, if not revolving on its axis, would be spherical, or very nearly so, even if composed of steel. But let it revolve on its axis, and it will be an oblate spheroid. A very small planet, like some of the smaller asteroids, or a meteoric rock, might retain permanently any given shape.

Liquids, confined in tubes, press with the same force laterally that they do perpendicularly, at any given depth. The same must be true of particles of matter in solids; but the force of cohesion holds them together so that they are not pressed out laterally. The cohesive strength of any substance being known, it is easy to calculate the height to which a perpendicular column of that substance could be raised before the particles would be forced asunder at the base. The tenacity of cast iron is sometimes estimated at 20,000 lbs. per square inch, but it varies greatly. This is when the force is applied by stretching a suspension, and the particles are strained apart. But the cohesion among the particles would be much greater where the force is applied by compression. I have not statistics to enable me to say what it is; but assuming the cohesion of cast iron to be twice as great under pressure applied in a given direction as it is when the force is applied by stretching, that is 40,000 lbs. per square inch, and assuming the weight of iron to be 450 lbs. per cubic foot, then a column of cast iron, of uniform thickness, could sustain the pressure of its own weight only to the height of 12,832 feet—a little over two miles. If the earth were a perfect sphere of cast iron, with gravitation and rate of rotation the same as at present, the pressure towards the center of the earth from the poles would exceed the pressure from the same area, near the equator, by an amount equal to the weight of iron 13 miles thick. And the pressure within the polar circles would be about equal to the weight of iron 10 miles thick. This would be a pressure of 165,000 lbs. for every square inch of surface within the polar circles. It would exceed the weight of sixty million cubic miles of iron around each pole. The strain from this enormous pressure would not be evenly distributed throughout the interior of the earth; it would be mainly concentrated on or near the plane of the equator. I think the earth could not withstand the strain from such a pressure. The poles would sink, and the equator would bulge out. There might be an oscillation of the different parts for a long time, but it would finally come to an equilibrium. I think that almost any mathematician will be convinced, by a little examination and reflection, that I am right.

Lawrence, Kan.

T. R. FISHER.

Boiler Explosions.

To the Editor of the Scientific American:

As the causes of boiler explosions are being discussed in the SCIENTIFIC AMERICAN, permit me to offer a word or two in relation to this subject. Occasional mention is made of a certain gas, represented as possessing terrible destructive properties, and claimed or believed by many to be the result of scarcity of water in the boiler, and the real cause of explosion. I have never yet seen any description or analysis of this gas, or been able to obtain any information that would afford a clue to its existence. It is true and well known that water is composed of two gases, oxygen, a supporter of combustion, and hydrogen, a combustible. It is further known that, when these elements are properly mixed, they are capable upon ignition of exerting an immense degree of force. It is well understood, also, that, when the vapor of water is

passed through an iron tube heated to redness, hydrogen is generated. It may not be strange that, with a limited knowledge of the laws that govern the changes among these bodies, some such idea as the above should have originated. But if we review carefully the process by which water is produced, and the method required for its decomposition, we can discover no ground whatever for the theory in question. When a jet of mixture of eight parts of oxygen (by weight) and one part hydrogen is ignited, we have a flame which develops the greatest heat known—namely, that of the compound blowpipe. In this flame, even gold is instantly fused and converted into smoke. Now, under this intense heat these gases combine, the sole product of the combustion being a vapor which is condensed to a liquid on cooling, showing that water is formed under the most intense heat we can produce.

It is well known that, if a clean iron tube be heated in a furnace, and, while it is glowing, a current of steam is passed through it, and thence into a tube of cold water by means of a small pipe, bubbles of gas will rise, and may be collected by inverting a glass jar filled with water over the mouth of the pipe, the gas ascending through the water. The gas thus obtained will not burn by itself, but will extinguish a lighted taper the instant it is introduced. It resists every effort to change its properties; in short, we know it to be hydrogen, a fixed gas, and one of the component parts of the water we have decomposed. Had the separation of these gases been due to heat alone, oxygen would have been produced also, and the introduction of a lighted taper would certainly have produced an explosion; but we can find no trace whatever of oxygen in the jar. On examining the interior of the iron tube, it is found that a rough scale has been formed on the surface, which is easily pulverized, having the appearance of rust. This substance is proved by analysis to consist of iron and oxygen, showing that the heated iron has absorbed the oxygen of the water. This change is due to the fact that, although oxygen has a strong attraction for hydrogen, it still has a more powerful affinity for iron; hence, it parts with its old associate to unite with the new. Heat has facilitated this change, which would have occurred in time without it. If we substitute a glass tube for the iron one in the latter experiment, it may be heated to near its point of fusion for hours, and a very moderate current of steam passed through; but we look in vain for the formation of gas of any kind, there being little or no affinity between the glass and the constituents of water. The steam will therefore pass through unchanged to the tube of water, where it will all be condensed again, notwithstanding the high temperature to which it has been subjected. When water gets low in a boiler, it falls gradually by evaporation, consequently the surface of the boiler must be overheated gradually. Now the quantity of hydrogen that would be produced in a given time depends entirely upon the quantity of oxygen that is absorbed by the heated iron.

This operation is always an exceedingly slow one, owing to the solidity of the material that must be atomized, and the gas is evolved in minute bubbles. Hydrogen being many times lighter than steam, it would be the first to pass out of the boiler. But should the gas accumulate in quantity, we have seen that it cannot burn or explode without a supporter of combustion. Steam is not a supporter of combustion. Even at a red heat, a mixture of hydrogen and steam cannot become ignited. Heat alone will not decompose water, and there is no way to account for the presence of free oxygen to a boiler sufficient to cause explosion.

Exeter, N. H.

GEORGE B. BRAYTON.

Color Blindness among Railway Employees.

In a recent article on the subject of color blindness, we pointed out how this infirmity, when affecting railroad employees, might become a source of public danger, inasmuch as it frequently prevents the person affected distinguishing the difference between a red and green signal light. From actual examination of railroad men in Europe, it would appear that cases of color blindness are by no means rare, but, on the contrary, are somewhat frequent. Among the employees of a Russian line in Finland, Dr. Kzohn recently found 43 persons to whom the red and green lights appeared precisely alike. In Sweden and Hungary similar experiments have also recently been conducted. On one Swedish line, ten per cent of the employees confounded red, green, and white lights. In Hungary, on the other hand, but one person out of 400 was found totally color blind, while three per cent of the remainder were more or less affected.

Bicarbonate of Iron.

We have lately received from correspondents in Arkansas samples of water so saturated with bicarbonate of iron as to completely obstruct, by precipitation, the pipes and valves of steam engines in which an attempt has been made to use the water. We are in possession of specimens of this deposited carbonate fully an inch in thickness, and remarkably free from foreign salts. It might find employment in the production of medicinal preparations and ferruginous salts used in the arts.

Discovery of a New Comet.

Professor Henry, of the Smithsonian Institute, announces that a new comet was discovered by Professor Borely of Paris on February 8, in right ascension, 17 h. 13 m.; declination, 1° 37'. Its south daily motion is +1 m. 44 s. in right ascension, and +3° 7' in declination. It has a brilliant, round nucleus. In this locality the new comet should be looked for during two hours before sunrise.

ASTRONOMICAL NOTES.

OBSERVATORY OF Vassar College.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned.

M. M.

Positions of Planets for March, 1877.

Mercury.

The planets Mercury, Venus, and Saturn rise so nearly with the sun in March that they cannot be readily found. Mercury rises at 5h. 42m. A. M. on the 1st, and sets at 3h. 32m. P. M. On the 31st, Mercury rises at 5h. 43m. A. M. and sets at 3h. 46m. P. M.

Venus.

On March 1, Venus rises at 6h. 2m. A. M., and sets at 4h. 19m. P. M. On the 31st, Venus rises at 5h. 34m. A. M., and sets at 5h. 29m. P. M. Venus and Saturn are in conjunction on the 16th, but they rise so nearly with the sun that they can scarcely be seen.

Mars.

Mars rises on March 1 at 2h. 53m. A. M., and can easily be found by its neighborhood to Jupiter, being a little south of that planet. On the 31st, Mars rises at 2h. 16m. A. M., and sets at 11h. 21m. A. M. The more rapid motion of Mars easterly among the stars has carried it far from Jupiter, and on the 31st they are about 18° apart.

Jupiter.

Jupiter is far south in declination; but as it rises at 2h. 51m. A. M. of the 1st, it can be seen for three hours before sunrise. On the 31st, Jupiter rises at 1h. 6m. A. M.

Saturn.

Saturn, like Mercury and Venus, is so nearly in the line of the sun's path as scarcely to be seen in March. It rises on the 1st at 6h. 46m. A. M., and sets at 5h. 40m. P. M. On the 31st, Saturn rises at 4h. 56m. A. M., and sets at 4h. 0m. P. M.

Uranus.

Uranus, which is so distant from us that its diameter is only about four seconds of arc, can, with an ordinary telescope, be seen, unlike a star, to show a disk. With a powerful telescope, Uranus looks like a very small full moon, whiter than the moon in color. At this time (February 17) one of its satellites can be seen.

Uranus rises on the 1st at 4h. 3m. P. M., and sets at 5h. 53m. the next morning. On the 31st, Uranus rises at 2h. P. M., and sets 3h. 52m. of the next morning. On the 31st, Uranus comes to the meridian a few minutes before 9 P. M., and is then 7° west of Regulus, and nearly 3° north.

Neptune.

Neptune cannot be seen in March with good telescopes.

Sun Spots.

The report is from January 18 to February 17 inclusive. On January 18 and 19, the large spot and the larger group of spots, mentioned in the last report, were still visible: the group, consisting of three irregularly shaped spots surrounded by a chain of small ones, being now near the center and the single spot, on the western limb. On January 23, when the next photograph was taken, the single spot had disappeared, and the group was far advanced on the western limb. On January 24 it was observed very near the edge, and, before the next observation, on the 27th, it passed off. The picture of this date shows the sun's disk free from spots. The photograph of February 1 shows a very small spot on the eastern limb which could not be found after that date. On February 7 a large spot appeared some considerable distance from the equator, on the eastern limb. Probably this is the same spot which traversed the disk between the dates of January 4 and 21, but was somewhat diminished in size. The photographs of January 8, 9, 10, and 13 show a regular motion of the spot. On February 14 a very small spot accompanied the large one, but it has not since been found. On February 17 the large spot was seen very near the western edge.

The Oldest Piece of Iron.

The oldest pieces of iron (wrought iron) now known are probably the sickle blade found by Belzoni under the base of a sphinx in Karnak, near Thebes; the blade found by Colonel Vyse, imbedded in the masonry of the Great Pyramid; the portion of a cross-cut saw exhumed at Nimroud by Mr. Layard—all of which are now in the British Museum. A wrought bar of Damascus steel was presented by King Porus to Alexander the Great; and the razor steel of China for many centuries has surpassed all European steel in temper and durability of edge. The Hindoos appear to have made wrought iron directly from the ore, without passing it through the furnace, from time immemorial; and elaborately wrought masses of iron are still found in India which date from the early centuries of the Christian era.

Remedial Agents.

Sickness being a tiresome, monotonous, dreary system of endurance, it is not strange that chronic patients demand from time to time some medicinal plaything which shall give the combined charm of novelty and renewed hope. This accounts, suggests the *Daily Graphic*, for the successive eras of water cure, friction, Swedish movement, quassia wood drinking cups, steam baths, galvanism, grape cure, milk cure, sun cure, cundurango, warm blood baths, extreme vegetarianism, will cure, and finally blue glass. All of these have doubtless some specific remedial quality, and all in time will probably contribute their quota to the grand coming system of eclecticism.

STRAIGHTENING WROUGHT METAL PLATES.

No. I.

The straightening of iron plates is an operation to properly perform which requires a great deal of judgment and careful manipulation. Every blow delivered should be directed to a definite end, for one misdirected blow entails the delivery of many others to correct its evil influence; and hence, if several of such misdirected blows are given, the plate will have upon it a great many more hammer marks, or "hammer sinks" as they are sometimes termed, than are necessary. As a result, not only will the painter (in fine work) be given extra trouble in stopping the hollows to make a smooth surface, but the following evil will result: Every blow struck by the hammer compresses and proportionately stiffens the small surface upon which it is delivered, and creates a local tension upon the surrounding metal. The misdirected blows then cause a tension acting in opposition to the effect of the

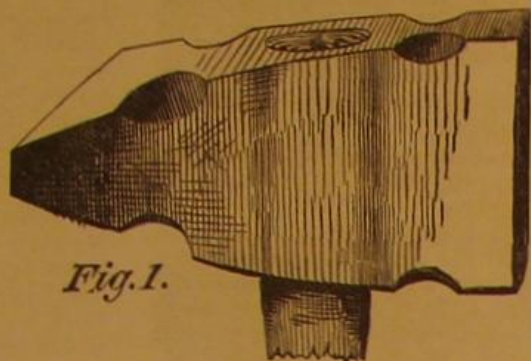


Fig. 1.

properly delivered ones; and though the whole plate may be stiffened by the gross amount of blows, yet there will be created local tensions in various parts of the plate, rendering it very likely to spring or buckle out of truth again. If, for example, we take a plate of iron and hammer it indiscriminately all over its surface, we shall find it very difficult to straighten it afterwards, not only on account of the foregoing reasons, but for the additional and most important one that the effect of the straightening blows will be less, on account of the hammered surface of the plate offering increased resistance to the effects of each blow; and after the plate is straightened, there will exist in it conflicting strains, an equilibrium of which holds the plate straight, but the weakening of any of which will cause the preponderance of the others to throw the plate out of straight; for the effects of the blows cannot be permanent unless the whole body of the iron is acted upon to an equal extent by the hammer. Suppose, for example, that we take a flat plate, and deliver upon it a series of blows round about its center. The effect will be to make it hollow on one side and rounding on the other, the effect of the blows being, not only to indent the plate in the spots where they fell, but to carry the whole body of the

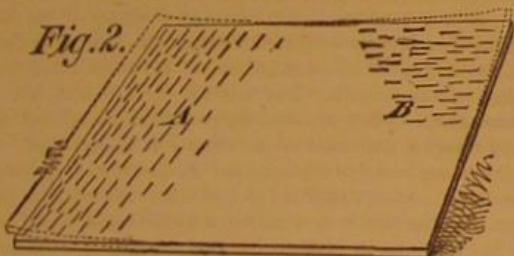


Fig. 2.

middle out of true; because, the area of the iron being increased by the stretching effect of the blows, the center leaves the straight line to accommodate the increased area. Thus, if we mark off a square foot in the middle of a plate, and hammer it so as to stretch it and increase its area $\frac{1}{4}$ inch each way, the form of the plate must alter to suit this added area, and the form of a dish or curve is the only one it can assume. If, however, the outside metal is also stretched to the necessary degree, the plate may be made flat. The skillful workman takes advantage of the stretching of the plate; and so soon as he has ascertained where the plate is out of true, he sets to work to stretch it so as to draw the crooked placed straight, taking care that the shape and weight of the hammer and the weight of the blows delivered shall bear a proper relation to the thickness of the plate and the material of which it is composed. If it is of consequence that the finished work shall bear no marks of the hammering, as in the case of engravers' plates a flat-faced hammer is employed; but for other work, the shapes, as well

as the weights, of the hammers vary. The hammer shown in Fig. 1 is called a "long cross-face;" "long" because it is intended to be used in both hands as a sledge, and is provided with a long handle (being used for heavy work) and "cross-face" because the length of the face on one end stands crosswise with the length of the face at the other. This hammer causes the metal to rise or lift in front of it, the direction in which the rise takes place depending upon the direction in which the length of the hammer face strikes the plate. Suppose, for example, that we strike the blows shown at the

end, A, of the plate shown in Fig. 2, and that we then turn the hammer upside down and strike the blows denoted by the marks at B in the same figure (this the workman can perform by reversing the hammer, without changing his position); the result will be to curl up the plate as denoted by the dotted lines.

This effect is produced by two causes, the first of which is the shape of the hammer face, and the second is the direction in which the blows fall. Fig. 3 represents an iron plate with one each of the blows, respectively shown in Fig. 2, at B and C, delivered upon it. Then, the indentation of the plate being denoted by the full line, the tension caused to the surrounding iron will be indicated by the dotted lines. It will be noted that these dotted lines are in each case longer on one side of the mark than on the other, and the reason is that the effect is greater on that side, or rather in that direction, because the hammer does not fall vertically upon the plate, but somewhat askant. If the plate shown in Fig. 2 be turned up on edge so as to appear as in Fig. 4, the direction in which the hammer would travel when striking the blows at B (in Fig. 2) is denoted by the arrows, B, in Fig. 4. While if we turn up the same plate so that its edge, D, in Fig. 2, will appear as the edge, D, in Fig. 5, the direction of the blows shown at C, in Fig. 2, will be denoted by the arrows, B, in Fig. 5; so that both the shape of the hammer face and the direction of the blow conjointly act to draw or bend the plate in the required direction. If we take a ball-faced hammer, the effect will be produced as shown

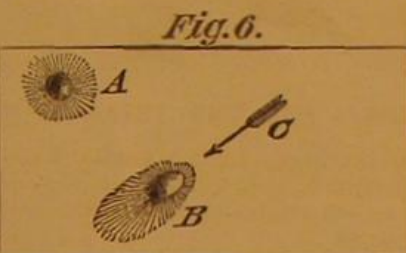


Fig. 6.

in Fig. 6, in which the circle, A, represents the mark left by a ball-face or pene hammer, and the diverging dotted lines show the effect of the blow upon the surrounding iron. B represents a blow delivered by the same hammer, which, while falling, traveled also in the direction of the arrow, C, the direction effects of the blow being denoted by the dotted lines.

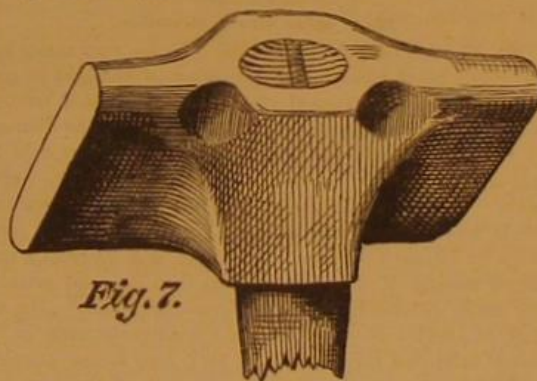


Fig. 7.

We next come to the twist hammer, shown in Fig. 7 in perspective, and in Fig. 7' in front view. This is a hand hammer with the two faces standing parallel to each other, but diagonal to the body of the hammer; so that, by turning the handle in the hand, the direction of the hammer marks will be reversed. Suppose, for example, that in Fig. 8 the outlines represent a plate; the lines slanting one way, as at A, will represent hammer marks made with one face, and those slanting the other way, as at B, are marks made by the other face of the hammer, the direction or line in which the hammer fell being the same in both cases. By very little moving of the position of the hammer handle, then, and by turning the hammer as required, the workman can place the hammer marks in any necessary direction, as shown by the remaining marks in Fig. 8, without requiring to change his position.

In referring to the hammer marks, as above, it is not to be supposed that the hammer indents the work, producing "hammer sinks;" the term marks being intended to represent the surface of the metal which received the direct impact from the hammer face.

In addition to the shape of the hammer and the direction of the blows, there is to be considered the weight of the hammer and the velocity at which it travels; and in this connection the following remarks may be made: The effect of a quick blow is to cause indentations or hammer sinks, because the speed of the hammer is of as much importance as its weight. A heavy body traveling slowly may represent the same amount of stored-up energy as that of a lighter one traveling at a greater velocity; but the effect of the impact with another body will be quite different. Thus, to use a familiar example, a tallow candle fired from a gun will pass through an inch board, making a hole clear through the

board; so likewise the effect of a light hammer and a quick blow will be productive of indentations. Quick blows, therefore, are never employed, the weight of the hammer being proportioned to the size of the work.

We next come to the straightening block, that is, the iron block upon which the iron plates are to rest (as shown upon

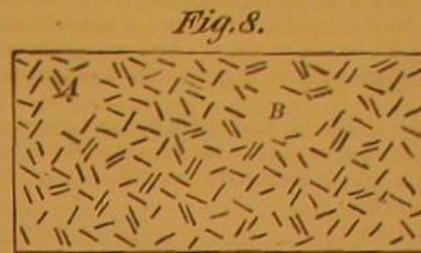


Fig. 8.

an anvil) while being straightened. The size of this block should be about 12 x 18 inches, and say 12 inches deep, which is large enough for the largest work, as will be perceived from the following considerations: It is necessary that the plate should be solid on the block, directly beneath the part of its surface which is being hammered, otherwise the effect of the blows will be entirely altered. If, for instance, A, in Fig. 9, represents the straightening block, and B, a plate resting thereon, then the blows struck upon the plate anywhere save over the very edges of the anvil will have but little effect, because of the spring and rebound of the plate; and the effect of the blow will be distributed over a large area of the metal, tending to spring it rather than give it a permanent set. If the blow is a quick one, it may indeed indent the plate without having any straightening effect. On the other hand, by stretching the skin on the upper side of the plate, it will actually, under a succession of blows, become more bent. In fact, to use a straightening block, so large in proportion to the size of the plate that the latter cannot be adjusted so that the part of the plate struck lies solid on the block, renders all the principles above explained almost valueless, and is a process of pounding, in a promiscuous way, productive of hammer marks, and altogether fatal to the production of true work. In the method of manipulation here explained, every blow delivered is given with the object of liberating the strains which may exist in the plate, holding it out of flat, or of drawing the plate so as to bring into line with the general surface those parts which are not in line with the main body of the plate. J. R.

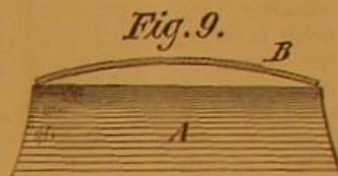


Fig. 9.

Cologne Water as an Anæsthetic.

Dr. Hugues reports in the *Nice Medical* several cases of anæsthesia produced by the inhalation of the odor of Cologne water. A young person suffering with tuberculous meningitis was, during a period of excitation when injections of morphine and chloral had not produced the desired effect, brought into a sound sleep within seven minutes after a handkerchief saturated with the Cologne had been placed over the nostrils. The sleep lasted about an hour, and the pulse remained at 75. There was no period of excitement, and the anæsthesia, without being complete, was very marked. Dr. Hugues has tried no new experiments of his own on the subject, but propounds the theory that a kind of hypnotic action takes place on the olfactory nerves analogous to that produced by brilliant objects (when intensely regarded) on the optic nerves. The journal whence we extract the above thinks that the anæsthesia is more likely produced by the essences entering into the Cologne, or possibly it may be due to their combination. In any event, the matter seems to be worth some further investigation.

Health of Employments.

The following instructive table was prepared by direction of the Massachusetts Legislature, by which it appears that the average age of

	Years.		Years.
Gentlemen is.....	48	Masons.....	48
Judges.....	46	Traders.....	46
Farmers.....	44	Tailors.....	44
Bank Officers.....	44	Jewelers.....	44
Copers.....	38	Manufacturers.....	43
Public Officers.....	37	Bakers.....	43
Clergymen.....	36	Painters.....	43
Shipwrights.....	35	Shoemakers.....	43
Hatters.....	34	Mechanics.....	43
Lawyers.....	34	Editors.....	40
Boys.....	34	Musicians.....	39
Blacksmiths.....	31	Printers.....	38
Merchants.....	31	Machinists.....	36
Calico Printers.....	31	Tenchers.....	34
Physicians.....	31	Clerks.....	34
Butchers.....	30	Operatives.....	32
Carpenters.....	29		

Reaching the North Pole.

Mr. J. H. Stevens, of Dayton, Ohio, writes to us to suggest the use of balloons, to be carried as far north as possible in sledges containing compressed gas, the gas being then utilized to inflate the balloons, which are then to be started with wire ropes attached. He thinks that a series of balloons could be started from the highest latitude, say 81° N., so as to pass over any intervening ice, and that communication could be kept up between the sledges or the ships and the balloons till the object was achieved. The details of the plan, which he gives with great minuteness, are too long for insertion in our columns.

THE TRIAL OF THE HUNDRED-TON GUN.

The 100-ton gun, built by Sir William Armstrong for the Italian Government, was, as we have already noted, transported to Spezzia, Italy, and there was fired fifty times, this being the proof test called for by the contract with the maker. The results of the trials show that, with a projectile weighing 1,997.6 lbs., and charges of powder varying between 299.6 and 378.5, the pressures at the bottom of the bore ranged between 16 and 21.4 tons per square inch. The velocities obtained were between 1,337.6 and 1,504 feet per second.

The four targets, against which the shots were directed, varied both in general construction and in the nature of the plates with which they were covered. Target No. 1 was composed of two

plates of forged soft steel from the Creuzot foundry. Their dimensions were 32.8 inches long by 56.5 broad by 21.8 inches thick. They were backed by two layers of wood measuring 25.1 inches in thickness, and supported by a heavy iron framework that rested at an acute angle on the earth. In target No. 2, there was the same general construction, with the excep-

tion, however, that the plates were of forged iron, partly of English and partly of French manufacture. Target No. 3 had two plates of iron, separated by wood on its upper half. The outer plate was 11.8 inches, and the inner one 9.9 inches, in thickness. The lower half of the target had an outer plate of 9.9 inches backed by a hard cast iron plate 14.8 inches thick. The wooden portions were the same as those already described. Target No. 4 closely resembled No. 3, so that it will be seen that all were constructed with a thickness of 21.8 inches of metal, besides sufficient wooden backing to aggregate a total thickness of about 51 inches.

The firing ground was located in a ravine near the coast, where a butt was erected of sandbags and gabions filled with earth. The cost of targets and earthwork was about \$125,000, each armor plate being worth about \$4,000. The effects of the shot—to enter into the detailed consideration of which here would occupy too much space—fully realized all anticipation. The terrible destructiveness of the enormous projectile is, besides, well exhibited in the annexed engravings representing one of the targets before (Fig. 1) and after (Fig. 2) being struck. Although the projectile failed to traverse entirely the steel plate, it was considered to have dealt the armor a shock which would have irretrievably damaged the same had the plating been upon a vessel.

As might be expected, the tidings of these results have created considerable excitement in England, as they show that such vessels as the *Invincible*, hitherto deemed impregnable to modern artillery, are no longer so. The British Admiralty has already ordered the construction of several plates 24 inches thick, or some three inches thicker than those used at Spezzia. Plans for a still larger gun are also under consideration; and the *London Times* announces the speedy construction of a 200-ton Fraser gun, capable of throwing a 3,995 lb. shot.

A SELF-SETTING RAT TRAP.

The annexed engraving represents a very ingenious rat trap, simply constructed in a manner calculated to allay the



suspensions of the wisest rat, as, after catching its victims, it displays them so that they serve as decoys for others. It consists of a drum-shaped cage of wire divided by a horizontal partition into two compartments. In the head there is a square hole into which is secured, by buttons, a frame carrying a number of downwardly projecting wires. In bearings in this frame is also a shaft, having upon it two diverging rows of wires, which form a swinging gate, sus-

pending centrally between the wires of the inlet. This gate the rat can easily push aside, so as to gain access to the interior; but he cannot return, because the gate at once swings back into place. The bait is placed in the upper compartment, and thither the rat makes his way. As soon as it dawns upon him that he is caged, he loses his presence of mind; and in his desire to depart, he dives into the first opening that presents itself. That opening is in the partition, and it leads him into the lower compartment. He cannot return, because the aperture encloses another frame, which is surrounded by converging sharp wires. There he stays, and by his presence deludes his friends into the belief that everything is all right, and that they can step right in and carry off the bait. When they try to do it, they join

Fig. 1.



THE TARGETS FOR THE TRIAL OF THE HUNDRED-TON GUN.

him. After a sufficient number of rats are collected, they may be removed by taking out the wire frames. Their subsequent disposal may be left to the consideration of a Scotch terrier.

Patented through the Scientific American Patent Agency, December 5, 1876. For further particulars relative to sale of State and county rights, etc., address the proprietors and manufacturers, J. T. Wilhide & Brother, York Road, Carroll county, Md.

More Blue Glass Skeptics.

Mr. Thomas Gaffield, of Boston, who for very many years has given much attention to the action of sunlight on glass, and the action of colored glass upon transmitted sunlight, makes the following statements, which would be damaging to the nonsensical blue glass theory of Pleasonton if that statement had any foundation to rest upon. Mr. Gaffield says: "The poorest kinds of colorless glass, and even those kinds which have been changed to a yellowish or purple tinge by exposure of years to sunlight, will transmit a much larger amount of the chemical rays than the most actinic of the really colored glasses, the blue and violet." He adds that, in a series of photometrical experiments made by Professor Stimpson and himself in 1867, they found purple or violet glass to cut off about 90 per cent. of the light rays; and he estimates that the same glass transmits from 20 to 30 per cent. less chemical influence than any colorless glass.

It has been suggested to us, by a skeptic in patent blue glass science, that it is difficult to perceive how the blue violet rays, which were already in the sunlight before it was filtered by the glass, can be augmented in their influence by such filtration. If they are thus augmented, as is claimed, then it logically follows that the present compound of sunlight is a very inferior production, in which certain ingredients serve to diminish the value of the others, and that the Creator has blundered badly in its manufacture.

Hard Times for Ironworkers in Germany.

In Krupp's works there were 12,100 hands employed in the spring of 1875; in September, 1876, there were 9,000. The wages for 12 hours were \$1; now they are 80 cents. In the works of Horde in 1875, 2,800 men were employed, who worked six double shifts every week; in 1876 there were 1,500 men working five double shifts. The Gute-Hoffnung-Hutte, at Oberhausen, employed in March, 1873, 7,175; in October, 1874, 5,876; in January, 1876, 4,142 hands. In the Bochum Steel works 4,600 men were employed in 1873, while in the first two months of 1876 the number was 2,250.

Remarkable Glassware.

A number of prominent citizens of New York and Brooklyn, including William Cullen Bryant, Erastus Brooks, Chief Engineer Nevins, Secretary Edward A. Kollmeyer, of the Brooklyn Fire Department, and others, paid a visit on Tuesday to the La Bastie Glass Works of South Brooklyn to witness the manufacture of glassware under the process patented by M. de la Bastie, of Paris, in 1875. This process seems to differ from the manufacture of other glassware only in the component parts of material used, as oxide of lead, soda ash, acid, broken glass, sand, etc. After the ware has passed from the workmen's hands it undergoes the annealing process by being thrown into a bath of tallow. The visitors were conducted through the works and the process of manufacture was explained. They were then conducted

into the storeroom, where lamp chimneys, tumblers, plates, globes, etc., were subjected to a test by throwing them carelessly around the floor, driving nails into boards with a lamp chimney, and pitching the plates 15 or 20 feet on a hard floor. One small plate was thrown into the air about 25 feet and allowed to fall upon a brick floor, without breaking. Lamp chimneys were placed on lamps and heated, and cold water was sprinkled upon them, but these severe tests did not affect the ware in the least. The works employ about 150 persons, mostly boys and girls, and turn out about 1,000 dozen lamp chimneys daily.—*Tribune*.

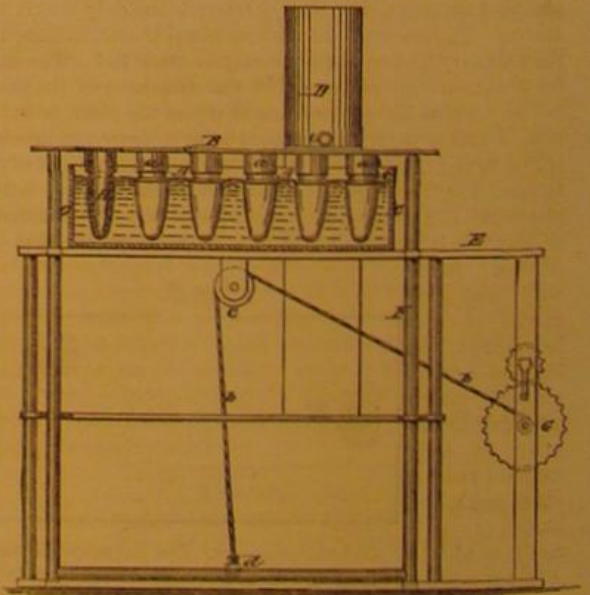
NEW MANUFACTURE OF RUBBER ARTICLES.

Mr. Charles E. Longden, of Naugatuck, Conn., has patented through the Scientific American Patent Agency (January 2, 1877), a new process and apparatus for forming rubber articles, which consists in dissolving the india rubber in naphtha or other suitable solvent, and dipping the moulds or forms upon which the articles are vulcanized into the solution of rubber a number of times, allowing sufficient time after each dipping for the naphtha to evaporate more or less. When the mould or form becomes sufficiently coated with rubber, the articles are allowed to dry on the mould, and are afterwards vulcanized in the ordinary way.

The apparatus used is represented in the annexed engraving, C being the vat for containing a solution of rubber or other vulcanizable substance. F is a movable frame, that is capable of sliding vertically through the table, E. A support, B, rests upon the frame, F, and has the socket, A, attached to its under side. In the socket, A, the moulds, A, are placed, so that the moulds project downwards into the rubber solution. The frame, F, is raised or lowered by means of the windlass, G, which is arranged in the frame of the table. A cord, D, running from the said windlass over the pulley, C, attached to the under surface of the table, is connected with a crossbar, D, in the lower part of the frame. F. D is a reservoir for containing a supply of the rubber solution, which is delivered through the pipe, E, to the vat, C, as the rubber solution in the vat becomes exhausted by dipping the moulds. The moulds or forms, A, are made from glass. They are first dipped, then raised out of the said solution and allowed to stand for a short time; and if the coating is not of the required thickness, the operation is repeated. After removal the forms are placed in a vulcanizer, and the rubber is vulcanized in the usual way.

The advantages claimed for this method of working rubber are that articles are seamless, and have a finished exterior and interior surface. They can also be made much more rapidly than by the ordinary process. The glass form permits of readily removing the rubber after it is vulcanized, and it gives the surface of the rubber, which is in contact with the glass during the process of vulcanizing, a

smooth and finished appearance. A further advantage consists in dispensing with moulds for the outside of the article.



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CRAB ORCHARD SALTS contain lime, magnesia, potash, soda, sulphuric acid, and a trace of hydrochloric, carbonic, and silicic acids.

INDUSTRIAL BARBARIANS.

Dr. Harmand, a French traveler who has recently explored a large portion of Cambodia, in Further India, describes in his narrative a curious tribe of people known as the Kouys. The name *Kouy* itself is an interrogatory, meaning, in the native language, "What is it?" A curious, though of course accidental, coincidence will be noted between the sound of the name and the Latin interrogation *Quis?* Of this tribe there are several sub-tribes, known, strangely enough, by the names of the peculiar industries which form their respective specialties. Thus there are the palm-sugar Kouys, the elephant-hunting Kouys, the paddy-gathering Kouys, and many others, besides the iron-making Kouys, whose primitive foundry is illustrated herewith. There is an odd analogy of this industrial division of the barbarous people to the separation of the Dutch and English into guilds, each pursuing its peculiar craft.

In the native smelting furnace there is a rectangular hearth upon which the ore is piled in layers, alternating with charcoal. To serve as tweezers, twenty-six clay tubes, spread in a fan-shape, are inserted in the walls and led under the charge. Outside the masonry these tubes are prolonged by bamboo pipes in like number, which connect with the bellows. These last consist of deer skins fastened tightly down at their edges. To the middle, a rope is attached and led to a bent lever. By raising this lever, the workman pulls up the middle of the hide, thus drawing in the air through the furnaces. The draft produced in one direction is now forced back through the charge in the opposite way by the smith pressing the deer skin down with his foot. As shown, there are two bellows which, working alternately, keep up a constant blast. There are no valves, and the air of course enters and leaves by the same orifices. So hot a fire is produced by these primitive means that the workmen are compelled to use bamboo screens to shield them from the heat. On each side of the furnace are apertures, whence the scoræ constantly escape. The furnace is kept in operation but for one day; for by the end of that time it is completely burned out, so that next morning the barbarian ironmaster begins his day's work by building a new plant. The iron produced is said to be of fair quality.



A KOUY SMELTING FURNACE.

prices in October, 1876, were: for fine 45 cents, medium 40 cents, coarse 33 cents a pound; and the average for the year was for fine 44½ cents, for medium 44 cents, and for coarse 36½ cents.—*Philadelphia Ledger*.

A NEW AMBULANCE.

Our illustration clearly shows the construction of what seems to be a very convenient device by which a wounded or otherwise invalid person may be carried on the back of a comrade or porter. It will be seen that the weight of the burden is equally distributed over the back of the carrier, so that the whole is borne without undue fatigue. The invention has been used in Turkey during the recent civil war, and was found to be handy and easily constructed. It is, moreover, light and portable when not in use; and it might be employed in place of the common stretcher in cases of ac-

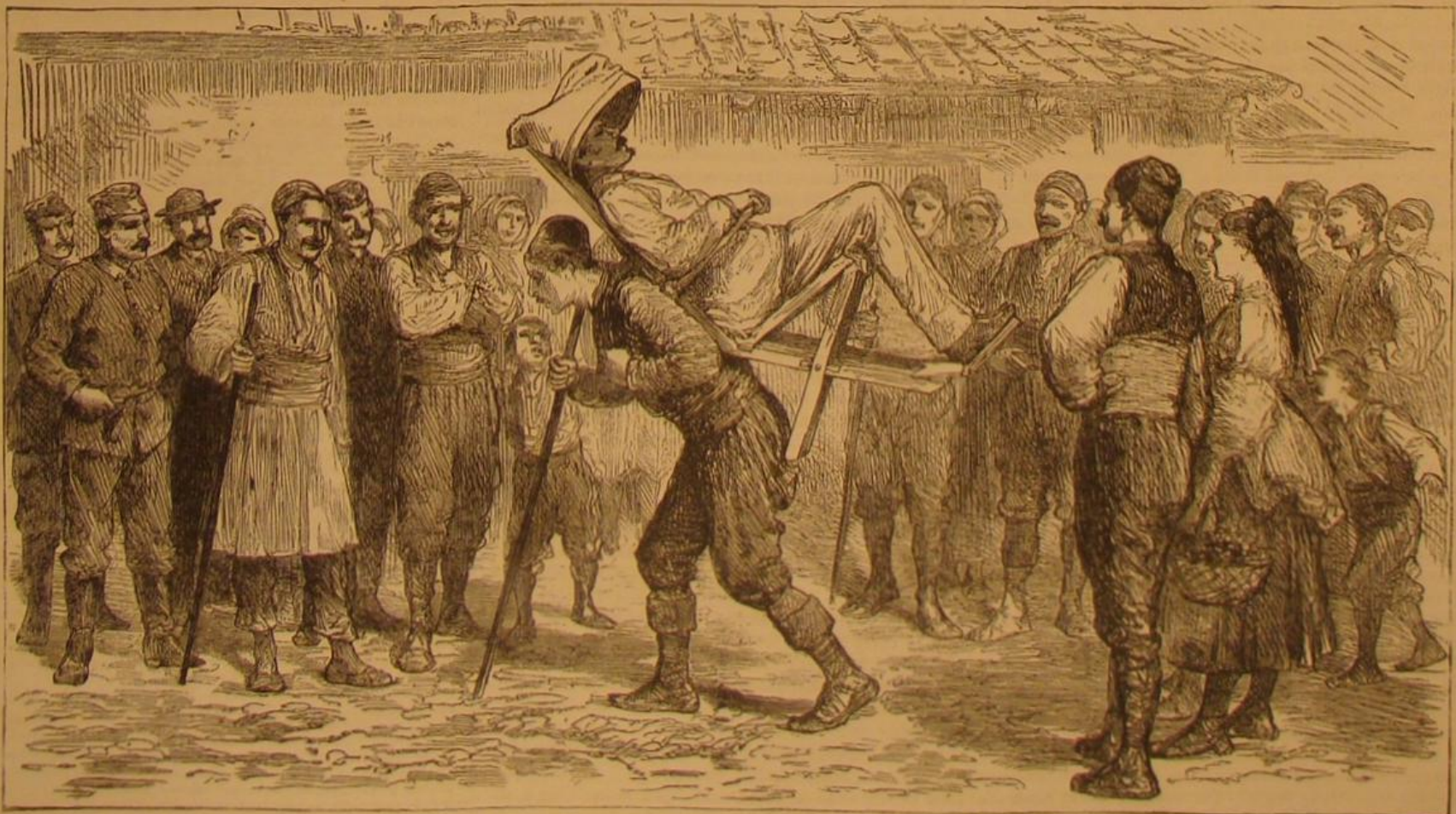
cident, as it affords a very easy reclining position, and keeps the sufferer with his head and limbs in their natural relative positions.

Japanese Fans.

The *Hiogo News* gives the following interesting information regarding the manufacture of Japanese fans. Every one has doubtless remarked the exceeding neatness displayed in their workmanship, and also has probably wondered how such carefully made articles even as the commoner kinds of paper fan can be imported to this country and sold at retail for five cents each.

Like many other manufactures, the principle of division of labor is carried out a long way by this branch of industry. The bamboo ribs of the fans are made by private people in their own houses, and combination of the various notches cut in the lower part is left to one of the finishing workmen, who forms the various patterns of the handles according to plans prepared by the designer. In like manner the designer gives out to the engravers the patterns that his experience thinks will be salable for the season next ensuing; and when the different blocks have been cut, it still rests with him to say what colors are to be used for each part of the design, and what different sheets are to be used for the opposite sides of each fan. In fact, according to our informant, this official

holds, if not the best paid, at any rate the most important position on the staff-in-ordinary. When the printed sheets which are to form the two sides of the fans have been handed over to the workman, in company with the sets of bamboo slips which are to form the ribs, his first job is to fold the two sheets which are to form the fan, so that they will retain the crease. This is done by putting them between two pieces of heavily oiled paper, which are properly creased. The four are then folded up together and placed under pressure. When sufficient time has elapsed, the sheets are taken out and the moulds used again, the released sheets being packed up for at least twenty-four hours in their folds. The next process is to take the ribs (which are temporarily arranged in order on a wire) and set them into their places on one of the sheets after it has been spread out on a block and pasted. A dash of paste then gives the woodwork adhesive powers, and



CONVEYING THE WOUNDED FROM A TURKISH BATTLE FIELD.

[For the Scientific American.]

A DAY'S ICE YACHTING ON THE HUDSON.

By invitation of Commodore Irving Grinnell, of the New Hamburg Ice Yacht Club, the writer spent Monday, February 19, in the interesting sport of ice yachting on the Hudson, at New Hamburg, 65 miles up the river. Mr. Grinnell and the writer prepared for the cold by donning warm overcoats and gloves, and protecting the feet and lower part of the legs from the wind by placing thick knit stocking legs over the junction of pants and shoes and under the indispensable "arctics." When ready, they proceeded from the house down to the river through the grounds, noting before starting that the thermometer was in the vicinity of the freezing point. There was a slight breeze, which soon freshened up, and the ice was in good condition, the morning's sun having as yet had but little effect on it. A safe course could be had for about two and a half miles from just above the New Hamburg dock, up the river. With some misgivings, the writer lay down on the narrow deck of the Flyaway; and with the commodore at the helm the yacht was soon flying across the river. Flying expresses it; the sensation is like nothing else, and it is very pleasing, though at first one feels like holding on very tight, naturally expecting to be shot out on the glossy surface every time the direction of the craft is reversed. This turning around, with the speed abating but a little, is a queer sensation. The yacht is steered so as to spin around inside of her own length, or a little over, the skates scraping sideways along the ice, and the adhesion being such that she does not, as would naturally be expected, slide sideways for some distance over the ice before getting on her course again, but makes a perfectly circular track around. There were some eight or ten yachts sailing to and fro, tacking here and there on the ice; and occasionally two or three coming up the river together for a friendly trial, made fine pictures with the ice-bound river stretching down, the Tanzkammer bluff to the left, with the grand old Storm King in the distance.

The craft Flyaway has an extreme length of 25 feet from the end of her boom to the tip of her bowsprit; she is built very narrow, in more of a boat form than most ice yachts, the side timbers running past the mast and curving in to the bowsprit as in form of a sailboat; she is sloop rigged, and carries 342 square feet of canvas. When, from the number of times the yacht had been up and down the river, zig-zagging here and there, the writer judged that he had been fully an hour on the ice, his watch recorded but 15 minutes. It is fast living; more impressions are received, and more events take place in a given space of time, than under any other conditions. One minute the boat was at New Hamburg, and in another, before the observation was noted, she was a mile up the river. Time is constant, but distance loses its ordinary relations to it.

Strange to say, from the slight jarring produced by the runners on the ice way, those who are new to the sport feel a sensation much like that felt on the approach of seasickness; and it has even happened that persons have been veritably seasick. The rearing, which frequently occurs, does its share in causing this feeling, as does the quick spinning around before described. This rearing usually happens with a strong wind, and generally when the yacht is on a curve just after going about, and results in the windward runner rising some two or three or even four feet above the surface of the ice, the rest of the frame, and consequently the deck, rising in proportion, so that the uninitiated voyager naturally expects a capsize, the yacht running for a few seconds entirely on the leeward and rudder skates. The voyagers sailed with the wind abeam or from the west, the river's course at New Hamburg running about a point east of north; and the boat usually made a tack and a half in a mile of straight course, keeping, as is always the case in ice yacht sailing, the sails flat aft, and steering so that the pennant at the masthead flew in a line with the gaff. When put directly before the wind to slow up, the pennant still flew aft, until the yacht's speed dropped down to that of the wind, the canvas shivering as if in the eye of the latter. At this diminished speed the yacht can be easily stopped by being spun around and brought head on to the wind. This is the method most generally adopted in heavy winds, instead of luffing up in the usual way from a beam wind. The vessel is anchored by placing the rudder at right angles to the keel, and lowering the jib.

In ordinary sailing, a vessel would be at her greatest speed before the wind; while in ice yachting it is just the contrary. Curiously, when sailing at a great speed with the wind abeam, or three quarters free, the yacht travels so much faster than the wind that the latter seems to blow from ahead. In beating to the windward, an ice yacht is pointed more closely, and her speed is about the same as that of the wind. An ice yacht attains her greatest speed when running in a direction somewhat similar to that in which the wind is blowing, making long legs to the leeward, or, as ice yachtsmen say, she "beats to the leeward." The resultant wind strikes her on the bows; and on changing from one leg to another, instead of "jibing," she goes into stays, with the wind, as before stated, apparently ahead.

A ice boat makes a good deal of noise, though it is not noticed much by the sailors. However, when standing on the ice and watching them, the "roar" of the skates can be heard over a mile away. The Flyaway, with Mr. Grinnell and the writer on board, participated in the morning in a scrub race with seven other yachts; but no fast time was made, the wind being fickle. The winning yacht made the 11 miles sailed in some 20 minutes. About midday, the

Flyaway was headed for the shore; and it seemed to the writer as if she were going to run into the stone embankments of the railroad; but by a dexterous turn she was spun half around and stopped.

Mr. Grinnell and the writer then embarked on board the Whiff, the beautifully finished yacht which attracted so much attention at the Centennial Exhibition. The wind being somewhat more steady, some fine spurts were made; and with a ten mile breeze, the swift craft made successively, $\frac{1}{2}$ mile in 45 seconds, 1 mile in 70 seconds, and finally 1 mile in 69 seconds, the latter being at the rate of $52\frac{1}{2}$ miles per hour. The Whiff in the afternoon won a 12 mile race, to which about six miles should be added for tacking, in thirty-three minutes, there being two other contestants, the winner coming in a minute ahead.

As results of this day's yachting, the writer found that his face was burnt somewhat by the wind, that the muscles of the upper part of the body were somewhat sore from the straining in holding on to the yacht, and that, as he dropped off to sleep, ice was all around him, and he seemed to hear the crunch of the skates, and to be spinning around *ad infinitum*.

[Those of our readers who desire to construct ice boats on the most approved plans will find the full working drawings of the Whiff in SCIENTIFIC AMERICAN SUPPLEMENT, No. 63. Every detail, including runners, framing, rudder, sails, and rigging, is given to scale, with full particulars. We believe that no publication of the actual plans for building fast ice boats was ever made until those given last year, in our SUPPLEMENT No. 1, appeared. The two sets of plans (SUPPLEMENTS No. 1 and No. 63) cover the subject very fully; and as a result, the adoption and general use in all cold climates of the American forms of ice yachts may be expected. From Norway, Sweden, Russia, Germany, and Canada, many copies of these ice boat plans have already been ordered.—Eds.]

NEW YORK ACADEMY OF SCIENCES.

The chemical section of the Academy held their regular monthly meeting at the School of Mines, Columbia College, on Monday evening, February 12. The first paper of the evening was by Professor C. F. Chandler, Ph.D., on the COMPOSITION OF PETROLEUM AND THE PROPER STANDARD OF SAFETY.

Professor Chandler stated that, although petroleum had been known for centuries, it had only recently come into general use for illumination, for the reason that suitable lamps had been wanting. Lamp chimneys were invented about the beginning of the present century, previous to which time there had been only smoky lamps such as are found at Pompeii. The inventor of lamp chimneys had done a great deal for civilization, by making it possible to read at night. In 1856, the manufacture of oil from Boghead coal was begun, and in a short time coal oil, or kerosene, had come into extensive use. Lamps had been devised for burning this coal oil, and proved suitable for burning petroleum. A company was organized to collect the petroleum, which was soaked up by blankets from the surface of pools of water. The speaker then described the boring of the first well by Colonel Drake, the subsequent excitement, the quantity of oil produced, and other incidents connected with it. The oil, he said, usually comes from Devonian rocks, which are much older than the carboniferous or coal measures. Petroleum contains about 85 per cent of carbon to 15 per cent of hydrogen. It consists of a series of hydrocarbons of the simplest kind known as the marsh gas or paraffin series, CH_4 , C_2H_6 , etc., or of the general formula $\text{C}_n\text{H}_{2n+2}$. The oils of Italy do not contain any of the lighter oils, which have already evaporated. In Pennsylvania, the rocks are impervious, and evaporation was consequently impossible.

In California, where the oil is more plentiful on the surface, there is but little beneath, as it has all run away or evaporated. There is another series of hydrocarbons called olefines, of the general formula C_nH_{2n} , but these do not occur to any considerable extent in American petroleum. They are distinguished from the paraffin or marsh gas series by the fact that they are attacked by sulphuric acid and converted into alcohol, so that the manufacture of alcohol from illuminating gas is a possibility. Alcohol was exhibited at the Paris Exhibition made in that way. There is some doubt at present whether the white solid which we call paraffin belongs to the paraffin or the olefine series; probably there are some of each series. There is another series of hydrocarbons known as the aromatic series, benzol C_6H_6 , etc., which is found in Rangoon tar, but not in our petroleum. When benzol is treated with nitric acid, it is converted into artificial oil of bitter almonds. Dr. Chandler thought he had noticed this odor in treating petroleum with nitric acid. After a digression on artificial alizarine, the speaker described the method of refining petroleum by fractional distillation, the destruction of coloring matter and gummy substances by sulphuric acid, and washing with soda, to remove traces of the acid. Sludge acid is the name given to the acid after it has been in contact with the oil, and it is from this acid that we derive the foul odors wafted to this city from Long Island City by every easterly breeze. This acid is used in the manufacture of fertilizers. In regard to testing safe and dangerous oil, Dr. Chandler showed some interesting experiments. Some oil was placed in an open tester and gradually heated on a water bath with a thermometer. It was found to flash, or give off combustible vapors, at 110°Fahr. ; and it burned at 118° , being what is called very safe oil. He then placed some of this same oil in a closed vessel resembling a metal lamp, but provided with a cork instead of the common head

or burner, and having electric wires attached. On heating the oil to 85° , and sending a spark through the vapors, an explosion took place which blew out the cork with a loud report, showing that oil, which has been considered safe, gives out explosive vapor at ordinary summer heat.

DEVICES FOR SECURING PRESSURE IN FILTRATION was the subject of a paper by Professor C. A. Seeley. He obtains the pressure on the principle of an aspirator, two bottles being employed and the water allowed to flow from one to the other.

This meeting was largely attended, a number of ladies being present, as is usually the case when the meetings are held at the School of Mines. Nor are we surprised at this, for Dr. Chandler's museum of chemical curiosities is always open to the inspection of the visitors, and recently this collection has received several important additions from the Centennial Exhibition. Among the finest of these is Bayer & Co.'s complete set of coal tar colors, both aniline and alizarine, with the intermediate products, each specimen being elegantly mounted with distinct gilt labels bearing the English and German name, and in many cases also the chemical formula. They are also numbered to indicate the order of manufacture; thus, Nos. 1 to 4 are coal, German, English, Scotch, and American; 5, coal tar; 6, benzol; 7, nitrobenzol; 8 aniline oil; 9, diamond fuchsine in large crystals; 10, silk dyed with fuchsine; and so on through each of the principal colors. Then came the rarer homologues of the benzol series, toluol, nitro and benitro toluol, chloride of benzyle; cumol, xylo, and toluidin; then naphthalin, nitro-naphthalin, and naphthylamine, muriate of aniline, a full set of methyl violets (ten in number), iodides of ethyl and methyl, wood tar, phenol (carbolic acid), rosolic acid, picric acid, and corallin. In the alizarine section, the same order is observed, coal, coal tar, anthracene (crude and pure), bi-bromanthracene, anthraquinone, sulphanthraquinonic acid, alizarate of sodium, and alizarine of seven different kinds, with specimens of cottons printed with them. Dr. Chandler has been particularly fortunate in securing to our city this beautiful and instructive exhibit, which he kindly places where all may see it free of charge.

American Fire Arms for the Turks.

The Providence Tool Company is at present filling the largest contract for arms ever given to a private armory. It is making six hundred thousand Martini-Henry rifles for the Turkish Government. At the close of last year there had been about one half of these rifles made and delivered. Recently the Turkish Government has been very urgent for the rapid fulfilment of the contract, and the works for some time have been turning out these arms at the enormous rate of one thousand per day.

Fire at the St. Louis Bridge.

A destructive fire took place a few days ago in St. Louis, Mo., among some shanties and frame buildings at the east end of the great bridge. A stiff breeze was blowing at the time, and the fire spread so rapidly that it was some hours before it could be checked, and by that time 1,000 feet of the approach to the bridge was rendered impassable, and it is likely to remain so for some time. The skeleton of the approach remains, all the woodwork having been destroyed. The damage to the bridge is estimated at \$125,000.

Fruit Trees.

It is a good practice to wash the trunk and main branches of fruit trees with lime wash. If the white color is not agreeable, a little soot can be put in to neutralize the glare. The wash destroys the eggs of insects and the germs of fungi, and keeps the bark free to swell as the cells grow. Where the white scale abounds on the bark the branches may be painted with linseed oil. It is a sure cure, and really seems to make the tree more healthy and vigorous than it would be without the wash.

A New Anæsthetic.

A new anæsthetic has been described by M. Rabuteau before the Academy of Sciences, Paris. It is hydrobromic ether, which, he says, can be administered without difficulty, and which is, moreover, eliminated almost completely by the respiratory passages. It holds an intermediate place between chloroform, bromoform, and ether. Considering the frequent recurrence of chloroform accidents, any new anæsthetic which promises to yield a greater degree of immunity from danger of a fatal result is worthy of trial.

Inventions Patented in England by Americans.

From January 17 to February 1, 1877, inclusive.
CONNECTING LINK.—J. Mann, Buffalo, N. Y.
DRAWING WIRE.—American Screw Company, Providence, R. I.
DRIVING LUMBER, ETC.—P. P. Soffer, New York city.
ELECTRIC LOG.—J. P. Haines, New York city.
EQUALIZING MOTION.—R. D. Milne, Santa Barbara, Cal.
INFUSION POT.—J. Cronwell, Cranford, N. J.
KNITTING MACHINERY.—C. J. Appleton, Philadelphia, Pa.
LIFE BOAT, ETC.—M. Bourke, Mineral Ridge, Ohio.
MAKING BRUSHES.—J. L. Whiting, Boston, Mass.
MARINE GOVERNOR.—G. Steele, New York city.
OIL STOVE, ETC.—J. J. Jarvis (of Boston, Mass.), Florence, Italy.
PIANO-FORTE KEYBOARD, ETC.—E. Eshelby, Whitestone, N. Y.
PICKLING WIRE.—American Screw Company, Providence, R. I.
PIPE JOINT.—J. F. Parsons, New York city.
PRINTING FABRICS.—J. Harley, Lowell, Mass.
PULVERIZER, ETC.—A. B. Lippsey et al., Hoboken, N. J.
PUMPING ENGINE.—J. B. Waring et al., Stamford, Conn.
REFRIGERATING, ETC.—J. J. Biss, Brooklyn, N. Y.
SCALLOPING BOOT UPPEPERS.—W. Manley, Rochester, N. Y.
SETTING BOILER TUBES.—Tube-setting Company, Salamanca, N. Y.
TRANSMITTING MOTION, ETC.—T. A. Weston, Stamford, Conn.
WATCH MOVEMENT.—Egton Watch Company, New York city.
WEAVING TUFTED FABRICS.—A. Smith et al., Yonkers, N. Y.
WIRE FENCE.—T. Seabury, St. James, N. Y.

Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WASHING MACHINE.

Charles K. Rogers, Oswego Falls, N. Y.—For the purpose of washing out streaky and heavily soiled parts, as wristbands, etc., a washboard is added and detachably secured. There is also a suitable device for holding a wringer, so that all the implements required for washing are placed within convenient reach.

IMPROVED WASHING MACHINE.

William Doan, Mountville, Tenn.—This consists in an arrangement of cup shaped plungers or compressors attached to a two-armed lever, which is pivoted to the side of a box for containing the clothes and water. The box is provided with a corrugated side and bottom, and in it the said plungers are worked.

IMPROVED WINDOW SHADE ROLLER.

Daniel Willis, Harrison, N. J.—When the shade is drawn down slowly, a catch at each revolution of the roller drops into a cam notch, and, when the shade is released, holds the roller from being drawn back by the tension of the spring. If the shade is drawn down a little and then released quickly, the quick motion of the roller throws the catch outward, so that it will pass over the shoulder of the notch, and when the motion is checked the catch will again drop into the notch and hold the roller in place.

IMPROVED WASHING MACHINE.

Samuel C. Wilson, Forest City, Ark.—By suitable construction, as each presser block moves forward and presses the clothes against the roller, the pawl of that roller will be drawn back, and as the presser block is drawn back the pawl will be pushed forward to turn the roller and change the position of the clothes, so that they may be operated upon each time in a new place.

IMPROVED AUTOMATIC FAN.

Seward F. Gray, Valdosta, Ga., administrator of James M. Gray, deceased.—This is an automatic fan for keeping off flies from dinner tables, sick beds, etc. The speed of the fan may be regulated, in the customary manner, by a suitable spring brake and regulating screw, that acts on a friction wheel placed on the shaft of one of the transmitting wheels of the clock train.

IMPROVED EARTH CLOSET.

Leamel Altman, Olney, Philadelphia, Pa.—This earth closet is so constructed that the dust from the falling earth cannot rise and settle upon the seat.

IMPROVED SHADE HOLDER FOR KEROSENE FIXTURES.

Patrick J. Clark and Joseph Kintz, West Meriden, Conn.—This is a shade holder for fixtures of all kinds, in which a lamp or fount with a chimney is used, so arranged that the fount, with the chimney attached, can be raised from the fount holder up into the shade. The fount chimney and shade can be moved horizontally sufficiently to be taken from the fixture without removing the shade.

IMPROVED COAL SCUTTLE.

Charles S. Irwin, St. Joseph, Mo.—This scuttle has a conical body with knees, on which it rests when placed on the stove. The bottom is concave, with median slide, to adapt it for use on magazine stoves.

IMPROVED PAPER DISH.

Sylvester E. Harlow, Fairbury, Ill.—The dish is made from a disk of paper which is cut radially from the center to the circumference, and it is stamped or crimped so as to form a conical bottom, that projects upward, and the flaring rim. The radial edges of the disk are thus made to overlap each other, and are secured by clips.

IMPROVED WARDROBE BEDSTEAD.

Wilson Sattelle, Wetherford, Texas.—This is an improved piece of office furniture, that combines office desk, bookcase, sliding and folding bedstead, hat rack, wash basin, and other devices, so as to utilize all available space in a very convenient manner.

IMPROVED COOKING RANGE.

Thomas J. Whitehead, South Paris, Me.—In this case, as in that for which a patent was granted to same inventor February 3, 1874, the range is in a double walled casing or air chamber, with doors and lids, affording access to the range. It is designed to have greatly increased facilities for cooking on a large scale, and possesses several new features adapting the construction to that end.

IMPROVED RECLINING CHAIR.

Benjamin F. Manier, Green Island, N. Y.—This consists of a supporting frame, which is attached to the bottom of the chair, and pivoted to the forked spindle, revolving in a stationary socket base. The bottom frame and chair are adjusted by the joint action of an arm pivoted to the spindle and to a bell crank lever.

IMPROVED NUTMEG GRATER.

Henry Scheibel, Bridgeport, Conn., assignor to himself and John Schneider, of same place.—This consists in the combination of a supporting main frame, having a socket or receptacle, with a spring-acted follower and a grating disk. By taking the handle of the frame in one hand, and revolving the disk with the other hand, the nutmeg is grated.

IMPROVED BOOK SUPPORT.

Allston Wilson, New York city.—This is a book rest of cheap and compact construction, on which the book may be conveniently arranged for reading and the leaves retained or clasped without the use of the hand, the book being quickly placed thereon and the leaves turned over in an easy manner. It consists of a supporting block, with swinging arms, folding away in a recess of the block, and having pivoted holding arms or clasps, folding into recesses at the ends of the arms, for holding the leaves. When the book is placed on the rest for reading, the arms are raised to the height required by the size of the book, and the holding arms then swing forward on the leaves. For turning a leaf, the arms are slightly raised, and, after the turning of the leaf, carried down again on the pages. When the book is taken off, after use, the leaf holders are folded back into the arms, and the arms then folded down on the block, so that the rest takes up only a small space, and may be stored away in convenient manner.

IMPROVED DOOR SPRING.

Frank C. Rhenbottom, Union City, Mich.—Screen and storm doors are generally hung on the outside of, and so as to lap over, the case, rendering it necessary that the spring shall fasten on the edge of and swing under the door when opened, while the moulding of case also leaves a very small space for the attachment of spring. Hence this inventor employs a downwardly tapering spiral spring, which may be adjusted to the edge of a door or the oval surface of a moulding.

IMPROVED SPRING PILLOW.

Angelina Underwood, Carrollton, Ill.—This invention consists of a skeleton frame composed of longitudinal curved spring ribs of wire, and transverse stays attached to a square frame, and backed up by one or more elliptic and spiral springs, and the whole covered in a suitable manner. The object is to provide a pillow which shall retain its form and be cooler and more comfortable in use than those of ordinary manufacture. Eyes are formed on the ribs and stays form a joint with the frame, so that the parts may move freely without danger of breaking. The frame or skeleton thus

formed is covered in any desirable way. A pillow made in this manner is cool, cleanly, and much more pleasant to use than the ordinary stuffed ones. It is specially adapted for sick rooms and hospitals, as it is readily aired and cleaned. When the pillow is to be used merely for a "sham," the spiral springs may be omitted.

NEW TEXTILE INVENTIONS.

IMPROVED YARN GUIDE AND CLEANER FOR SPOOLING MACHINES.

Joseph Garrett, Chester, Pa.—The object of this invention is to provide a cheap, durable, and efficient device for use in connection with the yarn guide of cotton spooling machines, for preventing the yarn passing through the guide slot always in the same place, so that the yarn will not be broken by the accumulation of dirt, seeds, etc., on the guide, as when the ordinary guide is used.

IMPROVED KNITTING MACHINE NEEDLE.

Stephen Woodward, Manchester, N. H.—This improved needle for knitting machines is so constructed that the hook and latch of the same may be turned up from the work, and thereby a part only of the needles be used for knitting, without the trouble of removing the unused ones from the cylinder; and the invention consists of a knitting machine needle provided with a hinge or loose joint between the latch piece and the shank, and also with an extension or crook of the shank. When the hook is down the shank will be at the left, the crook at the right, and the hinged part on the right of the end of extension, so that the shank will readily run in the cam, while the hinged part will be turned up from the work.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN HARVESTER.

Aaron Wilson, Tekama, Neb., assignor of one half his right to C. B. Telyea.—This is an improved machine for gathering corn from the stalks while standing in the field, which removes all the ears from the stalk by means of stripper fingers.

IMPROVED MILK PAN.

William Cooley, Waterbury Centre, assignor to himself and C. C. Warren, Waterbury, Vt.—In using this apparatus, the milk is put into the pan, the cover is put on, the air pump is applied, and the air is pumped out, forming vacuum above the milk. By thus removing the pressure of the air from the milk the cream is claimed to rise quickly.

IMPROVED BEEHIVE.

Randall T. Van Valkenburg, Angola, Ind.—The new features are found in the door having a rear piece with contracted aperture for excluding robbers. Also frames inclosed by the gauze covered frames, which form the living and breeding apartment for the bees; and surplus boxes for receiving the surplus honey made during the summer season.

IMPROVED ANIMAL TRAP.

George Washington Gibson, Shelbyville, Ky.—This trap is so constructed that there may be nothing to alarm the animal as he enters the trap, that it will lock the animal in as he attempts to reach the bait, and will reset itself as the animal passes into the cage or inner chamber.

IMPROVED CHURN.

James W. Smith, Humansville, Mo.—The cream having been poured into the receptacle and the cover secured, a rotary dasher is set in motion, and made to throw the cream toward the center, while its arms operate the reciprocating dashers, that force the cream outwardly from the middle of the churn.

IMPROVED EGG CARRIER.

Lewis Ingloe, New York city.—The eggs rest on elastic rubber disks stretched over suitable apertures in a board or tray, and are held upright by vertical leaf springs.

IMPROVED COMBINED CORN PLANTER AND CULTIVATOR.

Eli Chapman Gage, Witoka, Minn.—This improves the construction of the corn planter for which letters patent were granted to same inventor December 30, 1873. The novel features consist in the addition of a gear wheel, which may be removed and another substituted when it is desired to alter the distance apart of the hills, and a new mode of suspending the plows when turning or moving from place to place.

IMPROVED HARVESTER RAKE ARM.

Samuel Noxon, Jr., Ingersoll, Ontario, Can.—This consists of the metallic section of the rake arm made in two parts, each of which has a part of the pivot for the cam roller, and also a pivot for the hinge, by which the arm is hinged to the revolving head of the rake stand. The arrangement is such that not many pieces are required, and the construction is simplified.

IMPROVED HAND CORN SHELLER.

Ludwig H. Pirrung and Michael Zirbes, Chicago, Ill.—This consists of a grooved plate, swinging toothed lever, and conducting hood and spout, for conveying the shelled corn to a suitable receptacle. The ear is held with the left hand, and turned while the lever is worked to and fro with the right hand, until the corn is shelled from the cob.

IMPROVED CULTIVATOR.

Elijah H. Perkins and Solomon D. Perkins, Visalia, Cal.—This machine is adapted for cutting the weeds beneath the surface of the ground in cultivating plants so small as not to require soil to be thrown around them. It is also so constructed that it may be expanded and contracted for cultivating rows of plants of different widths.

IMPROVED HOP POLE.

Charles A. Sands, Burlington, Kan.—This invention consists of a central pole that is permanently set in the earth, upon which slides a cross head, to the outer extremities of which wires are attached, that are held at their lower ends by hooks fixed in stakes driven in the earth. The pole is provided with a rope for raising the cross head, and the ropes are furnished with friction blocks for the purpose of holding them taut.

IMPROVED TREE PROTECTOR.

John G. Peace and Isaac D. Comstock, Salem, Mo.—This consists of a tree box or protector, made of a number of slats nailed to top and bottom bands of sheet metal, and closed by the hook ends of the same lapping over the end slats. The tree boxes may be manufactured very cheaply, and applied or removed with great facility.

IMPROVED CHURN.

James Higgins, Westfield, N. J.—This consists in hanging a dasher churn on trunnions in a suitable frame, and providing one of the trunnions with a toothed wheel and a lock lever or detent, by which the churn may be held in a vertical or inclined position. It further consists in the construction of the mechanism by which the churn is driven.

IMPROVED COMBINED FERTILIZER AND SEED SOWER.

Richard L. Galer, Dunham, and Elijah E. Spencer, Paris of St. Armand East, Quebec, Can.—This invention consists in a combined fertilizer and seed sower with straight or crooked movable boots, divided into two flukes in such a manner that, the fertilizer being placed in the front boxes and the seed in the rear boxes (the boots having drills and covers attached thereto), the drills open the ground, and the fertilizer falls first and then the seeds. The fertilizer and the seeds are then covered with earth by covers hinged to the boots. This machine is capable, by means of its

straight and crooked movable boots, of changing the width of the rows and furrows in which the fertilizer and the seeds fall.

IMPROVED BEEHIVE.

Hiram Hatfield, Ossian, Ind.—In this invention the main portion of the hive, being an inner case, rests on cleats on the front and back, having its bottom composed of two sloping pieces, one of which drops below the other sufficiently to make a suitable passage for the bees into the hive, but so that the passage cannot be gained by the crawling bee moths. The bees have entrance through the outside case to this passage. It may be closed by a slide, and the passages may be partially closed by a detachable gate. The hive fills the outside case between the front and back, but is narrower the other way to make ventilating spaces, in which the dampers are arranged to shut off the air; also, to cut off the passage into the upper part of the outside case when the honey boxes are to be changed.

IMPROVED CULTIVATOR AND CHOPPER.

William B. Killough, Larissa, Tex.—This cultivator and chopper is so constructed that the plows may be conveniently raised from and lowered to the ground, adjusted to work at any desired distance apart, and at any desired depth in the ground, which will enable the plows to be moved laterally in guiding the machine, and which will allow the plows and chopping hoe to yield should they strike an obstruction, to prevent the machine from being broken. This invention consists in combinations of the various parts, to receive and support the operating mechanism of the machine, for guiding and controlling the plows, and for other operations which need engravings to properly describe their nature.

IMPROVED HORSE HAY FORK.

John B. Denning, Ross, O.—This fork consists essentially of a straight stock and pivoted arms or spurs, operated by a sliding rod. There is a new construction and arrangement of the catch and sliding rod which economizes space, and enables the case to be made flat and narrow, and at the same time avoids the necessity heretofore existing of pivoting the catch in such manner as to be exposed exteriorly of the case.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED COMBINED SACK HOLDER AND SACK FILLER.

Friedrick Sondermeyer and Frederick Schindler, Perryville, Mo.—This is an improved machine for holding sacks while being filled, and for raising grain or other substances from the floor or ground and discharging it into the sacks. The new features are improvements in the hopper and adjacent mechanism, and also a device which guides the grain inward as the machine is moved forward, so that the grain may be taken up by the elevator.

IMPROVED CARTRIDGE.

Herbert Buffington, Jacksonville, Fla.—There is a movable anvil for cartridges, consisting of a tubular main part, conical head, and end collar or shoulder at inner end. The fire from the primer passes directly through the tube to the charge, and not around the outside of the tube, securing thereby the reliable firing of the cartridge, and also a more effective combustion of the powder charge.

IMPROVED HELMET LIGHT.

Henry K. Nütze, Philadelphia, Pa.—This is a safety reflecting light, combined with the helmet of a miner's hat, or adapted to fasten to the breast of a person by a hook.

IMPROVED ELECTRIC TRAIN SIGNAL.

Laning L. Ferris, New York city.—This is a signal to be used on railway trains for indicating the separation of the train or the detachment of cars, and for the use of the conductor in signaling the engineer. It consists of a device attached to each end of the cars that automatically makes an electrical connection so as to ring a bell at the engine when the cars are separated. It also consists in the arrangement of levers or keys by which the conductor by pulling a cord may signal the engineer.

IMPROVED HAT HOLDER.

Payson H. Miner, Rome, N. Y.—This consists of a support formed of a continuous rod, having conical spiral at one end, upon which the hat rests, and a coil for receiving the screw, by which it is attached to the under side of the seat. The device is provided with an arm, by which it is turned, and to which a spring is attached for holding it in place.

IMPROVED SCHOOL DESK SEAT.

Eldridge Haynes, Kirk's Cross Roads, Ind.—When the seat is thrown up into vertical position the supports form contact with metallic stays, that are screwed to the side standards and to the fulcrums of the seats, so as to strengthen the bolts and define the extent of motion of the seat.

IMPROVED HORSESHOE.

Harry B. Cornish and Charles P. Hunt, River Falls, Wis.—This invention consists in cutting slightly tapering arc shaped grooves in the under surface of horseshoes. The arc of the said grooves is described in a vertical plane, and the grooves are dovetail in transverse section and open downward. It also consists in forming upon the base of the calks a tongue that is the counterpart of the arc shaped dovetail. The object is to provide a horseshoe in which the calks may be readily inserted or removed, but which cannot become loosened by any action of the horse's foot.

IMPROVED REVERSIBLE SEAT.

Lucius T. Stanley, Indianapolis, Ind.—This seat is supported by two pairs of swinging bars, whose upper ends are pivoted nearer together than their lower ends, so that the seat is reversed by swinging it on the bars.

IMPROVED MACHINERY FOR SCALLOPING BOOT UPPERS.

William Manley, Rochester, N. Y.—This is an improved machine for holding the button flies, vamps, and quarters of shoes while being scalloped. It was fully described and illustrated on p. 322, vol. 33.

IMPROVED WEIGHTED HORSESHOE.

Eugene E. Selkass, Galveston, Tex.—This is an improved weighted horseshoe designed for use in training a horse to trot fast, by extending his stride and squaring his action. It may also be used to prevent a horse from striking his knees with his feet. It is so constructed that the weight may be attached and detached, as required, and which when attached shall be entirely out of sight.

IMPROVED BOTTLE STOPPER.

George A. Ohl, Newark, N. J.—This improves the bottle stopper for which letters patent have been granted to A. Luthy, under date of November 2, 1875. It consists, mainly, of a rigid curved stopper-carrying lever that is provided at the lower end with an elongated loop or eye that plays in an extension staple of a solid collar of the neck, to which the closing ball is pivoted.

IMPROVED BLANK BOOK.

Hesekiah S. Archer, Brooklyn, N. Y.—This book is so made that any sheets whose reading matter has become valueless, or whose memoranda have served the purpose for which they were originally intended, may be removed. The leaves are open slotted, and are held by clamp nuts working on screws.

IMPROVED WIRE FENCE BARB.

John Nelson, Creston, Ill., assignor to himself and William H. Gosse, of same place.—This consists in a barb for fence wires, made from a short piece of wire by forming loops at the ends of a straight middle part, at right angles therewith, or nearly so, and upon the opposite sides of the wire, leaving the points projecting in opposite directions.

IMPROVED FOUNTAIN PEN.

William Alexander Brice, care of R. Clifford Poulter, 44 Middle Temple Lane, E.C., London, England.—This consists in controlling the flow of ink to the nib by admitting the air to replace the ink in the reservoir through a bent U-shaped capillary tube leading from an orifice in the side of the reservoir or holder in a convenient position, to be covered by the thumb or finger of the writer when it is desired to check the supply of ink to the pen.

IMPROVED BLOWING TOY.

Henry J. Green, New York city, assignor to Henry Shaffer, of same place.—This is an instrument for indicating the capacity of the lungs by the number of revolutions made by the fan wheel when propelled by a single expiration from the lungs.

IMPROVED COMPOSITION FOR FIREPROOFING.

William J. Ryckman, Brooklyn, assignor to himself and Frank B. Burt, New York city.—In order to render fireproof stage scenery—curtains, dresses, and fabrics in general—this inventor proposes a sizing compound, which also brings out the subsequently applied paint. It consists of equal parts of borax, alum, and muriate of ammonia.

IMPROVED REIN HOLDER.

Ransom P. Murray, Ashtabula, O.—By this device the reins may be tightly adjusted or displaced in a moment, while they are prevented from dropping down and getting dirty or entangled with other parts. The invention consists of two steel springs attached by one fastening bolt, their free ends passing in opposite directions to each other, one end extending through a top slot of the upper spring part, to be guided thereby when inserting or detaching the reins.

IMPROVED ROWLOCK.

Eugene Spedden, Astoria, Oregon.—This rowlock is so constructed that it may be readily shipped and unshipped, and cannot be lost, mislaid, or stolen. It has the lower part of its stem made smaller than the upper part, and adapted to be attached to the gunwale of a boat.

IMPROVED SKATE.

John Marson Lamb, South Hampstead, England.—The improvements consist in fitting the sole plate to slide to and fro on the runner, in order to secure or detach the skate, said sole plate carrying adjustable toe-clamps, to embrace the side edges of the boot sole, and having a claw which imbeds itself in the heel. The sole plate is operated by a lever similar to some others, but possesses advantages in its operation.

IMPROVED WICK ATTACHMENT FOR LAMPS.

John C. Shopland, Northport, N. Y., assignor to himself and William Morgan, of New York city.—The object of this invention is to provide kerosene lamps with an improved wick attachment, by which the lamps may be filled at any time without extinguishing the light, by detaching the burner, and supporting the same during the refilling of the lamps, employing the light of the flame during the filling by the sufficient supply of oil contained in the wick. The invention consists of a wick attachment, consisting of two separate wicks, the upper sliding up to the wick tube of the burner, and being wound upon a slotted revolving frame below the wick tube, and forming continuous contact with the lower endless wick within the lamp by a guided and spring-acted roller pressing thereon. The burner has a base plate with downwardly extending posts, for supporting the burner and upper wick section during filling, and is tightly secured to a collar and intermediate non-conducting layer of the lamp bowl.

IMPROVED GIG HARNESS SADDLE.

John Neill, Sinclairville, N. Y.—In this invention the metallic saddle tree, the side plates or wings of which have their front and rear edges bent upward and outward, and have a leather secured to them, to form sockets to receive the upper ends of bearers, is fastened to the pad. The skirt has its edges sewn to the edges of the pad. In the lower part of the skirt is formed a cross slit, through which the bearer passes, and which is strengthened by a loop. The bearers are passed in through the slits in the skirts, are passed up beneath the said skirts into the sockets of the saddle tree, and are secured in place by the terrets, so that should the said bearers break, or require to be renewed from any other cause, they may be drawn out by simply screwing out the terrets. By this construction no jockey is required, making the saddle neater in appearance and simpler in construction, while at the same time requiring less labor and less stock.

IMPROVED TOY HOOP.

Henry F. Post, Paterson, N. J.—This inventor attaches to a child's hoop a diametrical rod with central frame, carrying a pivoted bell, that is actuated by contact of the frame with the tongue of the bell during the revolution of the hoop.

IMPROVED POCKETBOOK FASTENER.

Daniel M. Read, New York city.—This improves the construction of the pocketbook fastener for which letters patent were granted to same inventor January 11, 1876, so as to make it simpler in construction. The entire fastener is now made of only two pieces.

IMPROVED TRANSPORTATION PACKAGE.

Nathaniel Halsted, Scranton, Pa.—By means of this package, butter, lard, and other substances may be transported safely in glass, earthenware, and other jars subject to breakage, and at the same time may be kept on ice in warm weather. Springs are contrived to support the bottom and sides of the jars, and the partitions between the compartments are constructed with openings through the bottom for the circulation of cold air from ice to be carried in one of the compartments for keeping the butter cool.

IMPROVED INCUBATOR.

Harris W. Axford, Omaha, Neb.—This is a heating, ventilating, air moistening, and electric heat regulating apparatus for an incubator. A pan contains the eggs to be hatched, said pan being in an oven, surrounded by a dead air space, and an insulating box filled with powdered charcoal. A pipe admits the heated and moistened air from the chamber surrounding the heater. This pipe contains the damper, to be opened and closed by a lever, which is worked by the armature lever of a magnet, which is placed in the circuit of a battery. The circuit is closed by a mercury gage, which causes the valve to shut off when the heat is too high. When the reverse is the case, said gage allows the valve to be opened by the spring of the armature lever. The mercury gage enters the center of the incubating oven, where it is subject to the heat, and one part of the wire is kept in the mercury, while the other part connects with the adjusting screw, which is made to dip into the gage, more or less, according to the degree of heat wanted; so that when the mercury rises to the point of the screw, and makes connection, the armature lever will be attracted, and thus the valve will be closed until, by the cooling of the oven, the mercury falls away from the point where the circuit will be broken, and the valve will be opened by the spring. The heat is furnished by a lamp supplied from a tank, and having a float and a suitable valve for automatically regulating the supply of oil, and thus maintaining regular heat.

UNITING THE UPPERS OF BOOTS AND SHOES.

David W. Thompson, Englewood, Ill.—The seam is formed mainly by means of a narrow strip which is sewed to the vertical edges of the quarters (the face sides of the leather being placed together). The edges of the quarters, as well as those of the strip, thus lie adjacent and opposite when the seam is pressed flat. A linen stay piece is applied on the inner side of the seam, the same being stitched through the edges of the quarters and the strip, so that all are firmly secured together. But the edges of the quarters are not directly connected by stitches.

IMPROVED BOOK CLIP.

John T. Weston, Creston, Iowa.—This is an improved device for holding music books open upon organs and other musical instruments, and it consists in a music book holder formed of wire, having its middle part bent into U form, having coils formed upon the middle part of its arms, and having the outer parts of its arms bent over parallel with their inner parts. In using the device, a bend is placed at the back of the book, when opened at the required place, and arms are placed upon the pages of the book. The coils enable the device to be placed upon books of various thickness. The ends of the arms are bent to form eyes to prevent said ends from catching upon and tearing the paper.

IMPROVED ADDING PENCIL.

Charles C. Fields, Abingdon, Va.—The object of this invention is to provide a simple and convenient registering attachment for pencils and penholders to facilitate the addition of long columns of figures. The invention belongs to that class of adding devices in which nothing less than the tens are registered, while the units are carried in the mind until they are raised to tens. The working parts of the device are compactly arranged in a case, through which projects an extension of the slide to permit the operation of the latter by the finger to move the registering wheel, and the said case is provided with a clasp for attachment to the pencil, and has also an independent painter and set of digits, whereby the number of units to be carried are separately registered and kept whenever the addition of a column is interrupted.

IMPROVED CARPET SWEEPER.

Henry F. Noyes, Boston, Mass.—This invention relates to an improved form of box or case for carpet sweepers; and it consists in the construction and arrangement of the hinges for fastening the lid or cover of the case to the frame, which hinges are formed of straps of metal arranged to embrace a pintle contained within a marginal bead of the cover, and having their leaves extended vertically downward into a mortise or slots cut edgewise in the rear board of the frame wherein they are secured by rivets. It also consists in constructing the arched metal top with a marginal bead, and the edge of the frame with a corresponding groove, and combining the two so as to prevent the escape of dust.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BOAT DETACHING APPARATUS.

William A. Brice, care of R. Clifford Poulter, 44 Middle Temple Lane, E.C., London, England.—This invention consists of a block with horizontal aperture, across which two bolts pass at opposite sides. The block is suspended at the upper part from the davit tackle, so that the bolts are vertical, and the boat is suspended from the device by a loop of rope passed through the aperture in the block from one side, and over or round the hold at the opposite side, and another loop similarly passed through the aperture and round the other bolt from the other side. The strain on the two ropes thus tends to draw the bolts against the sides of the block and hold them in position, and they are thus held intact so long as the strain of either rope is upon them; but immediately they are relieved of the strain by the boat being completely water-borne. The bolts, being in a vertical position, fall by their own gravity and slip out of the loops, which are thus set free.

IMPROVED EARTH AUGER.

George W. Shapley and Daniel Phillips, Austin, Minn.—This auger is so constructed as to enable a much larger hole to be bored than the diameter of the auger. It moves the small stones from the center toward the rim, so that they may be taken up by the cutters.

IMPROVED CLOTH CUTTER.

George D. Ferris, Springfield, Ill.—This is a combination of a cutter and a measuring and clamping device, the object being to accurately cut cloth either straight across the piece or on a bias.

IMPROVED PLUG TOBACCO MACHINE.

Thomas W. Prather, Union Depot, Tenn.—This invention consists in an arrangement of rollers for forming plugs of tobacco from leaves, which are fed to the said rollers by an endless apron; and it also consists in a cutting device for cutting the tobacco into suitable lengths after it is flattened by the rolls.

IMPROVED METAL TURNING LATHE.

Sander Johnson, Minneapolis, Minn.—This consists in the combination of friction rollers placed in spring bearings with the tail stock of a lathe in such a manner that they bear up the tail stock, and thus obviate friction between it and the lathe bed.

IMPROVED APPARATUS FOR BUNCHING BROOMS.

Daniel Van Wicklen, Green Bay, Wis., assignor to himself, Frank Lenz, and August Brauns, of same place.—This consists of two adjustable needles projecting from a slotted bed plate, and each provided with an eye, the lower part of which is V-shaped near the points or upper ends. The object is to provide apparatus for rapidly tying brooms in packages suitable for market or transportation.

IMPROVED HORSESHOE NAIL CLINCHER.

Jacob Slautterback, Millintown, Pa.—By suitable construction, as the handles are pressed together, the jaw that rests upon the forward end of the nail will be drawn downward, bending and clinching the nail. Here is a new and powerful mechanical construction.

IMPROVED HAND SNOW PLOW.

Edwin R. Betts, Bear Lake, Pa.—This consists of a snow plow whose mould board runs by guide rollers and grooves along the rail, and throws the snow from the inside of the same by a curved upright flange or plate on the outside of the braces.

IMPROVED GATE-OPERATING MECHANISM.

Albert R. Sherman, Natick, R. I.—This apparatus is for springing and closing gates for railroad crossings and other places. It consists, essentially, of a piston rod connected to the gate so as to swing it open and shut. Said piston works in a cylinder open at one end to the atmosphere, and connects at the other end, by means of a tube with a pump for forcing a liquid or fluid substance against the piston, so that it is moved in one direction or the other to operate the gate both ways.

IMPROVED ICE ELEVATOR.

Louis Zistel, Sandusky, O.—This consists of an inclined way, extending from the float in the water to the shore, and from the shore up to the highest point of the ice house, along which an endless traveling rope is conducted, being stretched over suitable pulleys, and moved by horse or other power. Knots of the rope take up a follower, and convey the cakes of ice along the way to the chutes that conduct them to the ice house.

IMPROVED CIRCULATING DEVICE FOR STEAM BOILERS.

William Ord, Brooklyn, O.—This invention consists of a boiler with a downward extending water leg, arranged at both sides of the fire box at the front end of the boiler, the water leg being connected by rear cylinders and a series of conducting tubes to the rear end. The water leg communicates by bottom holes, and by side holes near the corner or upper part of the leg, with the boiler.

IMPROVED STEAM WHISTLE.

John Elmg, Jacksonville, Fla.—This consists of a whistle that is divided longitudinally into three or more compartments of different lengths, each compartment being provided with an aperture for receiving the steam, and with the usual mouth. The object is to produce simultaneously in a whistle three or more harmonious sounds.

IMPROVED GAS RETORT COVER.

August Schwarz, New York city.—This cover is so constructed that it may be easily opened and closed, may be closed perfectly tight, and will keep the lid seat free from tar, etc.

IMPROVED ANTI-FRICTION JOURNAL BOX.

George Wilkes and Alexander Port, Monroe, Iowa.—This consists in the arrangement in the journal box of passages for oiling the rollers, and of a receptacle for oil into which the rollers dip at every revolution around the journal. The object is to provide a journal box that is adapted to journals of car axles, and to other heavy journals, that will be as nearly frictionless as possible, and which may be readily taken apart for repairs.

IMPROVED RAILROAD TIE.

George W. Chandler, Moingona, Iowa.—This consists of a tie constructed of clay or stone blocks, connected by longitudinal iron straps bolted together, the straps carrying fastening plates for supporting the rails.

IMPROVED HORSE POWER.

Radford C. Rhodes and William F. Holden, Crawfordsville, Ga.—This consists of a vertical supporting frame, placed on the main frame of the king post, and extended above and below the same for supporting a hand wheel and fly wheel on a shaft above, and a band wheel and pinion on a common shaft below the top piece of the main frame, to transmit the power of the horizontal cog wheel.

IMPROVED HEAT FENDER FOR FURNACES.

Joel B. Chandler, Clinton, Iowa, assignor to Francis L. Topper and M. A. Chandler, of same place.—This consists of an arrangement of flanged strips, to which are riveted, upon one side, sheets of iron, and upon the other side sheets of zinc, inclosing an air space between. The device thus formed is provided with hooks on the iron side, for hanging it to the rods that cross the face of the furnace. The object is to provide a device for protecting workmen from the intense heat.

IMPROVED COTTON CHOPPER.

John R. McCormick, Georgetown, Tex.—This is an improved machine for scraping, chopping, and cultivating corn and cotton, which embodies new mechanical construction, enabling it to be easily guided and controlled and readily adjusted for chopping or cultivating, or both.

IMPROVED FASTENING FOR SECTIONAL RATCHET WHEEL.

J. Morris Childs, Utica, N. Y.—The object of this invention is to secure a ratchet wheel to the round shaft of a hayrake in such a way that it can be put on and taken off without removing the attachments of said shaft, and in such a way that it cannot slip upon the said shaft, and will carry the shaft with it in its revolution.

IMPROVED CIRCULATING DEVICE IN STEAM BOILER.

Jacob T. Wainwright, Philadelphia, Pa.—The object of this invention is to utilize the greatest possible amount of heat by conducting the products of combustion back and forth several times through the boiler, and by introducing the feed water near the point of exit of the products of combustion, causing it to move between the partitions or deflecting plates toward the warmer portions of the boiler in a direction contrary to that taken by the products of combustion.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CROSSCUT SAWING MACHINE.

Heinrich M. Blohm, New York city, assignor to himself and Johann Erlenwein, of same place.—This is a crosscut sawing machine, that may be worked with great facility by one person, so as to be applied for the cutting of trees, sawing of the trunks into pieces, etc. It consists of a reciprocating saw carriage, to which motion is imparted by a rocking seat arrangement, the saw being guided in horizontal or vertical position and fed to the work by spring-acted roller attachments.

IMPROVED FLOOR CLAMP.

John Milton Wilson, Nashua, N. H., assignor to himself and James H. Hall, of same place.—This consists in the arrangement of two arms hinged together, so as to form a toggle or knee joint. Upon the extremity of one of the arms a lip is formed that embraces the edge of the flooring. At the extremity of the other arm a mortise is made, in which a spur is placed, which is driven into the joist. One of the arms is provided with a ratchet, and the other arm with a pawl, which retains the parts in position when the desired pressure is secured.

IMPROVED WAGON LOCK.

Frank Rakes, Greenup, Ky., assignor to himself and William Bryson, of same place.—This device is so constructed that it may be applied to and removed from the wheel while the wagon is in motion. It is formed of an U-shaped block, provided with the bent shank, a swiveled or pivoted link, and a strap. The block is applied to the wheel rim, and as the wheel rotates forward the jaw clamps the sides of the tire and felly.

IMPROVED SLED TONGUE.

John P. Lawson, Chandler's Valley, Pa.—This consists of a sled tongue, in which the tongue part is readily detachable from the roller, it being held in place by chains, which answer the purpose of braces. Said chains are made taut by a key driven through the tongue against a ring to which the chains are hooked.

IMPROVED FLOORING.

Otis S. Dickinson, Granville Corners, Mass.—This relates to a peculiar fastening for the blocks composing tessellated wood flooring; and consists of fastening strips that are T-shaped in cross section, and are fastened to the floor, and which fit into grooves cut across the end of the grain in the blocks.

IMPROVED BOARD ROOFING.

Arnold W. Zimmerman, Denison, Tex.—This is so constructed that the boards may contract and expand with changes of temperature without opening the joints, and which will carry off the rain without allowing it to work in through the said joints. The boards are provided with wide rabbets, made with lips upon their outer edges and along the opposite sides of their opposite edges.

IMPROVED FRAME BUILDING.

William R. Morris and Joseph Slanser, La Rue, O.—In order to enable any person to put up such buildings without requiring skilled help, this inventor proposes to construct the posts and beams of several planks that are bolted together, and locked to the girders by wedge pieces. The posts support the roof by angular plates and plate bearers spiked to posts.

IMPROVED MACHINE FOR PLANING SHINGLES.

Willard A. Kitts, Oswego, N. Y.—This invention relates to machinery for planing taper sawed shingles both sides at one operation, in which the shingles are passed along the planing knives by push bars worked by endless chains. The machine consists of rotary planers in stationary bearings, one for each side of the shingle, and spring pressers, for pressing the shingles against the planers. The arrangement is such that the taper shingles can be presented to planers in stationary bearings.

IMPROVED WHEEL PLOW CARRIAGE.

Abner K. Wolfe, Prairie City, Mo.—This invention consists in arranging crank axles independently, so as to swing upon tongue, and combining them with eveners, arms, and draft rods, so that when one plow stops the other can advance to relieve the machine from shocks and side draft, and to prevent the striking of the horses by the pole.

Business and Personal.

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

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.
Valuable patent for sale. Address Box 2377, Phila., Pa.
For Sale—10 H. P. Portable Engine, \$450; 40 H. P. Two-Flue Boilers and Fronts, \$300; 8 foot Planer, \$435; 22 in. x 12 ft. Lathe, \$175; at Shearman's, 132 N. 3d street, Philadelphia, Pa.

N. F. Burnham, York, Pa., wishes to contract with one machine shop in each State to sell his "1874 Turbine," and manufacture gearing for them.

Universal Screw Cutting Index and Rule for Compound Gearing, price 10 cts. Address E. Lyman, C. E. New Haven, Conn.

For Sale—State or County rights; an article for housekeepers in the hardware line. Address J. A. Worley, Cleveland, O.

Baxter's Adjustable Wrenches—The best for Farmers, Householders and Mechanics. Greene, Tweed & Co., 18 Park Place, N. Y.

Wanted—Situation as draughtsman or shop foreman. Understands general machine work. Small salary accepted. References first-class. Address "Expert," 412 N. 4th St., Philadelphia, Pa.

Send for James W. Queen & Co.'s Catalogue of Drawing Instruments and Materials; also catalogue of Microscopes, Field Glasses, Telescopes, and other optical instruments. 924 Chestnut St., Philadelphia, Pa.

For Sale—The whole or part interest in a money and labor saving invention, for shoe factories, now in practical operation. Address J. M. De Lacy, Trenton, N. J.

The Zero Refrigerator was awarded a grand Centennial medal. Send for book. Lesley, 236 W. 23d St., N. Y.

Book on Making and Working Batteries, Electrotyping, Plating, etc., 25 cts. T. Ray, Box 356, Ipswich, Mass. Cheap!!!—Foundry and Machine Shop, with or without Agricultural Dept. F. D. Bennett, Jackson, Mich.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.
Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

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

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

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

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

Chester Steel Castings Co. make castings twice as strong as malleable iron castings, at about the same price. See their advertisement on page 157.

Set of Mechanical Curves, as illustrated in Sci. Am. Supplement, No. 59, mailed on receipt of \$5.25, by Keuffel & Esser, New York.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

Walrus Leather and supplies for polishing Iron, Steel, and Brass. Greene, Tweed & Co., 18 Park Place, N. Y.

See Bost's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 5-25. Send for pamphlet and sample of work. B. C. MacLay Co., Battle Creek, Mich.

Notes & Queries

J. E. M. will find a description of the jointed boat on p. 343, vol. 34.—J. L. will find directions for fastening leather to iron pulleys on p. 409, vol. 33.—H. W. T. will find something on incubators on p. 273, vol. 33.—D. F. H. will find a description of the manufacture of postage stamps on pp. 308, 227, vol. 27.—J. M. will find a description of a flour bolt on p. 117, vol. 32.—O. F. S. will find something as to acid chromate of lime on p. 28, vol. 36.—H. E. W. will find a good recipe for lacquer for brass work on p. 116, vol. 33.—C. L. C. and F. W. D. are informed that the botanical name of the garden box is *burus sempervirens*.—A. B. will find directions for grinding old faneets on p. 192, vol. 1, SCIENTIFIC AMERICAN SUPPLEMENT.—H. A. B. will find directions for the decalcification process on p. 275, vol. 34.—A. B. C. will find something on lubrication in an engine cylinder on p. 258, vol. 36.—A. A. B. will find particulars as to the opening of the Paris Exposition on May 1, 1878, on p. 276, vol. 34.—W. I. will find directions for changing older into vinegar on p. 166, vol. 32.—J. A. W. will find directions for making Pharaoh's serpents on p. 218, vol. 34. Either, in a test tube held in the hand, boils by the heat of the hand. The glass does not make it boil.—J. H. W. is informed that the United States Capitol is lighted with gas, which is ignited, when necessary, by electricity.—T. R. W., Jr., will find on p. 259, vol. 35, directions for making paste.—F. W. will find a recipe for a silver polish for metals on p. 299, vol. 31.—Will A. V., who asks as to shellac varnish, state explicitly what it is that he desires to know?—T. F. T. will find something on burning petroleum in boiler furnaces on p. 165, vol. 36.—J. A. C. will find directions for galvanizing iron on p. 346, vol. 31.—V. A. S. will find directions for making indelible ink on p. 394, vol. 33.—F. W. H. will find a description of an incubator on p. 273, vol. 33.—P. S. T.

will find directions for making a blackboard on p. 299, vol. 28.—D. O. will find something on the use of old silk on p. 309, vol. 31.—J. J. B. will find a recipe for a black mortar on p. 133, vol. 36.—W. S., H. W. S., J. J. T., J. D. M., W. A. M., J. A. C., A. K., A. J. W., A. J. B., H. K., J. L., W. C. F., J. T. S., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) P. F. K. says: I. We have a forty horse power return tubular boiler which I blew off lately for the purpose of washing it out. I blew off at 10 lbs. pressure, having previously pumped it full of water. After I had blown off all the water, I closed the blow-off cock and left it to cool off. I soon heard loud reports in the boiler, like pistol shots. I shut off the water as soon as I could, whereupon the reports died away. A. The noise was caused by sudden contraction of the heated plates when cooled by the entering water. 2. Why do the rails on curves of a railroad last longer than those on a straight track? A. We could not answer this question satisfactorily without knowing more details.

(2) S. G. asks: 1. How is salicylic acid manufactured? A. By strongly heating for several hours a neutral alkaline carboxylate in an atmosphere of carbonic acid. The residue in the retort is dissolved in hot water, and the salicylic acid is precipitated in an impure state by the addition of a mineral acid. It is purified by distillation in a current of steam. See p. 259, vol. 35. 2. Could it be used in solution, without quicklime, for preserving eggs? A. Yes, if the eggs were kept in a cool place.

(3) J. N. S. says: I have concluded to paint my floor and some shelves contiguous to a small engine with tungstate of soda, as I fear that the excessive heat from the furnace will ignite the woodwork. Will you please give me the formula for mixing the tungstate of soda and water, and the tungstate with the silicate, for the paint? A. Dissolve about 1 lb. of the salt in 3 or 4 gallons hot water, and apply with a brush. Dissolve 1 lb. of the waterglass, in fine powder, in 1 gallon of boiling water and apply as a varnish. It may be mixed with a little oxide of zinc, well agitated when using. It will preserve the wood, as well as render it fireproof.

(4) L. K. says: I have an achromatic telescope which makes stars of the first magnitude appear as large as the full moon; and I wish to know what additions I can make to increase its magnifying power? A. We think you want to increase its defining power instead of its magnifying power; for no good telescope will show stars to be anything but a point with more or less radiations of light according to the state of the atmosphere. Your telescope lenses are not properly made or they are misplaced, they have too much aberration, either spherical or chromatic, or probably both. Take a piece of paper three fourths of an inch in diameter, and cover the center of the objective; then focus on an object. Then remove the piece, and cover the outside portion, letting the light pass through only that part which was covered in the first instance. Then focus on the same object, and note the difference of the two. These will agree if the glass is of the proper curves. If the edge is the shortest focus, then that part of the lens between the center and edge will require flattening by polishing, and vice versa.

(5) W. W. M. says: I have just completed a large barn, and up through the center I have erected, from a solid foundation, a strong framework of 8 feet square; this runs up to the roof. The object of this was to erect some kind of a wind power which would do my barn work, such as cleaning oats, cutting hay, shelling corn, pumping water, etc. I have seen a power erected in the form of a drum with perpendicular fans which could be closed or opened at pleasure. 1. Can you give me a plan for the construction of such a power? A. If such a form of windmill should be enclosed in a revolving rectangular cupola upon your barn, the fans might be fixed stationary within a light circular rim, and the force of the wind, when too violent, moderated by the insertion of automatic luff-blinds in the front of the cupola. The most simple form of such a windmill, however, would be that in which the sails or fans are set horizontal, and the shaft horizontal and with bearings near the floor of the cupola, in which case only the upper half of the mill wheel is exposed to the wind. 2. Would it be practicable to have a power of this kind worked on the principle of the turbine wheel? A. We think not, as in the case of the turbine the weight of the water is an element that would not apply here.

(6) G. B. M. asks: Can you give me any information concerning the building of a Vienna bake oven? A. We have been informed that the bread of the Vienna Bakery depends, not upon any peculiarity in the oven for its alleged superiority, but upon the yeast and the method used in the manufacture. The ovens are said to be constructed as follows: They are like the old-fashioned brick ovens which were used before the introduction of stoves and ranges, but on a much larger scale. There are six of these, each twelve feet long and at the broadest part nine feet wide, the shape being oval. A roaring fire of wood is made in one of these ovens, and kept until three feet of masonry underneath it are heated through. The ashes are then carefully swept out, and the bread is baked on the hot tiles which form the oven floor. Steam pipes pass through these ovens, but these are heated only while the baking is in progress in order to maintain an even temperature. It is necessary to make a new fire in an oven only once or twice in three days, according to the amount of baking required.

(7) S. G. asks: What is the greatest number of revolutions allowed to a steam fan blower per minute? A. It depends on the form of the fan, pressure of blast, etc. It would require a considerable treatise to answer your question properly, but you will find much information in the catalogues of manufacturers.

(8) T. R. V. asks: Does pouring hot water on a frozen lead water pipe cause it to burst? A. We imagine that the hot water only reveals the cracks that have already been made.

(9) O. C. L. says: I wish to move a lever up and down with a force of about 12 lbs., and at the rate of about 80 strokes each way per minute, by means of a weight having a fall of 6 feet. How heavy a weight shall I use, and how shall I arrange it to work at the above speed? How long will it run? A. You do not send sufficient data. You can make the calculation for yourself from the following considerations: Theoretically, weight $\times$ (distance it moves while lever makes a stroke) = $12 \times$ length of stroke; so that, if the weight moves $\frac{1}{2}$ as fast as the lever, it must be 144 lbs.; and if the distance moved by the lever per minute is 6 feet, the contrivance will run for 12 minutes. A set of gear wheels, with a clock escapement, or some similar contrivance to regulate the movement, will answer very well.

(10) J. C. T. asks: What is the loss of power on the crank motion compared with the power applied at a tangent? In other words, if it takes 1 ton of coal to do a given amount of work on the cylinder and crank movement, cutting off at half stroke, with a piston traveling 300 feet per minute, how much coal would it take to do a like amount of work if power were applied at the rim of a wheel of the same size as the crank, and cutting off so as to work steam down to atmospheric pressure, the rim of the wheel traveling the same number of feet per minute as the piston does? A. There is no loss of power. You will find this point fully discussed on p. 121, vol. 31.

(11) G. A. D. asks: Is it more economical to carry a steam pressure of 60 or 65 lbs. on boiler than it is 40 or 45 lbs., the engine easily doing the work required with 25 or 30 lbs. pressure? A. It depends on the engine. If the pressure is reduced by throttling, it will be rather a disadvantage to use high pressure steam. If the engine has an automatic cut-off, there may be considerable economy in using the increased pressure. You can readily settle the matter by experiment.

(12) J. C. D. asks: What is the best way of testing a boiler in order to ascertain its economy in fuel? A. Measure the coal burned and water evaporated, and also test the quality of the steam.

(13) G. W. K. says: 1. Which is the best way to drive a burr, with belt pulley on spindle, or with bevel gear? A. Unless you use cut gears, the belt will be rather more efficient. 2. Will it be difficult to keep an 8 inch belt from running off of pulleys on upright shafts 10 feet apart? A. Flanged pulleys are often used on vertical shafts, but are not necessary if the shafts are accurately lined and the pulleys crowned.

(14) C. W. N. asks: 1. If a vessel and her cargo weigh 1,000 tons, will she displace 1,000 tons of water, or more or less? Can the hull be modeled so as (always weighing 1,000 tons complete) to displace more or less than 1,000 tons? A. The weight of water displaced will always be equal to the weight of vessel and cargo, whatever the models, it being understood, of course, that the vessel floats. 2. A butcher has stated positively to me that, if a creature were put on the scales, weighed, and then killed in his tracks, that he would weigh more dead than alive. I disputed this; was I right? A. We should have been inclined to dispute it too, unless your friend had produced some indisputable evidence in support of his assertion.

(15) J. B. says: I wish to run a small engine, a little time each day, by compressed air, using a boiler 40 inches x 20 feet for a reservoir, and a windmill to force air into the boiler. Can I force the air in with a common force pump, such as is usually used for forcing water into steam boilers? A. It will probably be necessary to use a water jacket, or some device for cooling the air, if the compression is considerable, unless the pump is new.

(16) M. A. K. says: There are five machines run by compressed air. The compressor stands half a mile from the work. When the compressors are run by steam, it takes 65 lbs. pressure to run them. When there is 55 lbs. on the engine, all the machines will not run well. But if one of them stops, the others run all right; and the air escapes from the escape valve on the compressor just as much when the five machines are attached as it does when only four are running. I claim that they do not raise pressure enough; another man claims they are making more than the machines need; for, he says, it is blowing out of the escape valve all the while. A. According to your account, we agree with you that it would be better to increase the pressure.

(17) W. J. McG. asks: In an ellipse the semi-conjugate diameter is equal to the distance from one of the foci to another and of a semi-transverse diameter; and in the application of square root, employed to find distance of foci from center, I make use of a contraction, as follows: To find the difference between the squares of two numbers, multiply their sum by their difference. Example: What is the difference between the squares of 7 and 9? $9+7=16$, $9-7=2$, $2 \times 16=32$. Proof: $7^2=49$, $9^2=81$, $81-49=32$. A. This is a well known principle, to be found in nearly every treatise on algebra.

(18) J. H. D. asks: Is a locomotive any heavier on the track when drawing a heavy load than she is running light or drawing a light load? If she is, how much, and why? A. If, as is usual, the locomotive is attached to the load in such a manner that it only draws and does not exert any lifting force, the weight on the driving wheels is not affected by change of load.

(19) O. G. S. asks: Will a certain quantity of ice placed in an airtight glass box and suspended in water give a greater amount of cold to the water than if the ice were first placed in contact with the water? A. A given quantity of ice at 32° Fahr., unless acted upon by some hygroscopic salt which determines its rapid liquefaction, cannot be made to reduce the temperature of a surrounding body of water more than a certain number of degrees in a given time. The total and ultimate quantity of heat absorbed or rendered latent by the ice, in the process of liquefaction, regardless of the time consumed in the act, will be the same under any conditions. Surrounding the block of ice by a glass envelope will somewhat retard the refrigeration of the surrounding body of water. The degree of refrigeration of the water is dependent only upon the exclusion of

exterior heat, the quantity of ice liquefied, and the time consumed in the act of liquefaction. See answer to J. J. S., p. 91, vol. 30.

(20) B. F. M. asks: Is there a cement that will fasten the butt ends of a rope together, and do it quickly? A. We do not think it probable that you will succeed very well in this. One of the strongest cements adaptable to this purpose consists of a solution of best glue in strong, hot, acetic acid. Even this, however, does not dry immediately. A fused mixture of equal parts of asphalt and gutta percha is also recommended.

(21) D. H. says: In a recent issue of your journal, you advised blue colored lamp chimneys to be used by persons reading a great deal at night. How can I color my lamp chimneys? A. You cannot stain them satisfactorily, but may purchase suitable chimneys of blue glass.

(22) C. M. says: A German paper gives the following: "Lamp chimney and blowpipe combined. In this novel device the vapors of petroleum mixed with hot air produce a high degree of heat, on a small scale, the whole apparatus being of the size of a common lamp, and an experimenter can melt in this way, in a small crucible, 4 ozs. of copper or nickel, or 3 ozs. of wrought iron within 10 minutes' time." Is this possible? A. Popular accounts like the above are usually to be taken with some grains of allowance, but the result given does not seem impossible.

(23) H. B. asks: 1. Is a short stroke engine better than a long one for sawmill use? For instance, is a 10 x 16 or 18 inch engine better, and will it furnish more power and more quickly than a 10 x 20 inch one? A. For the same piston speed, the short stroke engine will make more revolutions per minute than the other, which may be an advantage or not, according to the design and construction of the engine. For the same number of revolutions in each case, however, the long stroke engine will develop the most power. 2. Will a portable engine and boiler, say of 25 horse power, for sawmill use, furnish as much power as one of the same size stationary? A. Yes, if the machinery has the same general proportions and design.

(24) N. E. L. says: Which takes the most power, a large or a small circular saw, both having the same surface speed and the same number of teeth to the inch, and cutting the same kerf? A. If one saw has twice the diameter of the other, and cuts at the same rate of speed, it only makes half as many revolutions in a given time, and hence does not require any more power to drive it, under the conditions you have stated. In practice, however, large saws are thicker than small ones, and frequently run proportionately faster and with larger feeds and deeper cuts; so that generally large saws take more power than small ones.

(25) G. H. E. T. asks: What sized fan blower, and what number of revolutions of such, would be required to fill an iron tank which is 2 x 1 x 2 feet in 2 minutes of time to 5 lbs. pressure? A. You will find it difficult, if not impossible, to produce such a pressure with a fan blower; and if you use a positive action or displacement blower, you can calculate its size to deliver a given quantity of air at a fixed velocity, or the velocity required to deliver this quantity with a fixed delivery per stroke.

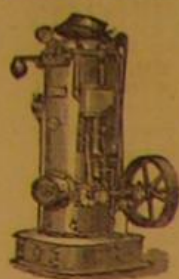
(26) G. T. asks: Our engine room is of stone, two stories high, and is excessively hot in summer. I think it could be much improved by proper ventilation, but do not know exactly how to proceed. I thought of putting a large air shaft, say 2 x 4 feet, above the boilers to extend above the roof. Do you think that would improve it? The boilers are covered with brick, but the dome, cylinder, and heater are not jacketed, and they radiate a great deal of heat. A. From the description, we judge that there is considerable radiation of heat that might be prevented with advantage both as regards economy and comfort. Then you should admit the outside air, either by means of a wind sail or ventilating wheel, and provide a shaft to allow the heated air to escape.

(27) T. W. D. asks: How may a novice refine bookbinders' gold rags on a blacksmith's forge? A. Cut the rags into very small pieces, mix them with a small quantity of carbonate of soda, place loosely in a small, covered, black lead crucible. Heat the crucible at first moderately and when the cloths are all carbonized raise the temperature to bright redness. The fused gold will collect as a small button in the bottom of the crucible, and when cold may be removed and freed from the soda by a little sulphuric acid.

(28) F. L. asks: In your issue of February 3 there is an article on bronzing. I have tried the composition, but there is something wrong about it. My method of applying it is to cover the article I wish to bronze, and let it dry, and then brush it off. What is wrong? A. Heat the metal in the same manner as when applying a lacquer. The preparation is intended more particularly for articles of brass.

(29) A. S. asks: 1. Would a plan for cleaning out or scouring sewers be patentable? A. Yes, if novel. 2. Are the mouths of sewers in New York city open, or under the water at all tides? A. Some of them are partly open at low water. 3. What are the maximum and what the minimum grades given to sewers? A. The maximum is that of the steepest streets, which in some cases is considerable, although we have not the data to name either that or the minimum. The latter is very low indeed—in some streets not sufficient to prevent the water from backing up into the drains during the prevalence of showers. 4. Are any with only the grade caused by the fall of the tide, such as the Canal street sewer must be, I think? A. There is a slight grade even in Canal street. 5. Are the inlets from the streets open, or have they traps? A. They have culverts which form a trap; these, however, are easily punched through in cleaning them out, and are not always kept in repair. 6. Is there any difficulty in keeping any of the sewers from accumulating sediment? A. Yes. 7. Is any expense incurred yearly in removing sediment, and is it heavy? A. A contract is made to remove the sediment in the sewers by the load, and that in the culverts by the year. It is a source of great expense.

(30) S. H. B. asks: Can aniline ink stains be easily removed from clothing? Most recipes for re-



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THE UNITED STATES TORPEDO STEAMER ALARM.

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

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

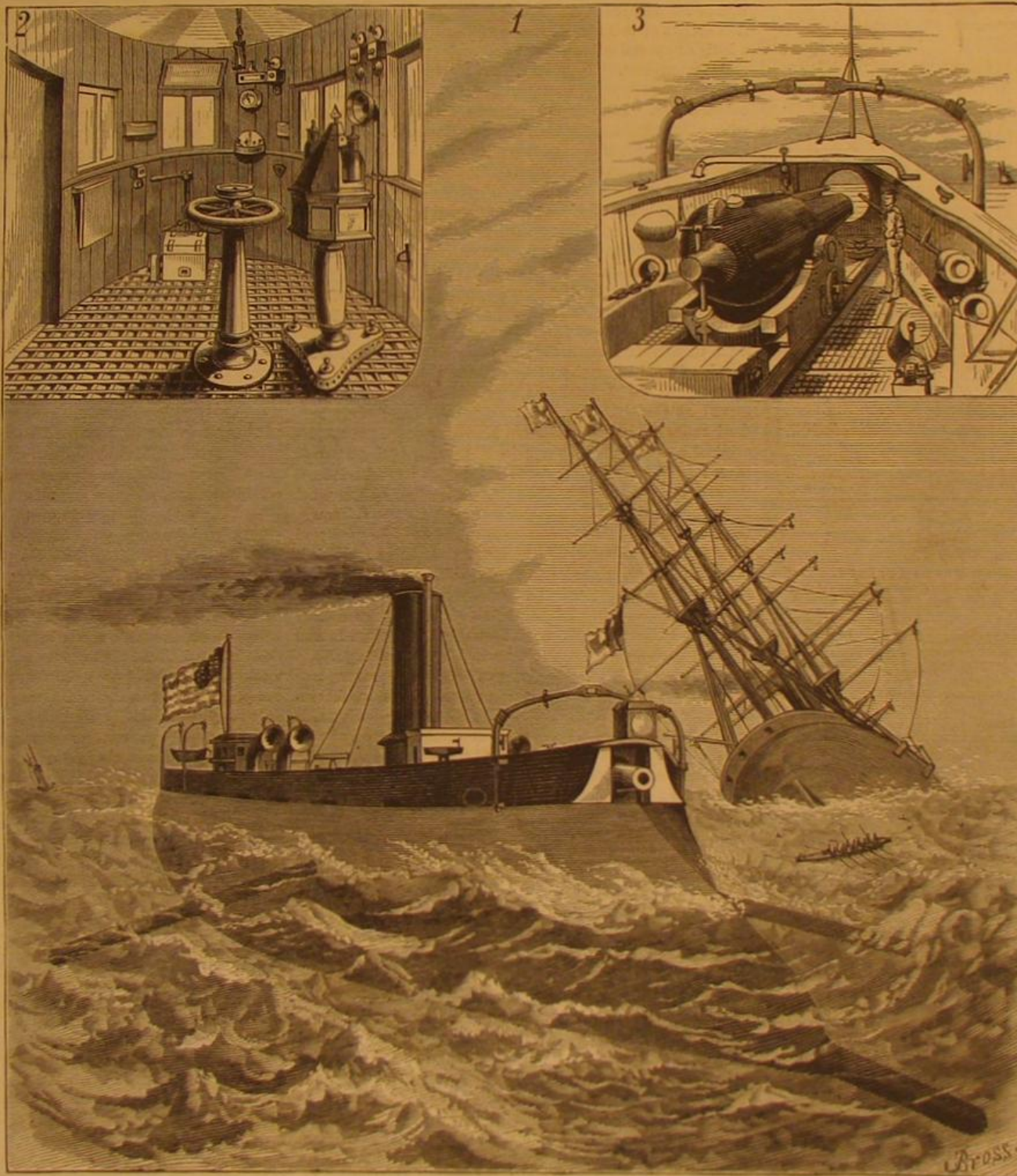
An excellent idea of the shape of the Alarm may be obtained from the large illustration, Fig. 1. Her length is 172 feet, of which 32 feet is snout or ram; her beam is 27 feet 6 inches, and she draws 11 feet of water, displacing about 700 tons. She is built of thoroughly tested charcoal iron, and on

the English bracket plate system: that is to say, she has really a double hull, one shell being constructed inside the other. Within the outside shell three longitudinals of great strength run the entire length of the vessel, and are connected with bars running in a horizontal direction by brackets. The different sections can be entered through man-holes, so that a person can pass from stern to stern between the inner and outer vessels. These compartments are all watertight, so that, in event of a leak, only one section could fill. The whole interior of the vessel is also built in compartments which may be hermetically closed, so that, in

is effected by the total abolition of a rudder, and by steering her with the same apparatus which propels her, the Fowler wheel, which is represented in Fig. 5. The wheel turns on a vertical shaft; and its paddles are feathered by an eccentric cam in such a manner that, at one part of their revolution, they have a pushing and drawing action on the water, while at another part they present only their edges. The device, in fact, is simply a feathering paddle wheel, turned horizontally instead of vertically. By suitably turning the cam wheel, which is done from the helm, the feathering of the paddles is caused to occur at different points; and in this way the ship may be turned, or rather her stern twisted, around as if on a pivot. At the same time, by suitably adjusting the paddles, the vessel goes ahead or backs, the engine meanwhile running always in the same direction.

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

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



ADMIRAL PORTER'S SYSTEM OF TORPEDO WARFARE.

case of rupture of both shells at any point, it would still be impossible to fill the entire ship with water. The side plating is not thick, as it is not intended as armor, the vessel, as already explained, being almost wholly submerged while in action.

In order to attack an enemy suddenly, and to pursue him in case of flight with success, and also to be possessed of a very necessary mode of self-protection, it is evident that a vessel such as the Alarm requires not only the means of speed but of handling her with the utmost readiness. The theory is that she is always to meet her adversary bows on; and as her most formidable enemy is the ram, she must be able to turn in so small a space and so quickly that it would be impossible for her to receive a fair broadside blow. This

[Continued on page 162.]

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VOL. XXXVI, No. 11. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, MARCH 17, 1877.

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WHAT IT COSTS TO FEED INSECTS.

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

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

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

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

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

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

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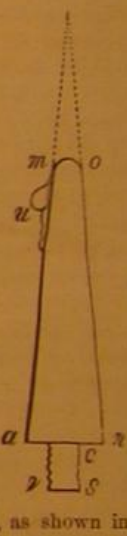
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EXPLOSIONS ON LIGHTNING ROD POINTS.

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

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



THE INDUSTRIES AND RESOURCES OF NEW SOUTH WALES.

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

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

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

Mr. Reid's essay is primarily designed to exhibit in some detail the inducements which the colony offers to immigrants, and of these we summarize below those regarding which a workman would naturally first ask to be informed. The area of the colony is 323,437 square miles, that is about as large as the New England States, New York, Pennsylvania, New Jersey, Delaware, Ohio, Indiana, Illinois, and about a

third of Iowa, combined. The climate is remarkably salubrious, the death rate is low, and epidemic diseases are rare. Means of intercommunication consist of 692½ miles of finished railway and 8,012 miles of telegraph wire, and 561 additional miles of railway are projected. The telegraph is under government control, and a message of ten words may be sent to any part for one shilling. The Post Office includes a system of government savings banks. The public debt is not more than three years' revenue. Land for settlement can be obtained of the government in any area between 40 and 320 acres for \$4.84 per acre, payable on easy terms.

The present mainstay of Australian prosperity is live stock, and this is conspicuously true of New South Wales. The value of cattle, horses, etc., in the colony in 1875 was over \$35,000,000, and the wool export is very large. There is no part of the country where sheep and cattle will not thrive; and with the improvements which are constantly being made in the preservation of meat, it is likely that before long the rearing of live stock for consumption in Europe will become a great and valuable industry. The soil is suitable for the cultivation of all northern cereals, coffee, tea, tobacco, cotton, sugar, olives, cinchona, indigo, and rice, besides the fruits of the temperate and semi-tropical zones. The demand for agricultural laborers is therefore especially marked. There are abundant coal resources, the approximate coal area being 24,840 square miles. The gold mines are believed to be extensive, but labor must be had before they can be developed. Tin and copper are largely mined, and a fine quality of iron is obtained. There is a diamond area of 500 square miles, and in gems of all kinds the country is remarkably rich. The larger manufacturing industries include ship and boat building, brick making, milling, tanning, engineering, foundry work and pottery—all of which are carried on in extensive establishments. Of the minor industries, nearly all are represented as in a flourishing condition. The eight hour rule in labor is generally followed. Taxes and rents are low, while wages are fair. A bricklayer, for example, can earn in Sydney from \$2.50 to \$2.75 per day. Building laborers get from \$1.50 to \$1.75. In the iron trades the pay for eight hours' work ranges from \$2 to \$3 per day. Painters receive from \$8 to \$15 per week. In the gold mines, a day's wages is, for eight hours, \$1.87 to \$2.08; in copper mines, same time, \$2.08 to \$2.60; in coal mines, five hours' work, \$2.35; in iron mines, nine hours' work, \$1.75 to \$3.50. As regards the cost of living, a house containing 6 rooms may be hired in Sydney for from \$3.50 to \$5 per week; in the suburbs this rent falls as low as \$2.50 to \$3.50 per week. Smaller houses ranging down to three rooms are proportionately lower in price. In the matter of food, beef sells for 8 cents per lb., flour 3½ cents, bread the same, sugar 6 to 8 cents. Generally the prices are high, in some respects notably so, as butter is quoted at 50 cents per lb., milk 16 cents per quart, and bacon 25 cents per lb.; but these are Sydney rates, and the cost of living appears to be somewhat less in the country, while wages out of the city average rather higher.

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

THE WORLD'S POPULATION.

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

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

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

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

the square mile; of America, 5½; of Australia and Polynesia, about 1½ to the square mile.

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

PATENT RIGHTS AND PATENT WRONGS.

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

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

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

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

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

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

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

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

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

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

The chief opponents of the patent system are the Western Grangers, whose narrow views have been represented in the recent anti-patent enactments of their State legislatures and also in the bill now pending in the United States Senate. Have those same Grangers ever seriously asked themselves the question where their organization and the wealth it represents would have been—where they personally would have

been—had there been no patent system to encourage inventions, and no fruits of such a system to make the cultivation of the interior wilderness possible, or to enable its pioneers to send its products to a profitable market? We hazard the assertion that the "obnoxious" patent system, and the inventions it has encouraged, have done more for the Grangers than they have ever done for themselves.

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

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

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

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

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

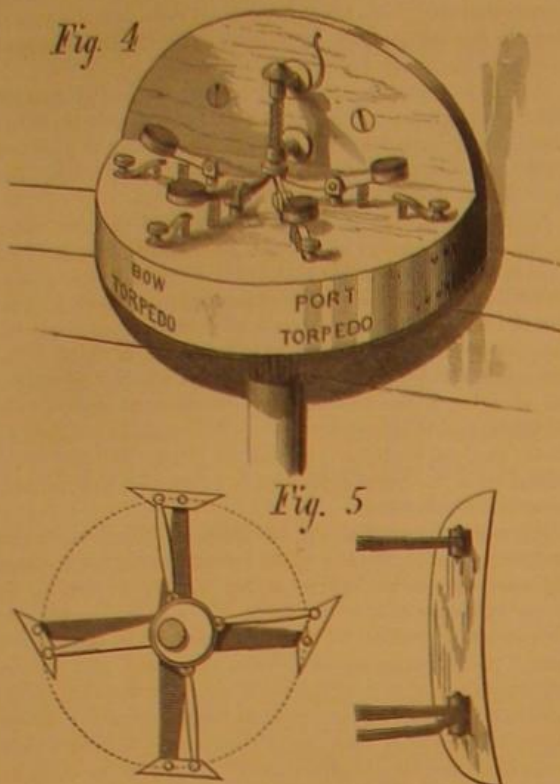
The worst possible cases of patent "oppressions" are trivial compared with the burdens which rising communities have had to bear through speculations in land. Shall we say, therefore, that private ownership of land is injurious and ought to be abolished? Or, because the great landed fortunes have not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

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

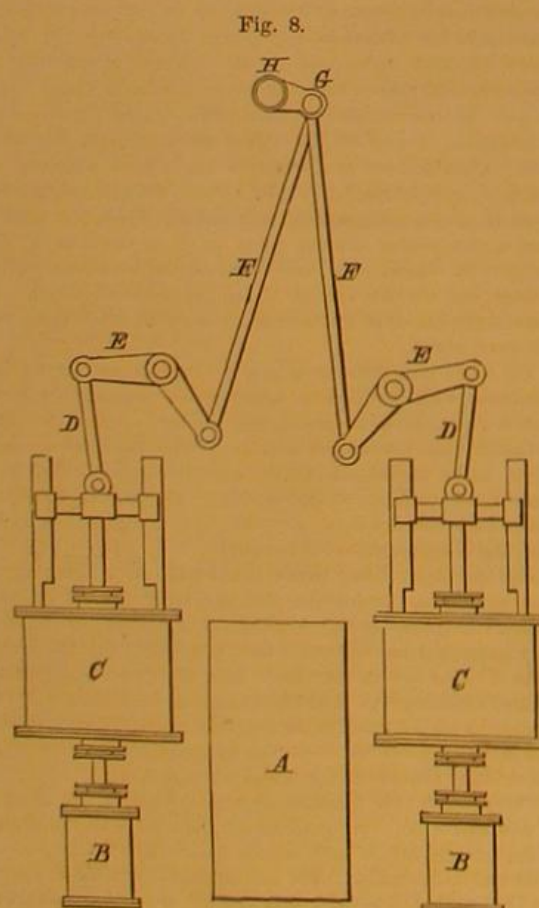
There remains the question whether the patent system can be modified so as to mitigate the alleged evils of its workings without impairing in any serious degree its efficiency as a stimulant to invention. We are inclined to think it may; but the case is not as clear that sudden or reckless changes are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

[Continued from first page.]

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



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



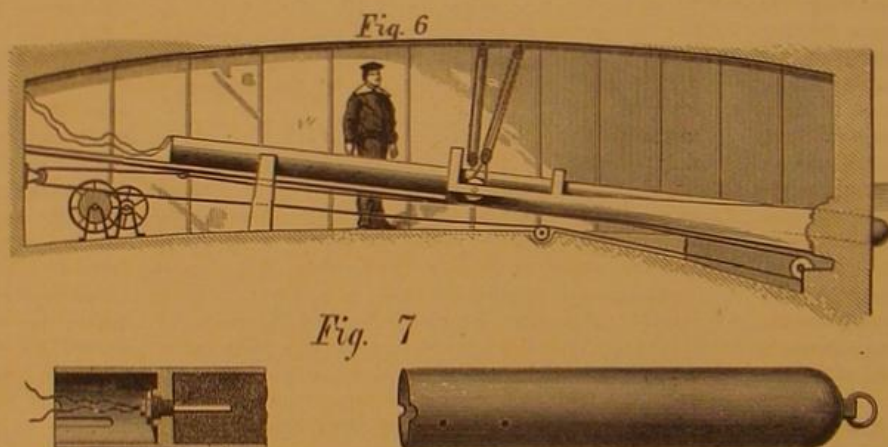
and then the captain, in the wheel house, touches the key, and the explosion follows.

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

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

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

The question of how the Alarm herself would fare against the heavy guns of a modern ironclad at close quarters is really of little moment. As we have shown, it would require



ADMIRAL PORTER'S TORPEDO SPAR.

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

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

British Patent Documents.

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

round tin box, and attached to the skin by cords. The weight of the document, with seal and appurtenances, is two pounds four ounces avoirdupois. The object of this formidable affair is to let the common people know that the government has granted a patent to Smith for a birdcage or a flat iron.

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

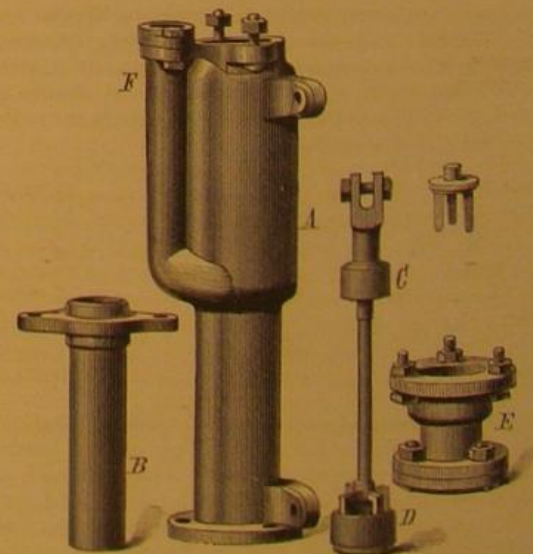
ROBAUGH'S LITTLE GIANT PUMP.

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

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

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

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



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

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

Japanese Mushroom Culture.

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

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

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

A New Use for Glycerin.

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

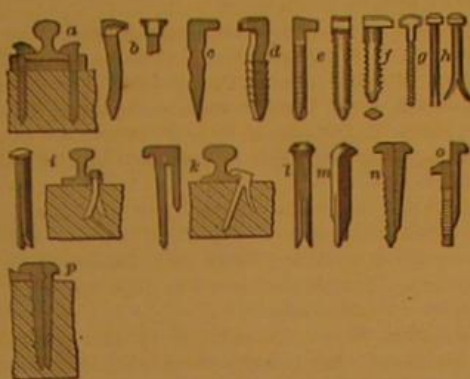
SPIKE MACHINERY.

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

SPIKES

are nails above the tenpenny size. Twelvepenny spikes are 3½ inches long, and weigh 45 to the lb.; the succeeding sizes are sixteenpenny, twentypenny, and thirtypenny, and then follow the railroad spikes, of large size and various patterns.

Fig. 1.



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

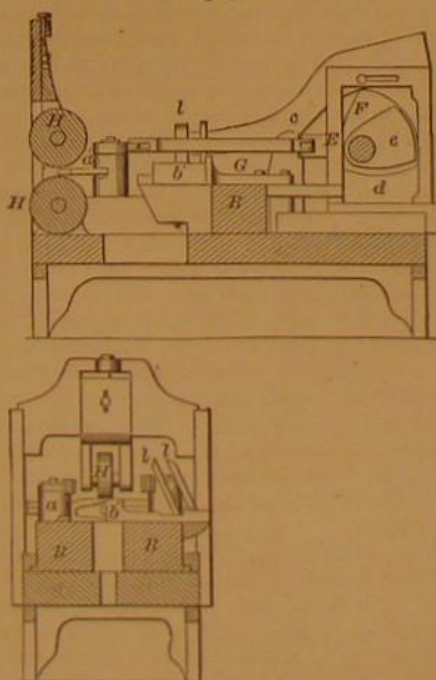
a shows a rail composed of an upper rail and a grooved bedding-piece, secured by spikes of the ordinary kind. b is curved, to cause it to bear more strongly against the rail, and the head has a shoulder at the back, which comes in contact with the wood before the hooked forepart touches the flange of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

For the manufacture, the

SPIKE MACHINERY

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

Fig. 2.



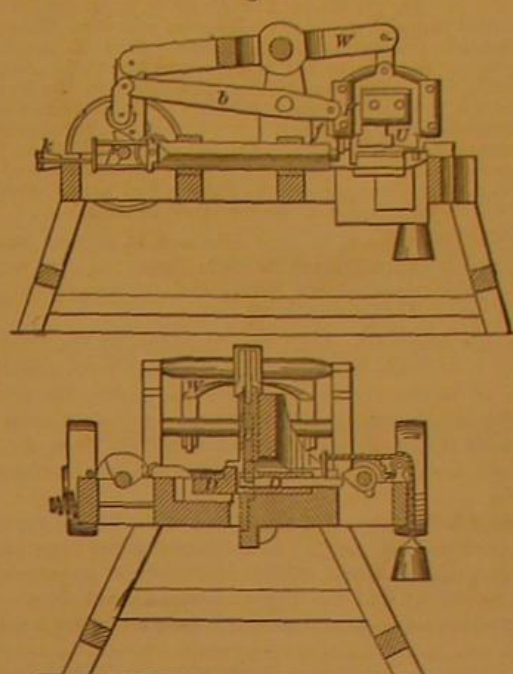
imparts a traversing motion to the carriage, B B, and a cam, F, rocks the lever, e, which carries a die, b, between which and the stationary die, b, the body of the spike is formed. The die, b, is, by means of inclined parallel guides, l l, partially rotated, so as to close gradually on the body of the spike. While the spike is clamped between the dies, the header, G, having a slot, i, into which passes a pin, e, connecting it loosely with the bed, advances with the bed, and

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

is brought in contact with the end of the blank, which projects beyond the dies, at the same time turning on its pivot, so that its pressure is first applied to one side of the head, and is gradually brought to bear squarely upon it at the completion of its stroke.

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

Fig. 3.

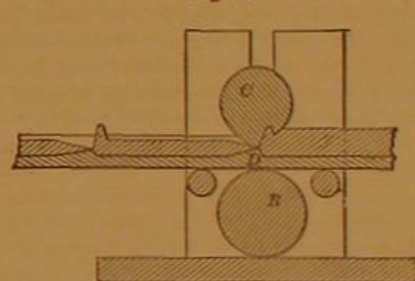


of the spike or bolt, which is first grasped between two moving dies, C D, that shape the body. A vertically moving die, U, operated by the lever, W, forms the point, and a second vertically moving die, f, operated by the lever, b, the head. The levers, W b, have pivoted arms, which are turned down,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

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

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

Fig. 4.



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

Slide Valve Friction.

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

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

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

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

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

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

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

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

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

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

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

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

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

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

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

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

Some time since, Congress appropriated \$200,000 to complete the Washington monument in this city; but before expending this amount it was determined to ascertain whether the ground was solid enough to bear the immense weight which would be placed upon it if the monument was erected in the style contemplated in the design, and about \$2,500 have been expended in boring, etc., to test this important matter. The examination is said to have developed the fact that the completion of the structure in its present site is impracticable, and it is therefore suggested that the part of the monument now erected be taken down and erected in another portion of the city in a different and, it is to be hoped, a better

style, one that will not be thought, like the present nondescript structure, to be a shot tower or glasshouse, and one that will be an honor to him whose virtues it is intended to commemorate.

OCCASIONAL.

The Iron Plow.

To the Editor of the Scientific American:

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

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

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

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

J. HESTON SMITH.

Lambertville, N. J.

The Balestrieri (?) Reflector.

To the Editor of the Scientific American:

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

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

DAVID SHIVE.

Allentown, Pa.

The Commercial Value of Scientific Knowledge.

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

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

"It will be readily understood how important is the possession of both theoretical and practical knowledge by the worker, for, while the scientific man is capable of pointing out improvements in processes, he is so placed in the majority of cases that he is unacquainted with the methods of working; on the other hand, the practical man, looking upon his processes as trade secrets, and being unacquainted with their defects, never seeks the aid which a knowledge of Science places at his disposal." Many instances of a persistence in wrong methods or in wasteful processes might be collected, but one alluded to by Mr. Bunce will sufficiently indicate the commercial value of a knowledge of Science. "Birmingham, as is well known, reckons amongst its most important industries the manufacture of jewelry, and in the processes of coloring and refining gold and silver considerable waste of the valuable metals was, and probably is still

to some extent, incurred. In the process of coloring gold articles a minute portion of the valuable metal is washed off; but owing to a want of acquaintance with the chemical processes involved, only a percentage of the gold is recovered from the washing waters. Thus, in recovering silver from the liquor, the usual process is to throw it down as chloride by means of common salt, but the workmen and the employers, being unaware of the fact that an excess of salt redissolves a portion of the silver, have for years been throwing away a considerable quantity of silver. On the authority of Mr. Woodward, the Professor of Chemistry to the Institute, it is stated that one firm has effected a very material saving in this process entirely by the knowledge gained by one of its members while attending the classes of the Institute. Here we have a definite instance of the commercial value of a knowledge of Science; but, if the proposition were not obviously true and required to be demonstrated by evidence, many instances might be gathered together."

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

Do Snakes Catch Fish?

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

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

Dried Potatoes.

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

Adulterating Rubber.

The use of the salts of barium for adulterating goods sold by weight is on the increase. Some rubber goods have been found with these salts in the material, which on combustion left as much as 60 per cent of ash, pure rubber leaving only 2.5 or 3 per cent. The adulterated goods cracked and lost their elasticity.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXII.

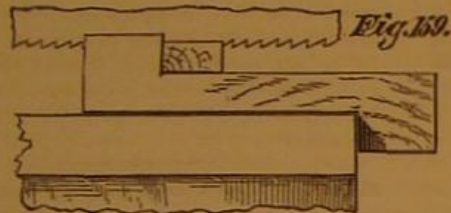
BENCH WORK.

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

A good bench is a great assistance to a pattern maker. It should be perfectly true on its upper surface, which is best made of hard wood and covered with a coat of varnish to prevent dust or drippings of glue from adhering to it, so that it is always cleanly in appearance. The vise, when screwed close to the bench, should come level with its top, and the butt or stop for work to press against should be so constructed that its height may be readily altered, as this will have to be done perhaps fifty times a day. In the absence of a well contrived mechanical stop, which always admits of re-adjustment without stooping, I should recommend a stop of wood made by placing two wedges together,



workman's tools, are the shooting board (already described), the mitre box, and the bench hook. The mitre box is a contrivance to enable a workman to saw mouldings, pipe patterns, etc., to an angle of 45°; it is simply a trough with saw cuts made at the required angle. The stuff to be cut is laid



in the trough and pressed to one of its sides, the saw being guided by the saw cut. The bench hook is a piece of wood sawn to the shape shown in Fig. 159, and is used as a butt; for timber, in cross-cutting work, should not be sawn directly on the bench.

Figs. 160, 161, and 162 are illustrations of different methods of joining pieces of wood together so as to form a square or any angle. Fig. 160 represents a tenon and mortise joint, made as follows: The two pieces, A and B, having been planed or otherwise made to size as required, are marked for the position and length of the mortise in one case, and for the length of the tenon in the other; both pieces are now gauged with a mortise gauge, both being marked alike; and then from the face side we mark a tenon or mortise of the

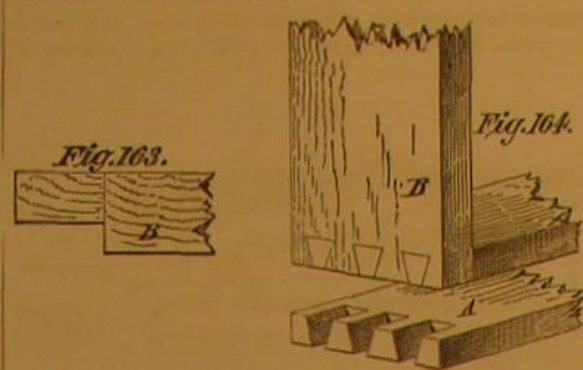
size required, which is generally a third of the thickness of the stuff. Where the mortise approaches the end of the piece, a provision has to be made to insure strength by adding the extension denoted in Fig. 160 by the dotted lines. This practice, however, though often adopted in carpentry, is rarely admissible in pattern work; and in its stead, the tenon or the piece, B, is diminished in width, as shown in Fig. 163, the mortise being made to correspond. In order to avoid breakage during the cutting of the mortise, the piece, A, Fig. 160, is got out an inch or two longer, which excess is sawn off after the glue is dry; an excess of a $\frac{1}{4}$ to $\frac{1}{2}$ inch should also be allowed on the tenon, as it is necessary to chamfer off the corners of the tenon so that in driving it may not damage the mortise. To prevent the tenon from, in time, working out, the mortise is slightly tapered; that is, made wider on the side remote from the piece carrying the tenon. Then the tenon is provided with two saw cuts, one on each side, near the edge; and after being driven home,



wedges are driven into these cuts, thus locking the joint. A joint more commonly in use among pattern makers is the half lap shown in Fig. 161, which has been already described. When this joint occurs away from the end of the pieces, the mortise need not, and should not, extend through the piece.

This joint, besides being glued, may be fastened with screws, or, if very thin, riveted with short pieces of lead wire.

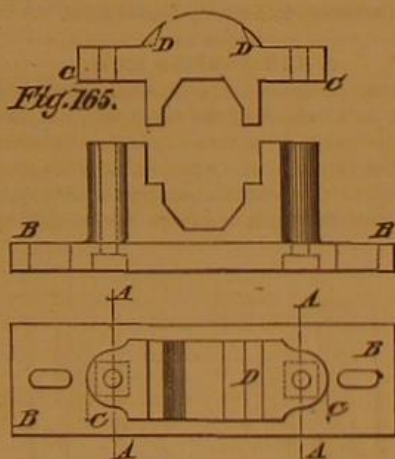
A very superior method of jointing is the dovetail, shown in Fig. 164, which is serviceable for connecting the ends and sides of a box, or any article in that form. The strength of the corner formed in this way is only limited by that of the



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

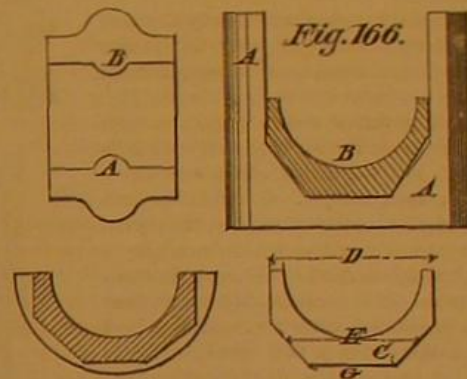
Fig. 162 is a mitre joint, the only one serviceable to mouldings, pipes, and other curved pieces. It is not a strong form of joint, and is only used where the preceding kinds are inapplicable. It is made with glue, the pieces having been previously sized; and as an additional precaution, if the work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

As an example, to make the pattern for a pillow block, as shown in Fig. 165. This pattern will be more easily moulded with the base up; that is to say, it will lie in the sand in the reverse position to what it is drawn in Fig. 165. Prints will be required for the bolt holes, square prints for the recesses in the block intended to be cored out to receive the heads of



the cap bolts, and round prints on the tops of the cheeks and oval prints on the base. We first plane a piece for the base, BB, to the correct size, allowing $\frac{1}{16}$ inch to the foot for the contraction of the casting in cooling. We next draw center lines upon it on both sides. It must now be observed that a hollow or filleted corner appears where the cheeks of the block meet the base; and, further, that the recess in the block to receive the brasses is drawn to a depth coinciding with the height of the hollow or fillet. It will be advisable, therefore, to prepare a piece of the length from C to C, and to shape the ends to the outline of the cheeks, and, forming in this piece all the fillet, the cheeks may next be prepared of a thickness from the line, A to D. These must be strongly fastened, and are best mortised clear through the base, and glued fast. Two semicircular pieces must be turned for the portions outside the lines, A A, and three-cornered pieces must be fitted in the square recess to make it octagonal as required. Nothing now remains but to attach the core prints and make a suitable core box. A half box will suffice for the cap bolt holes, and a whole one for the holes in the base, as the cores for these latter will stand on end. To make the cap, we take a piece of timber large enough to make that portion of the cap that is above the line, C C; and we line or mark out the form of the cap on both sides (using a center line to make the marking on the two sides correspond), and pare away the surplus wood down to the lines. The pieces below the line, C C, are to be afterwards glued and nailed on. It is advisable to cut out a recess in the top of the cap, as shown in Fig. 166 at A B, to afford convenience to the machinist in using the wrench upon the nuts. Fig. 167 is a sectional view of a pattern for the brasses; and this pattern requires great care in its making, for the following

reasons: Brasses of this kind, and of a size not larger than is required for a journal about ten inches in diameter, can be fitted in much quicker by chipping and filing than by any other method; and in any event, a great deal of labor and metal can be saved by constructing the pattern of the necessary shape. Since, however, to give the required shape without the reasons therefor would not convince the reader of the correctness of the method, I will fully explain the two. It has been stated in former remarks that brass castings are smaller than the patterns from which they are cast by an amount of $\frac{1}{8}$ inch per foot, which is due to the contraction of the metal in cooling. Now, in addition to this contraction, the casting of a brass also contracts across the bore. Suppose, for example, that, in Fig. 166, A A represents a locomotive axle box, and that B represents the brass for the same, the two being shown in section, while C represents the casting for the brass. Beginning, then, with the casting, C, we have the following considerations: The diameter of the brass across D will be less than it should be, because such castings always close in that direction more than is due to the contraction in cooling. As a consequence of this, the top of the bevels, as denoted by the dotted line, E, becomes less than it should be; and when the brass is fitted on the sides and let



down in the box ready to fit on the crown and on the bevels, the bottom of the brass will bed and the bevels will not, as shown in the illustration. Now, supposing the angles to be at the top $\frac{1}{2}$ of an inch from the bevels of the box, then it will require about $\frac{1}{8}$ of an inch to be taken off the bottom of the brass to let the sides come to a fit, whereas if, when the bevels of the brass contact with the bevels of the box, the bottom of the brass were $\frac{1}{8}$ inch from the bottom of the box, $\frac{1}{8}$ inch taken off the bevels would let the bottom come home. It is then easy to see that the pattern maker should make the pattern so as to allow for the shrinkage across D, and at the same time insure that the bevels of the brass shall contact with the box before the bottom does. Then by the time that the machinist has taken sufficient off the bevels of the brass to fit them to the bevels of the box, the crown will come home, and the best way to insure this is to make the bevels of the brass of the same shape as those in the box, and then take a certain amount off the crown face of the brass (G in Fig. 166). What this amount should be depends upon the angle of the bevels; for bevels of 45° the proportions should be, for brasses of two and less inches bore, a full $\frac{1}{8}$ inch; for brasses having a bore of from two to four inches, $\frac{1}{16}$ inch will answer; while, if the bore is from four to seven inches diameter, $\frac{1}{32}$ inch will be a good proportion. If, however, the bevel is greater, these proportions may be increased. This is an important matter, and should never be overlooked or neglected, since it reduces the labor of fitting the brasses by at least one half.

Roumanian Amber.

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

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

SALICYLIC ACID AS A SYRUP PRESERVATIVE.—M. Lagoux, after a series of experiments to determine the minimum percentage of salicylic acid to be added to fruit syrups to prevent fermentation in hot weather, reports the proper quantity of acid to be equal to $\frac{1}{16}$ the weight of the sugar contained in the syrup.

IMPROVED STEAM ENGINE CUT-OFF.

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

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

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

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

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

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

Gas Iron.

The entire product of the Etna Iron Works, Allegheny City, Pa., is worked and heated in all departments with natural gas, brought to the works through pipes from the wells, which are nearly 1,500 feet deep, and situated in Butler county, Pa., 19 miles from the mills. Iron treated with this fuel—pure hydrogen and carbon compounds—becomes homogeneous, and has a uniform strength and finish not to be found in ordinary grades of iron. The superiority of

is released, the weight of the contents on the gates drop them and turn the shafts, releasing, by the pawl and cam connections of the shafts, successively the remaining shaft sections, so as to drop automatically the gates and empty all the pockets. Simultaneously with the dropping of the bottom gates, vertically guided end gates, F, are raised when the water has full sweep through the scow, so as to produce the rapid submerging of the contents from the pockets. The entire load of the scow can thus be easily and rapidly discharged without requiring a large number of hands, and without loss of time. After the load is dropped into the water the bottom gates are raised, and simultaneously therewith the end gates and guard plates are closed.

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

Patent Rubber Worm—A New Fish Bait.

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

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

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

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

Centennial Medals.

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

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

Fig. 1

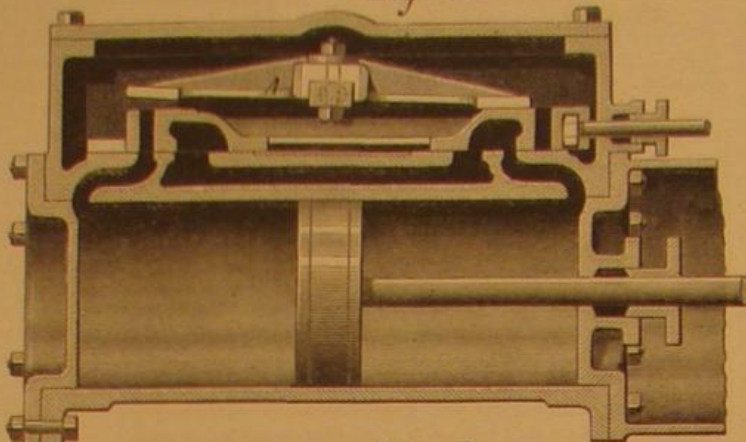
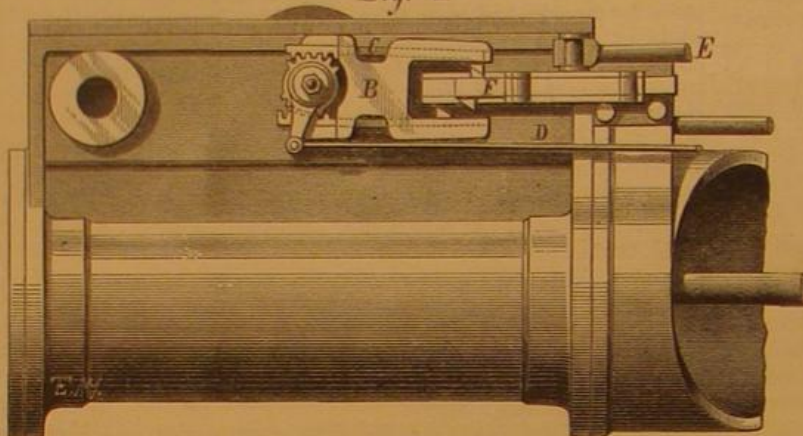


Fig. 2

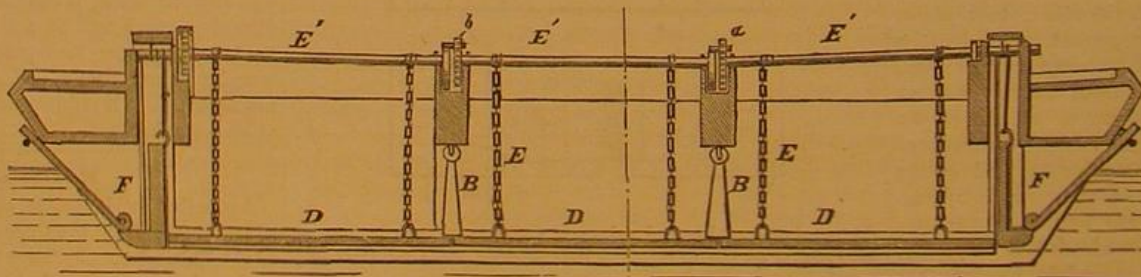


FISH'S VARIABLE CUT-OFF.

natural gas iron is attributed to the amazing heating power of this new agent, as well as to an entire absence of sulphur and other impurities met with in all coals, and absorbed readily by iron when in a highly heated state.

A NEW DUMPING SCOW.

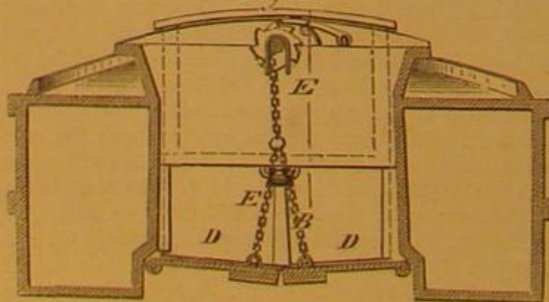
We illustrate herewith a new dumping scow, which is so constructed as to admit of the rapid and convenient discharge of the load into the water by the automatic action of gates and the sweep of the water through the scow. The vessel is built in two separate boat-like structures, laterally connected, between which is a large intermediate space for



ALLEN'S DUMPING SCOW.—Fig. 1.

material to be transported. This central space is divided into compartments that are closed at the bottom by hinged drop gates, D, which bear against the lower enlarged ends of pendent arms, B', when they are closed. Each gate is raised or lowered by means of suspension chains, E, at the ends, that

Fig. 2.



branch out from one common chain wound up on the ends of each top shaft, E', for each pocket. The shafts, E', turn in suitable bearings for winding up the chains by suitable crank or lever mechanisms, being retained by ratchets and pawls. The chains are alternately wound on the shafts in an opposite direction, so that, when the pawl of the first shaft

THE BAD LANDS OF WHITE RIVER.

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

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

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

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

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

waste, is reflected back to him from the white or colored walls, unmitigated by a breath of air, or the shelter of a solitary shrub.

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

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

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

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

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

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

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

The Steam Engine of the Future.

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



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

THE OLEO-MARGARIN INDUSTRY.

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

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

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

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

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

Dr. Mott, in the article which we published recently, presented a careful résumé of all the various patented processes bearing on this subject of artificial butter making; and he pointed out very clearly that the only successful means which has been discovered is that invented and patented by Hippolyte Mège. Mège, it appears, discovered first that, to produce from the fat the necessary granulated material, a low temperature of melting is necessary, while a high one is destructive; and secondly, he devised the method of converting oil into butter by churning it with milk. The corroborating investigations of Drs. Chandler, Adams, and

Mott leave little question but that Mège's discoveries bear as important a relation to artificial butter making as do the eye-pointed needle and feed motion to the sewing machine; and that, like the latter, it is hardly possible to produce the one any more than successfully to construct the other without the employment of these fundamental creations. Consequently, herein lies the cause of the failure of the various compounds which from time to time have been offered to the public, but which were not produced according to Mège's process. The record of Dr. Chandler's experiments shows a very extended investigation both into the past literature of the subject and into actual conditions in order to discover whether, by any other mode similar to that described by Mège, a like product could be obtained. The gist of Mège's idea is in these words: "My observation is that 125° Fah. is about as high as the heat can be raised safely in the melting kettles. Professor Chandler heated a sample to 150° Fah.; and although the resulting product was carefully subjected to the regular processes, it possessed a disagreeable and offensive odor, which could not be eradicated. Fat heated to 143° and 180° yielded similar results. A trial was made wherein the heat was raised to 230°, and this product was worse than any. In fact, Dr. Chandler concludes that the higher the temperature, the inferior the product; and so narrow is the dividing line that, while melting at 123° yields good results, melting at 130° produces altogether bad ones; while nowhere does it appear that Mège's process has been anticipated. Dr. Chandler also states that he finds oleo-margarin butter "to be a good and wholesome article of food, and equally as free from injurious effects as the butter made from cream." Professor Adams' experiments were made simultaneously with those of Professor Chandler, and his results and conclusions are substantially the same. In order to verify the conclusions of both of the above eminent chemists, and at the same time to reach some further details as to the conditions of investigations, etc., Dr. H. A. Mott has recently conducted a series of separate researches embodying four sets of experiments, in each of which from 400 lbs. to 500 lbs. of fat, prepared by washing, etc., were used. The results of his experiments are as follow.

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

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

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

CONSTITUENTS.	Artificial butter (Brown).	Artificial butter: average of 3 analyses (Mott).	Cream butter (Mott).	Same as last calculated to 5.25 per cent of salt.
Water	11.25	12.005	12.29	11.827
Butter solids	88.75	87.995	87.71	88.173
	100.00	100.000	100.00	100.000
Fats { Olein				
Palmitin	87.15	82.025	86.01	82.765
Stearin				
Butyrin, etc. }				
Casein	0.57	0.745	0.19	0.183
Salt	1.03	5.225	1.51	5.225
Coloring matter	trace	trace		
	88.75	87.995	87.71	88.173

Besides the use of oleo-margarin for the manufacture of artificial butter, it finds another extensive channel in the manufacture of cheese. The skimmed milk is placed in the usual cheese vat, and heated to 92° Fah., when the oleo-margarin, in a fluid condition, is added and stirred for from three to five minutes, or until an emulsion is formed, when

rennet is added, sufficient to cause coagulation in from 8 to 10 minutes, and thus the oil added is made to enter into the composition of the curd. The curd is then cut and worked in the usual manner. The Hon. X. A. Willard, Professor Caldwell, and others have stated that the cheese produced is very palatable, and makes a good, healthful article of food.

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

Preparing Cod Fish for Market.

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

A Wonderful Species of the Cotton Plant.

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

The Analogy of Sound and Light.

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

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

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

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

zontal vibrator. For lecture purposes artificial light is used, which is further reflected and magnified upon a screen. When musical sounds are produced by the vibrators, various luminous geometrical figures are formed on the horizontal speculum and reflected on the screen by the single or joint action of the vibrators described by the pencil of light; and the form and motion of such figures demonstrate the exact relations to each other of the musical notes produced. Sounds which harmonize to the ear produce regular figures to the eye, as, for example, segments of the circle, ellipses, ovals, circles, or straight lines; and if the amplitude of each vibrator be equal, these luminous figures will hover on the speculum or screen with an apparent steadiness like that of the heavenly bodies hovering in the sky. If the sounds do not harmonize, the figures are confused, unsteady, and complicated, presenting an appearance as if the wave lines were contending with each other. The mathematical relations of musical notes are also demonstrated, regular simple forms being produced by combination of those notes which result from vibrations bearing a definite numerical ratio to each other, while irregular and unsteady figures are caused by notes which have no such ratios. The pattern made on the screen by a discord is very bewildering to the eye.

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

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

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

A Japanese Cotton Mill.

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

Snake Charmers Humbugs.

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

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

Dr. Fayer states that certain descriptions of serpents—chiefly of the genus *naja*—most undoubtedly are suscep-

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

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

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

East Indian Jewellery.

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

A New Mode of Shipping Guns.

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

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SPLIT WHEEL.

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

IMPROVED WATER TUBE AND CIRCULATING STEAM BOILER.

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

IMPROVED ATTACHMENT FOR RAISING AND LOWERING RUDDERS.

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

IMPROVED WATER-PUMPING APPARATUS.

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

IMPROVED TURBINE WATER WHEELS.

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

IMPROVED TIRE-HEATING DEVICE.

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

IMPROVED SCREW PROPELLER.

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

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ARTIFICIAL FEATHER.

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

IMPROVED FLOWER FRAME.

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

IMPROVED HINGED SPLINT.

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

IMPROVED LABEL HOLDER.

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

IMPROVED DEVICE FOR MUSICAL INSTRUCTION.

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

IMPROVED RECORDER.

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

IMPROVED LINE FASTENER.

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

IMPROVED HYPODERMIC SYRINGE.

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

IMPROVED Mousing HOOK.

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

IMPROVED LINE FASTENER.

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

IMPROVED HARNESS SADDLE.

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

IMPROVED WATERING TROUGHS.

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

IMPROVED TOY PICTURE.

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

IMPROVED POCKETBOOK LOCK.

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

IMPROVED ANILINE DYE.

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

IMPROVED AUTOMATIC TOY.

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

IMPROVED HARNESS BUCKLE.

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

IMPROVED FOUNTAIN PEN.

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

IMPROVED SHOVEL.

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

IMPROVED MARKING BRUSH.

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

NEW AGRICULTURAL INVENTIONS.

IMPROVED HORSE HAY RAKE.

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

IMPROVED SULKY PLOW.

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

IMPROVED HARVESTER.

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

IMPROVED BEEHIVE.

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

IMPROVED PLOW.

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

IMPROVED RECIPROCATING CHURN.

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

IMPROVED CORN PLANTER.

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

IMPROVED FENCE POST.

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

IMPROVED GATE.

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

NEW HOUSEHOLD INVENTIONS.

IMPROVED PIANO STOOLS.

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

IMPROVED BIRDCAGE SCREEN.

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

IMPROVED COVER FOR SPRING BED BOTTOMS.

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

IMPROVED BURGLAR ALARM.

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

IMPROVED PETROLEUM STOVE.

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

IMPROVED LAMP WICK.

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

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED EXCURSION WAGON.

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

IMPROVED WHEEL FELLY.

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

IMPROVED GUIDE FOR SAWING MACHINES.

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

IMPROVED BLIND SLAT ADJUSTER.

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

IMPROVED MACHINE FOR SAWING AND BORING WOODEN BLOCKS.

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

IMPROVED SASH CORD FASTENER.

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

IMPROVED COMPOSITION FOR VENEERS.

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

Business and Personal.

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

Lieut. George H. Palmer, of the 16th U. S. Infantry, will please send his present address to the publishers of this paper.

For Sale—Singly or half, a number of U. S. Patents; also perfected, patentable inventions, big and little. Address J. B., 144 S. 16th St., Philadelphia, Pa.

For Sale—Baldwin No. 1 Foot Lathe, with Chucks, etc. Nearly new. Address Lock Box 133, Dallas, Tex.

\$3,000.—Wanted a partner with this amount in a Machine Shop, the inventory of which is estimated at least at \$5,000, for manufacture of patented articles. Address A. D., 303 Morris avenue, Newark, N. J.

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

For Sale—Half interest in Hoisting Apparatus for Saw Mills. Address John Rice, Chatham, N. B.

Tackle Blocks and Patent Iron Sheaves. Full line. Catalogues mailed free. Address Penfield Block Works, Lockport, N. Y.

Mountain Pen Holder—Wanted parties to manufacture, in quantities, the Pen Holder and Case. Address for particulars, Philip Goehring, Richwood, Union Co., Ohio.

Interest for Sale, or on Royalty—New Compound Engine, Marine, Locomotive, or Stationary; one cylinder; no dead center or back pressure; lighter, more compact, and more economical than any known engine, either in first cost or consumption of fuel. For particulars, address J. N. Petty, 8 Broad St., N. Y.

Wanted—Party to put about \$4,000 in manufacture of an article approved by the best mechanical engineers. Almost unlimited market and large profits. Address Box 320, New York city.

Wanted—Second-hand Re-sawing Machine, in good condition. Address, with full particulars, R. B. P., 48 Liberty St., Utica, N. Y.

For Sale—Rights to manufacture and sell in Western States, new patent Machine for Cutting Sides and Bottoms of Sheet Metal Vessels. Tinsmiths save one third by using it. Stiles & Green, Copenhagen, Lewis Co., N. Y.

Second-Hand Spoke Machinery for sale cheap. Address J. F. Ferrigno, Canandaigua, N. Y.

Second Edition.—A Book and Documents giving instructions for Selling Patent Rights; commended by Scientific American, vol. 29, page 377. We sell all kinds of blanks. Circulars free. S. S. Mann & Co., 132 Dolphin St., Baltimore, Md.

Send for James W. Queen & Co.'s Catalogue of Drawing Instruments and Materials; also catalogue of Microscopes, Field Glasses, Telescopes, and other optical instruments. 924 Chestnut St., Philadelphia, Pa.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 330 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y. Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 439 Grand St., N. Y.

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

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

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

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 173.

Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

Emery Grinders, Emery Wheels, Best and Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

D. Friable & Co. manufacture the Friction Pulley—Captain—best in the World. New Haven, Conn.

Notes & Queries

A. B. S. will find directions for making an molan harp on p. 330, vol. 26.—A. F. B. can copper iron wire by following the directions on p. 90, vol. 31. To silver it, use the preparation described on p. 290, vol. 31.—C. D. is informed that we do not know of the offer of a premium for a method of crystallizing maple syrup.—H. B. B. and many others should read our article on the horse power of an engine on p. 53, vol. 33.—E. T. will find directions for building a hen house on p. 139, vol. 36.—T. C. will find something on the formation of butter in the process of churning on p. 119, vol. 30.—T. F. M. will find a good recipe for ice cream on p. 251, vol. 28.—J. W. B. will find on p. 253, vol. 30, a recipe for paste for fastening paper to tin.—C. W. D. will find on p. 123, vol. 31, directions for bluing steel.—W. W.

does not give the length of his crank arm nor the speed at which the car is to run.—T. H. C. will find something on the use of zinc in boilers on p. 36, vol. 32.—E. E. P. will find directions for building a refrigerator on p. 251, vol. 31.—C. E. C. is informed that steel has been used for making boilers. As to flow of water through pipes, see p. 48, vol. 29.—H. L. C. will find directions for polishing shirt bosoms on p. 303, vol. 31. To clean kid gloves, see p. 283, vol. 30.—W. D. can use aquarium cement on his warden case. See p. 302, vol. 28.—A. B. will find a recipe for Babbitt metal on p. 123, vol. 28.—T. A. B. is right as to the size of the drill asked for by W. H. R. The 1/4 drill would be about 1/16 smaller than the 3/8 hole.—H. & W. will find a good recipe for a depilatory on p. 229, vol. 28.—W. S. F. will find directions for nickel plating on p. 174, vol. 30.—L. A. H. is informed that the lava gas tip is made by a patent process.—B. F. F. will find something about the Australian colonies of Great Britain on p. 161, vol. 30.—H. L. C. is informed that we do not recognize his coin from the impression he sends.—D. F. H. will find an answer to his query as to large and small wagon wheels on p. 91, vol. 36.—H. Y. D. will find directions for making hydrogen on p. 341, vol. 27.—B. H. W. can mount photographs by following the directions on p. 91, vol. 31.—J. W. B. will find a recipe for an aquarium cement on p. 302, vol. 28.—McC. will find a recipe for marlage on p. 302, vol. 31.—J. S. R. will find an article on American graphite on p. 55, vol. 25.—L. J. D. will find a recipe for a bright bronze on p. 51, vol. 33.—C. L. T. should read our articles, now in course of publication, on straightening metal plates.—O. S. is informed that we have no means of verifying the sea serpent story.—A. J. P. and R. W. C. will find a recipe for baking powder on p. 123, vol. 31.—E. J. will find a recipe for black enamel on iron on p. 308, vol. 26.—J. D. Jr. will find an answer to his query as an alloy that will expand on cooling on p. 138, vol. 36.—T. S. V. will find a recipe for cement for patching leather boots on p. 119, vol. 28.—J. H. W. will find a description of an incubator on p. 273, vol. 33.—C. R. will find a recipe for artificial marble on p. 57, vol. 28.—H. J. D. will find directions for French polishing furniture on p. 11, vol. 32.—J. M. T. will find a formula for safety valves on p. 363, vol. 29, and for horse power of engine on p. 33, vol. 33.—G. W. W. will find a recipe for a depilatory on p. 107, vol. 30.—C. B. W. will find directions for re-tinning tinware on p. 139, vol. 36.—J. McP.'s device is not a perpetual motion, as it depends on heat for its power. As to the flight of birds, he forgets that the atmosphere rotates as well as the earth.—W. B. will find something on the retina of the eye on p. 20, vol. 32.—C. H. S. will find directions for making artificial merschaum from potatoes, etc., on p. 307, vol. 34.—F. L. will find directions for coloring gold chains on p. 43, vol. 30.—H. J. D., S. H., J. F. L., T. M. F., J. H. N., W. B. B. L., E. E., R. S., P. W., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

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

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

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

(4) J. C. P. says: 1. I wish to build a tug boat for the purpose of towing barges laden with oyster shells. The barges are 30 feet long by 10 feet wide, and 3 1/2 feet deep, and will hold 7 or 10 tons of shells. What size should the steam tug be to tow such barges at the rate of 3 or 5 miles per hour? A. If you only mean to tow one barge at a time, an ordinary row boat, 18 to 20 feet long, fitted with engine and propeller will answer very well. 2. What are the constituents of oyster shell lime? A. An analysis of oyster shells by Schosberger shows that they consist of three layers, as follows: 1. Inner layer, the so-called mother-of-pearl. 2. Brown hard scales, forming the outer edges of the successive laminae of the outer shell. 3. A chalky layer, interposed between the laminae of the shell. The first of these contains: Carbonate of calcium 94.7, organic matter 2.2, other salts and loss 3.1. The second contains 89.1, 6.3, and 4.6, and the third 88.6, 4.1, 6.7 of these ingredients respectively. You should consult our advertising columns for addresses of dealers and manufacturers.

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

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

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

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

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

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

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

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

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

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

Of what size should master taps be? A friend says that they should be of the same size as working taps, while I hold that they should be 1/2 of an inch larger. A. Master taps for tapping dies should be from once to twice the depth of the thread larger than the bolt the die is intended to cut.

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

(14) J. J. asks: Will a well constructed condensing engine of 5 inches bore and 12 inches stroke, cutting off at 1/4 stroke, with a steam pressure of 100 lbs. (which would be 25 lbs. at end of stroke, and an average of about 57 lbs.), give as much power as a compound engine taking the same amount of steam? A. No. The compound engine would give most power.

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

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

strontium 8 parts, shellac 2 parts. Green No. 1: Chlorate of potash 9 parts, nitrate of barium 30 parts, lycopodium 3 parts, sugar of milk 2 parts. Green No. 2: Chlorate of potash 1 part, nitrate of barium 8 parts, shellac 2 parts.

(17) J. F. asks: Please tell me how I detect tellurium in ores, and in what minerals it is chiefly found? A. Metallic tellurium is a tin-white, brittle substance, with a metallic luster, and a specific gravity of 6.25. It is never found free in Nature, but usually in combination with either bismuth or gold and silver. With bismuth, it constitutes the mineral known as tetradymite, which has a steel-gray color and a high metallic luster. Tetradymite occurs in tubular crystals or foliated masses, which mark paper like black lead. Tellurium, in combination with gold and silver, forms the mineral sylvanite, of metallic luster and steel-gray color. When fused on charcoal it yields a light yellow, malleable globule, which contains 1 part telluride of silver and 2 parts telluride of gold. Metallic tellurium has, at present, no place in the arts, and finds a market only in the preparation of mineral and other scientific cabinets. Its price is quoted by dealers in rare metals at about \$8 per ounce or \$50 per pound.

(18) E. C. H. asks: 1. Is cast-steel suitable for laps and dies for steam pipes, and for other kinds of screw-cutting? A. Yes. 2. What is the shrinkage of cast-steel, and of malleable iron? A. It is very irregular, differing according to the size of the casting. 3. How much larger should the tap be for cutting open dies than the bolt that the dies are to be used on? A. About 1 1/4 times the depth of the thread larger.

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

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

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

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

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

(23) S. J. T. asks: What form of coupling is the most durable and best adapted to run the line shaft of a threshing machine cylinder, 700 or 800 revolutions per minute on an angle, say, of about 30°? A. Use an ordinary universal coupling.

(24) W. W. asks: 1. Please give me the philosophy of the expansion of steam in the cylinder of a steam engine. Why does a cylinder 7 feet long and 3 1/2 feet in diameter, other things being equal, give a power twice as great as a cylinder of half that length, although the surface of the pistons is the same? A. The power of an engine is the resultant of three data, pressure, distance, and time. If a piston has 1,000 lbs. pressure on it and moves 3 1/2 feet in 1 second, it has half the power of one that has 1,000 lbs. pressure and moves 7 feet in 1 second. 2. Is the pressure on the piston, after it has passed 6 feet from the starting end of the 7 feet cylinder, any greater than it was when it had reached a point 1 foot from that of starting? A. Yes, unless the steam is cut off before the end of the stroke. If the steam follows the piston full stroke, the power will increase in proportion to the length of the cylinder. If the steam supply is cut off before the piston reaches the end of the stroke, the steam will expand and lose pressure in proportion to the increased space it occupies.

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

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

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

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

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

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

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

(31) S. W. asks: What are the names of the elementary bodies discovered since 1800? A. The element gallium, discovered by Lecoq in 1875, is the only one.

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

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

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

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

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

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

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

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

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

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

No. of atmospheres.	Degrees of temperature Fahr.	Lbs. pressure per inch.
1	60	00
2	180	About 15
3	260	30
4	320	45
5	380	75
6	440	105
10	560	135

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

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

(43) H. H. asks: 1. Is steam visible in a boiler? A. No. 2. Does water boil in a boiler when there is a pressure of steam? A. There is no violent

ebullition unless the pressure is practically removed. 3. How large a boiler is required for a 40 horse engine? A. One capable of evaporating from 10 to 60 cubic feet of water per hour. 4. What size of steam pipe is required for a 20 horse engine? A. Make it about $\frac{1}{4}$ the diameter of cylinder.

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

(44) J. J. T. says: What is the cause of the knocking in a water pipe? I am running a 20 horse engine, and the pump is attached to the crosshead; the feed to it is $\frac{3}{4}$ inch lead pipe with an air chamber on it; the discharge pipe to the boiler is 1 inch, with an air chamber. When pumping, the feed pipes make a fearful noise, as though some one were hammering it. A. The area of the suction pipe or suction valve is probably too small, causing the valve to have too much lift; and its violent closure causes the noise.

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

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

COMMUNICATIONS RECEIVED.

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

On a Geographical Question. By P. G.
On the Distances of the Stars. By W. W.
On Shipping Nitro-Glycerin. By C. L. K.
On a New Car Coupling. By the O'K. McK.
On Civilization. By T. R. V.
On the World's Age. By A. F.
Also inquiries and answers from the following:
J. C.—W. A. M.—Y. S.—J. M. P.—N. S.—J. B. H.—O. O.—F. Z.—J. H. G.—A. B.—T. W. P.—H. A. H.—H. C. H.—A. G.—R. T. G.

HINTS TO CORRESPONDENTS.

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

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

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

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH
Letters Patent of the United States were
Granted in the Week Ending
February 6, 1877,
AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Adding pencil, C. C. Fields.....	187,114
Advertising, B. S. Howard.....	187,139
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Animal bones, etc., treating, Carles & Koehler.....	186,924
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Book support, W. S. Barnard.....	186,974
Boot and shoe, H. Samson.....	186,988
Boot uppers, uniting, D. W. Thompson.....	187,197
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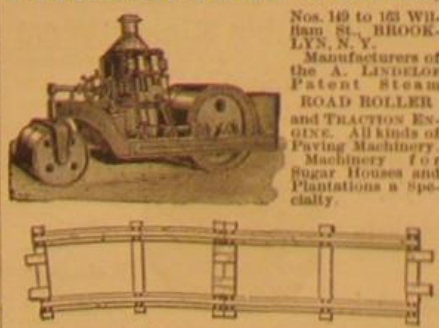
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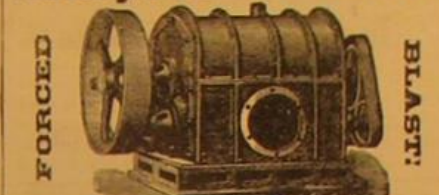
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PNEUMATIC TRANSMISSION.

FROM "ELECTRICITY AND THE ELECTRIC TELEGRAPH," BY
GEORGE B. PRESCOTT.

The transmission of messages between the branch and central stations in the large cities, by means of pneumatic tubes, constitutes an important and valuable feature of the modern telegraphic establishment.

Messages are sent from the Central office of the Western Union Telegraph Company, New York city, by compressed air, and to the Central office by exhaust air, the engine, pumps, and valves being at the Central office. In our large illustration, Fig. 1, is represented the receiving and sending station in the operating room of the above named company's building. The tubes on the right are those in which messages are dispatched; from those on the left messages are received. The mode in which the messages are prepared for transmission is described in detail further on. It will suffice to say here that the paper is folded and inserted in a felt-covered case. A valve is opened and the latter inserted in the lower end of one of the tubes. The valve is then shut, and in thirty-two seconds the case travels through about 2,100 feet of tube and arrives at the Broad street station, the fact being announced by the sounding of an electric bell at the sender's table. To make the journey through the 3,308 feet of tube, between the Central office and the Cotton Exchange, occupies about 55 seconds: the compressed air which empties the case being under a pressure of about 9 lbs. Although by using greater pressures a higher velocity is easily attainable, the above is found to answer practical requirements best. To draw cases from the stations to the Central office a vacuum of some 12 inches is employed. The number of messages transmitted daily between the hours of 8 A.M. and 5:30 P.M. averages, we are informed, from two to three thousand. The arrangement of the apparatus is as follows: To the pumps are attached two large mains, one for pressure and the other for vacuum. These mains are carried from the engine room to the operating room, where the pneumatic tubes are situated, and are of such dimensions as to obviate the effect of the intermittent action of the air pumps. The valves are of two kinds, single and double sluice, and are so arranged that they can be employed for exclusively forwarding messages by compressed air, exclusively receiving messages by exhausting

air, and for alternate forwarding and receiving through a single tube. The arrangement of the single sluice valves is shown in Figs. 2 and 3, on page 178. T is the tube which forms the prolongation of the underground conductor.

To receive a carrier at the Central office the lower end of this tube is closed by raising the hinge valve, C (which has a rubber packing); the stopcock, V, is then turned, which establishes a communication, through T and S, with the vacuum main. A vacuum is produced in T, and the valve is kept closed by atmospheric pressure. The carrier, on arri-

the roller, j, thus opening a valve within the cylinder, L, and establishing communication between the reservoir of compressed air and the tubes, M and T. The carrier is there forced forward in the tube, and whenever its arrival is announced by the electric bell, the slide is pushed back to its normal position.

If the rod, f, were connected rigidly with the crossbar, d, a certain effort would be required to push back the slider, owing to the friction due to the pressure on the surface of the obturator. This effect is avoided by making the rod, f, slide in the crossbar between the limits, b and l, for, in pushing it back, the inclined plane first leaves the roller, j, and the compressed air ceases to enter the tube; then the crossbar meets the ring, l, and the rod, f, removes the obturator without difficulty.

The greater portion of the parts which form the valves are made of brass. They are attached to strong boards, the one in a vertical and the other in a horizontal position. The latter forms the table, and receives the carriers to be sent, and those which are received from the corresponding offices.

The accompanying diagrams show, Fig. 4 a back view, Fig. 5 a section, and Fig. 6 a top view of the double sluice pneumatic valve. The following is a description of the method of using it and of its action: To send a carrier by the forwarding or outward tube, the mode of working is as follows: The carrier containing the message is inserted up the mouth of the pneumatic valve, P, Fig. 5, into the message chamber, M, until its buffer is held by the contraction at C, which is the true diameter of the message tube. (The illustrations show the valve in its normal position.) The handle, H, is then drawn forward, carrying with



PNEUMATIC TRANSMISSION IN NEW YORK CITY.

val, forces it open, but, as the shock which the carrier receives upon its arrival destroys its momentum, it is drawn up by atmospheric pressure and suspended against the opening, O, of tube, S. As soon as valve, C, falls, the operator shuts the stopcock, V, and the carrier, being no longer held by the outside pressure, falls out of the tube, T, by its own weight. To send a carrier from the Central office, it is placed in the tube, T, Fig. 3, and the operator, by means of the handle bar, m, pulls the sliding apparatus, formed by the rods, g, and the crossbar, d, which latter meets the ring, b, fixed on the rod, f, and carries this with it. The obturator, K, fixed to the end of f, is thus made to close the extremity of the tube, T. When this closure is complete, the inclined plane, h, fixed on one of the rods, g, meets and pushes back

it the sluice valve, S, until the mouth of the message pipe, P, is closed. By this time the stop, S', strikes against the tail of the quadrant, Q, pressing it into the slot, z, of the steel slide bar, B; and by the continuation of the motion necessary to bring the sluice valve, S, to the end of the sluice box, b, bringing with it the tail of the quadrant, which is centered at O, gives an opposite motion to its other extremity, which, fitting into the rack, R, opens the top sluice, T. During this motion an inclined plane, l, Fig. 6, which is fixed upon one of the side rods carrying the lower sluice, passes between the fixed roller, F, and the roller fitted upon the pressure valve, V, establishing communication between the pressure main and the message pipe; the air thus admit-

[Continued on page 178.]

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The Art of Moulding. By E. W. ANDERSON.
Notes on Hydraulic and other Cements at the Centennial. By Gen. Q. A. GILMORE, U. S. A. A valuable paper, showing the best methods of making Portland Cement now practised. Best methods of making and using Concretes. Descriptions of the Manufacture of other cements. Catalogue of the Portland, Roman, Selenitic, and Paris Cements exhibited at the Centennial, with table of the Strengths of the various exhibits, as deduced from actual trials.
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IV. MEDICINE, HYGIENE, ETC.—A Graphic Study of Brain Motion.—Congestion of Fibrous Tissue for Ringworm.—On the Poisonous Properties of Yew Leaves.—How to Prepare Raw Meat.—Color in Oysters.—Nature of Protoplasm.
V. ASTRONOMY, METEOROLOGY, ETC.—The New Star in Cygnus.—Position of the Equinox.—Spectrum of a Lyre.

SELECTION APPLIED TO MAN.

The population of our globe is now about fifteen hundred millions, or about an average of thirty to the square mile of land surface. With proper cultivation of both land and water, and the largest possible reclamation of waste and desert land by irrigation and otherwise, the earth is capable of supporting perhaps ten times as many people: probably not more, as that would require every inch of dry land to be as densely populated as China now is, and a very considerable portion of the earth's land surface is and must ever remain practically uninhabitable.

Assuming such an increase of the world's population to be possible, the question naturally arises: When is the limit likely to be reached—and what then? The contingency may seem at first sight to be very remote, but in reality it is not, provided human progress continues at the present rate. The dominant race of to-day is that which is fairly represented by the people of England. The influences of modern civilization have been felt on that island as manifestly as anywhere; and we shall not go far wrong if we estimate the progress of the immediate future by the ratio of the immediate past. The population of England at the beginning of the present century was, in round numbers, a little under 9,000,000. It is now not far from 24,000,000. With the same rate of increase for seven generations more, the English people will equal in number the present population of the entire globe! At the end of the fifteenth generation the descendants of the English people, if they continue to increase at their present rate, will number (if statistics and mathematics tell no lies) fifteen times as many as the world now supports, and fifty per cent more than we have set as the limit of the earth's possible population. Inasmuch as the English are not the only people that are rapidly increasing in numbers, it is clear that the struggle for existence among the tribes of humanity is likely to be rapidly and seriously intensified.

Thanks to the advancement of knowledge, scientific and sanitary, the physical conditions of life are becoming more and more favorable; the average duration of human life is increasing, and the plagues and fevers that formerly scourged the world and kept the population low are being brought under control, if not entirely stamped out. The tendency of civilization is toward arbitration instead of war, and so that means of keeping down the number of the human swarms is likely to be lessened rather than increased; and the same may be said of the increasing abolition of personal strife and individual murder. The means so frequently resorted to by crowded peoples heretofore to keep the natural increase within bounds—the general destructions of infants—grows more and more abhorrent to human instincts, and is not likely to be revived: certainly not by people of the higher types that are destined to inherit the earth. The multiplication of facilities for transporting food, incident to modern civilization, with its improved agriculture, combine to make the famines once so frequent and destructive of life more and more rare, more and more impossible. The great scourges of humanity—pestilence, famine, war, and murder, domestic and social—are thus clearly on the wane; and as no substitution for them can be foreseen, there is no reason to infer that the present rapid increase in the earth's population is likely to be stayed by natural means. Such being the case, the earth's sustaining capacity will be reached before the race is many centuries older.

What then? Will the fittest survive? If natural selection were the law with man as with brute nature, that would most probably be the result; but it is not. That is, not wholly. Under the influence of charity and other religious sentiments, it is usually the weakest, often the worst, that is most favored in the struggle for existence. The burdens of social and political life fall chiefly upon the worthy, who have to support not only themselves and their own offspring, but the idle and the vicious and their multitudinous spawn. The artificial selection which religions, governments, and societies chiefly foster tells steadily against the best. The sense of responsibility which the struggle for existence creates in the minds of the thoughtful tends in the same direction, in putting a check upon the natural increase of the higher orders of humanity; while the heedless animalism of the unthinking and the vicious, on the contrary, leaves them free to multiply without stint, and the superior life-power of the higher is no match in the long run for the unrestricted fertility of the lower. Our civilization, like all those which have preceded it, thus carries in itself the elements of its own ultimate destruction: or, at the least, elements which make its overthrow possible at any moment, by causing the lower grades of culture to preponderate in numbers and political power. This, of course, on condition that human societies continue through future ages to be regulated by the social laws which now prevail: a condition which, we are happy to believe, must sooner or later cease to hold. The danger is too serious, and the enlightening influence of Science too persuasive. Already there is a growing disposition on the part of intelligent lovers of humanity to break away from the unscientific customs that have come down to us from barbaric ancestors; and the instinct of race-preservation will compel a radical change in many of them, particularly those which determine our treatment of the physically and morally tainted. Preventive measures are rising more and more above those that are palliative and remedial; charity is becoming broader and more far seeing; the rights of future generations begin to weigh against the privileges of the present; and there is infinite promise of good in the change.

It would be sheer presumption and foolishness to predict

specifically the issues of conditions so complicated as those of existing humanity; but having in view the intensifying struggle for existence in store for future generations, and knowing the immense advantage which a pure and high race must always have over lower races, it is safe enough to predict that the ultimate lominion of the world will rest with that people, whether black, yellow, or white, which will so shape its political and social system as to rigidly favor the perpetuation of its best—which will studiously eliminate every serious moral or physical taint from its life-stem. As all cannot survive, it is becoming more and more the duty of humanity to elect wisely which shall survive, the good or the bad: or more correctly, perhaps, whether the chances of any unborn generation are in favor of physical and moral health, or the contrary. To favor the former does not imply or necessitate the destruction of any life; but it does necessitate such an interference with individual liberty as shall restrain the vicious and the diseased from being over-represented in generations to be; and the time may come when it will be vitally necessary to prevent such debasing elements from being represented at all. At any rate, it is clear that, whatever high-grade people first rises to the moral level of applying a proper system of artificial selection to humanity, and steadily purifies its stock by eliminating vitiating strains, criminal or otherwise, that people will lead the world in civilization and power. It will do more: it will retain that leadership, and develop a type of humanity which will endure and improve as long as the earth remains habitable. All others contain the seeds of their own destruction.

EXPLOSION OF KEROSENE LAMPS.

A correspondent writes as follows:

"A few evenings ago, a lamp burning in my kitchen suddenly went to pieces; the oil at once blazed up and ran off the table in a burning stream, setting fire to the floor. The oil blazed up two or three feet high, and but for prompt attention the results would have been serious. The lamp was of glass, of the flat form, said to be the best; the oil vessel would hold half or three quarters of a pint; the wick was long enough to reach the bottom. The flame was turned rather low, but by no means as low as possible, and the lamp had been burning the greater part of two evenings since it had been filled, so that it could not have been too full. It was not exposed to a draft and could not have been upset or shaken; no one had been in the room for at least half an hour previously. The oil was claimed to be able to stand 150° fire test; and immediately after the accident some of the oil was tried with a lighted match, but it would not burn. The explosion did not throw any pieces of the lamp more than a few inches, and the oil was not scattered at all; the noise was so slight that, when heard in an adjoining room, it was supposed that the chimney had broken and fallen off. Question 1. Why did the oil that ran from the lamp burn as freely as turpentine, while the oil poured from the can would not burn at all? 2. Is any kind of kerosene oil safe, and (3) if so, how can the consumer test it?"

As this subject involves the protection of life and property, and as similar instances have lately become common, we think it of primary importance that the causes of such accidents should be well known, and that some prevailing errors should be corrected, as they lead to precisely such catastrophes as the one in question. But our correspondent was more fortunate than one acquaintance of ours, who, coming home late in the evening, found his house entirely burnt down, the only possible cause being that a servant had left a kerosene lamp, partially burnt out, alight in her room, and as the flame burned down an explosion doubtless followed, spread the oil, and set the house in flames.

Our correspondent's accident illustrates the following popular errors: 1. He states that the lamp was of the flat kind, said to be the best. Some of the flat lamps have the flame so near to the body of the lamp that the containing vessel and the oil become warm; then the latter easily reaches the temperature of the flashing point, 110, 120, or more degrees. This shows that flat lamps are not by any means the safest.

2. He also says: "The lamp had been burning the greater part of two evenings since it had been filled, and so could not have been too full." A full lamp cannot explode; explosion is caused by the space in the lamp over the oil, which, when filled with air mixed with vapor of the oil, forms an explosive mixture. A barrel full of petroleum can take fire, but will never explode. Not long ago, we had an illustration in New York of the dangers of empty petroleum barrels: A man struck a match, in order to light a pipe, upon an old petroleum barrel, and it exploded at once, nearly killing him. The barrel was filled with a mixture of petroleum vapor and atmospheric air, which happened to be in the proportion necessary to make an explosive mixture, namely, 1 volume of vapor to about 10 volumes of air. In fact, the addition of 10 per cent of petroleum vapor to common air makes a most dangerous mixture. It is, therefore, an error to suppose that a lamp can be too full; and we advise house-keepers to fill them, and never let them burn out, and to avoid as much as possible any empty space over the oil.

3. It is a popular mistake to test the oil at the common temperature. Only benzine and naphtha will take fire under these circumstances; but if the kerosene is adulterated with the latter, the mixture may be ignited also. Good kerosene, when cold, will burn only with a wick; but if we warm it, the vapor will first flash on nearing a flame; if we warm it more, the oil itself will take fire.

We should, therefore, warm the oil when we test it: the simplest way is to pour some in a tablespoon and keep it in contact with the surface of hot water, of which the temperature can be found with a common thermometer; if the oil is claimed to stand the fire test of 150°, it ought not to burn before being heated to that degree. We published an illustra-

tion of a simple method of testing kerosene on page 403 of our volume XXXIV.

It will thus be seen that our correspondent's lamp exploded because it had burned for a long time since filled, leaving a space over the oil, which filled with its vapor as the lamp, being of the flat kind, became warm. When the flame was turned down, the lamp cooled a little, the vapor contracted, and in its contraction drew in air, until enough of it had entered the space above the oil to form the explosive mixture above referred to. This mixture was set on fire by the flame; and, of course, the lamp was broken by the explosion. The kerosene left in the flat lamp became heated by the flame, being much nearer to it than it would have been in a lamp of a taller or more nearly globular form, and of course was therefore ready to burn, while the cool kerosene in the can was not. The pieces of glass were not scattered much and the explosion made little noise, because either there was not a very large space filled with the explosive mixture, or the explosion took place as soon as the mixture became inflammable, and before enough air had been drawn in to give the mixture the most effective proportion.

We believe that these remarks solve the difficulties which many readers have encountered; and we will close this article with a few words of advice. 1. Do not buy lamps in which the flame is too near the body of the lamp. Kerosene can ascend in a long wick; and short wicks only tend to heat lamps and oil, and to encourage accidents. 2. Use the cylindrical wicks, with the draught in the middle; and use a long burner, which brings the flame to a distance of at least three inches from the body of the lamp. The form of the brass student's lamp is a very safe one, as in this the oil reservoir is at a long distance from the flame. 3. Be always prepared to test the oil you buy, as already described. You can heat the water to boiling point, and then mix it with cold water until it shows 150°, or any other desired temperature. If people would take the trouble to apply this simple test occasionally, they would largely diminish the number of accidents. 4. Keep the lamp full of oil, and never let the kerosene burn away much, and so avoid the dangerous empty space above the oil, especially when the lamp is flat and the flame not far above it. 5. Never turn a kerosene lamp low; rather extinguish it, as, besides the possible danger already described, there is the nuisance of an unpleasant and unwholesome smell given off when the wick is turned lower than it is intended to be used. The cause of this is imperfect combustion, and the consequent evolution of injurious gases.

A LESSON IN ARCTIC NAVIGATION.

For a number of years an enterprising Canadian, Mr. E. W. Sewell, of Levis, has maintained the possibility of safely and profitably navigating the ice-bound waters of the St. Lawrence river and gulf in winter, thus practically overcoming the hitherto unbroken blockade of Canadian ports during half of each year. After long and strenuous efforts, he succeeded last year in persuading the Dominion Parliament to subsidize a line of mail steamers for winter service, and proceeded to build and equip a vessel for the arduous work. The steamer was completed, and her first trip successfully made about the middle of January, between Pictou, Nova Scotia, and Georgetown, Prince Edward's Island, a distance of about fifty miles.

The "Northern Light," as the pioneer navigator of Canadian ice floes has been named, is a small but powerful propeller of 400 tons register, 145 feet in length, and 25 feet beam. She is driven by a pair of compound engines of 700 horse power, and is immensely strong, her horse power per foot of displacement being greater, it is said, than that of any other vessel of the kind. Her screw is twelve feet in diameter, 19½ feet pitch, and well submerged, it being intended, as a protection against ice, that at least four feet of water shall in all cases cover the upper blades. Her draught varies from eight forward to sixteen feet aft, to enable her to ride upon and break down the ice floes as well as crush them by her momentum. Very little iron was used in her construction, except a plating 4½ inches thick for fourteen feet abaft her stern, a 2½ inch plating on her keel for part of its length, and a massive rudder of solid wrought iron. The rest is sheathed with 2½ inches of ironwood.

The first trip of the Northern Light demonstrated her ability to overcome the heavy ice floes of Northumberland Strait, and to make good progress through continuous fields of unbroken ice nearly a foot thick. The only accident occurred in a narrow channel near Pictou Island, crowded with heavy floes: in charging an unusually heavy mass of ice the iron cutwater was torn from its bolts by the shock, but no other damage was done. A correspondent of the *Tribune* reports the incidents of the first trip at considerable length, and is naturally exultant at her success:

"We had done what no man has done before. We had sailed in midwinter across the Strait of Northumberland, and shown that with proper appliances men may defy the ice blockade which for nearly two centuries has shut out Prince Edward's Island from traffic with the outer world. And if the narrow strait can be crossed, it follows that the wider waters of the Gulf can be more easily penetrated to ports like Gaspé, Richibucto, and Miramichi. With these connected with Halifax, Cape Breton, or Newfoundland, by a line of powerful ironclad steamers, the present water isolation of Canada will be exchanged for an uninterrupted and profitable, although limited, winter commerce. Who can say that Louisbourg's deserted harbor, or Placentia's squalid haven, may not yet become of renewed importance as the depot of the winter exports of the Dominion?"

Mr. Sewell's scheme involves the winter navigation of the St. Lawrence river, below Quebec, as well as the Gulf: the beginning being made in Northumberland Strait, not because its navigation is easier than elsewhere, for that route is really the most difficult of all, but because of an agreement made when Prince Edward's Island joined the Canadian Confederacy, that strenuous efforts should be made for the winter navigation of that channel.

LIGHT AND THE DISTANCES OF THE STARS.

A correspondent writes as follows:

"One of the New York daily papers gives an account of a recent lecture delivered by a Professor Grant on astronomy, in Great Britain, and reports him to have said that some stars are so distant from the earth that light, traveling at the rate of 185,000 miles a second, would take half a million of years to reach us, and that consequently we would observe now what had transpired on such stars half a million years ago. Is not this last statement entirely erroneous? Does not the eye travel almost instantaneously along the line of direction of any object within the range of either unassisted human or telescopic vision, and do we not accordingly see what is transpiring now at any point within such range? Please state whether this view or that imputed to Professor Grant is correct."

To point out the error in our correspondent's reasoning, we have only to apply it to the propagation of sound and to the ear; and then we may ask, almost in the same words: "Does not the ear travel almost instantaneously along the line of direction of any sounding object within the range of either unassisted or assisted human hearing, and do we not accordingly hear what is transpiring now at any given point within such range?" We may ask this with good reason, because the nature of the propagation of light and sound are identical, the eye being the organ for the perception of the first, the ear that for the perception of the second. Now the fact is that the eye (or the sight) travels as little toward the luminous object as the ear (or the hearing) travels toward the sounding object; both organs merely receive impressions from the luminous or sonorous rays. It is perfectly well established that we see astronomical events later than they occur, and it was this fact which taught us that light moves with a velocity of 185,000 miles per second. The eclipses of the moons of Jupiter revealed to Roemer, the celebrated German astronomer, this fact; he found an irregularity which no astronomical data could account for, and he observed that the periods between these eclipses were longer when the distance between us and the planet was increasing, while, inversely, the periods became shorter when this distance was diminishing. He found at last, by close observation, that every time that the planet was, say 100,000,000 miles further off, we see that eclipses happen 9 minutes later than they do when the planet is at its nearest distance. As 9 minutes is 540 seconds, we have only to divide 540 into 100,000,000 to find the velocity of light per second, which is very nearly 185,000 miles. This has been verified afterward in various other ways; the velocity of light has been directly measured (by the help of most ingenious and delicate apparatus) by Foucault and Fresnel; while the aberration of the fixed stars, which consists in an apparent displacement of the same, produced by the yearly motion of the earth in its orbit, fully corroborates the scientific theory. It is, therefore, a positive fact that we see the stars as they were at the time when the light which reaches us now left them; and we see the sun as he was 8 minutes ago, the nearest fixed star as it was 3½ years ago, and the pole star as it was 36 years ago. Of the other stars, very few are near enough for us to measure their distances; but most of them are thousands of times further off, and therefore we see them as they were thousands of years ago; and when the telescope reveals, in the depths of infinite space, stars thousands of thousand times further off still, we are convinced that, as their light can only reach us in millions of years, we see them as they were millions of years ago. Perhaps at that remote period, in those unfathomable distances, blazing suns have been created of which the light has not yet reached us, and inversely those may have become extinct of which the light reaches us now: in the same way as when the sound of a gun, exploding at a great distance, reaches us, the real explosion is a thing of the past, and may have taken place 50, 60, or more seconds before, according to the distance.

THE NEW ENGLISH PATENT BILL.

For the third time, a bill providing for material alterations in the English patent system has been brought before Parliament. In 1875 and 1876, one was introduced by the Lord Chancellor in the House of Lords; at present the bill is under the sponsorship of the Attorney General, and makes its appearance in the House of Commons. The chief feature of the new law is the abolition of the present system of granting protection, and substituting therefor a system of examination similar to that practised in the United States. That gigantic appendage of wax, with its elaborate attachment and tin box, known as the Great Seal, is to disappear; and in lieu thereof the patent will be sealed with a simple stamp. The lifetime of a patent is to be twenty-one years; but unless the patentee obtains a certificate of renewal before the end of the third, seventh, and twelfth years respectively, the patent will cease at the end of any one of these periods.

One good thing at least is proposed in this bill, and that is the reduction of the expense of an application to one half the present cost. The scale of taxes is to remain the same as under the previous law: namely, before the end of three years, \$250; before the expiration of seven years, \$500; with a further \$500 before the end of twelve years, thus extending

the full term of a patent to twenty-one years, being seven years more than are now allowed for the full term of a patent. The Lord Chancellor is empowered, under the new bill, to grant a longer time for the payment of these taxes in cases where patents have been accidentally allowed to lapse.

Among the other more important provisions is one giving the Crown unlimited powers to use any invention at a price to be decided by agreement of the parties; or where there is no agreement, the "Treasury or some other tribunal" is charged with arbitration. The objectionable feature of compulsory licensing is introduced in one clause, and in another patentee risks the revocation of his patent if within the three years he fails to use or put the invention in practice in Great Britain. If the patentee does not see fit to grant licenses, the Lord Chancellor has the right to do so. This is an interference with the right of every man to his own property, for which it is difficult to see any justification. Lastly, the old system of granting patents to the importers of foreign inventions is to be abolished; but the bill does not propose to prevent foreign inventors from securing patents on the same conditions as British subjects, provided the inventions have not been patented abroad or introduced into the realm for more than six months. The granting of amended or supplementary patents—similar to the French *brevets d'addition*—is provided for.

The above are the outlines of the bill which is now under discussion, and of which the British Government are using every endeavor to secure the passage. Our English contemporaries, in very lengthy discussions of the subject, think that, before it becomes law, several of its provisions will meet with material modification.

In the early days of our Patent Office, say from 1836 to 1850, but few applications for patents were made in a year, and as a consequence the range of cases available to the examiner for purposes of reference was obviously much smaller than it is now. But since the aggregate of American patents has reached nearly 200,000, while thousands have been granted abroad—for nearly every country on the globe now has its patent laws—it has manifestly become impossible for thorough searches to be made, and hence it is almost useless to employ an examining force to decide whether or not a patent should be granted. After thirty years' experience in soliciting patents, not only in this country but all over the world, we think we have had superior opportunities for observing the working of the various patent systems; and as a result, our opinion is that the existing English system of issuing patents presents the fewest objectionable features. To abandon that system in favor of a plan of official examination, similar to the necessarily imperfect one which exists in this country, would be a blunder.

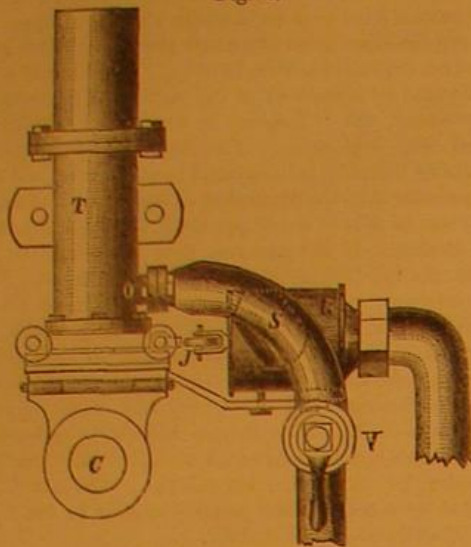
The *London Engineer*, reviewing the new bill, says:

"It is somewhat unfortunate that the existence of the system in the United States should be cited as an argument in favor of its adoption here, because it is a matter of common notoriety among those who have taken the trouble to inquire that the fact of a preliminary examination being required is in truth not an obstacle to the re-patenting of old inventions; and the further fact, which we have already pointed out, that during the years 1872, 1873, and 1874, from 212 patent actions reported in the United States, there resulted the destruction of no less than fifty-three patents on the ground of want of novelty, is very significant. Moreover, the American technical press has constantly complained of the serious defects of the system followed by their Patent Office, a system which, it should be borne in mind, has been in process of elaboration ever since the year 1836, a period which may be regarded as almost coincident with the history of invention in that country. There is, however, to our mind, a vital objection to any system of preliminary examination. It is an objection which no refinement of practice can remove, because nothing short of infallible wisdom or omniscience in the examiners would neutralize it. We allude to the possibility of the destruction of an invention almost in its inception, in consequence of the difficulty or impossibility of inducing an examiner, or the Court, to perceive in it the one, perhaps delicate, distinction between it and something that has gone before—a distinction which may be the means of building a great success upon the ruins of many previous failures. This is not a novel objection, but it cannot be too strongly urged. To take an example: In his able paper on the expediency of a patent law, Mr. Bramwell alluded to Watt's invention of the separate condenser. If we imagine to ourselves a reference of Watt's application to an examiner, fully informed for the period at which the invention was made, is it not more than conceivable that the examiner would have pronounced against Watt on the score of novelty? His engine resembled other engines, but he separated his condenser from his cylinder, a change which in all probability the examiner would have said was a mere detail introduced for the purpose of setting up a claim to invention. Again, we have a still more striking illustration in the case of the regenerative furnace, a patent for which was refused to Mr. Siemens* simply because, in an old house belonging to an order of medieval knights, it had been found that the hall was warmed by means of air drawn through heated stones. The actual apparatus, we believe, consisted of two chambers under the floor filled with stones. Each was alternately heated by a furnace and alternately cooled by a current of air, which, after it had abstracted heat from the stones, was turned into the building. No other such apparatus had been known to exist, but the authorities found it out and judged Mr. Siemens' stove to be an old invention. Fortunately, the doors of the English Patent Office were open to him, and we know the result. How often do we find that the novelty of an invention is only determinable after prolonged and costly litigation—litigation which is generally in proportion to the value of the patent? It should be remembered that the law is satisfied with the barest amount of novelty; and if that little is often so difficult to discover, it is fair to ask what the examiners will do for us, and what estimate we may make of the costs of an elaborate argument on appeal from them."

* The rejection of Dr. Siemens' application here referred to was made, we believe, by Prussia, which is almost the only country besides our own which maintains an examining bureau to decide on the novelty and utility of inventions.

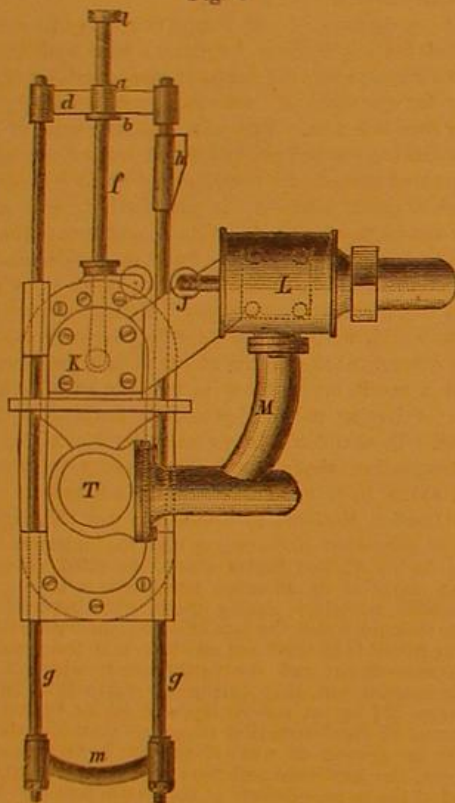
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ted immediately acts upon the lower part of the carrier (which portion it expands, so as to make it fit the pipe with

Fig. 2.



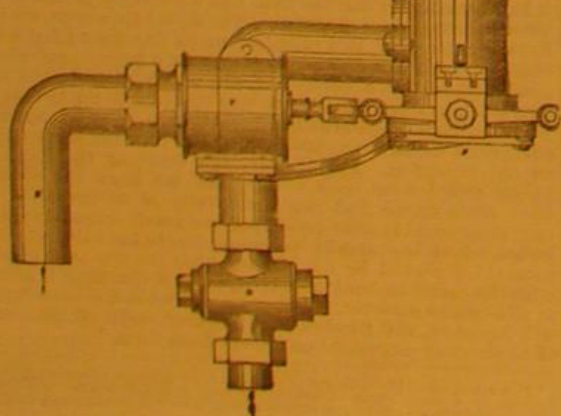
as little friction as possible) and forces it onward to its destination. If it be necessary to send a second carrier while the first is in transit (a process which is undesirable), the

Fig. 3.



handle, H, Fig. 5, is pushed back to its normal position, thus producing a reverse motion of the valves by closing the upper part of the tube before the lower part is opened, and preventing any discharge from the message tube. The second carrier is then inserted and the handle pulled forward as previously explained, again opening communication with the compressed air in the main. The time necessary for this operation being about four seconds, it can be easily understood that in the length of pipe the momentary cutting off the pressure is hardly felt, so that the speed of the first carrier is not necessarily lessened. It must be understood that the cock, D, Fig. 4, is always closed. The foregoing description applies to a pneumatic tube used entirely for forwarding carriers by means of compressed air.

For receiving carriers, the com-



munication between the pressure main and the pressure valve, V, is first cut off by means of a stop-cock fitted upon the tube, E, but lower than is shown in the diagram. The handle, H, is then drawn forward, and the stop-cock, D, opened, thereby establishing communication between the message pipe and the vacuum main. The carrier inserted at the distant end is then pushed forward by atmospheric pressure, until it arrives in the message box, M, and signals its arrival by the sharp noise caused by its striking the sluice valve, S. The handle, H, is then pushed back, the stopcock, D, having been previously closed; and, by the arrangement already described, the message pipe is closed by means of the sluice valve, T, Fig. 4, and the bottom of the tube being open the carrier falls out of the message chamber, M. It will be remembered that before the admission of compressed air the forwarded carriers are held at C. The buffers of the received carriers, however, having passed this point, the carriers rest free in the chamber, M, and drop out.

When the tube is used for a constant succession of carriers from the out station, it is necessary to pull forward the handle, H, immediately after the taking out of any carrier. The short space of time occupied in this operation will not have any appreciable effect upon lessening the speed of the succeeding carrier. It will be seen, therefore, that a number of carriers may be continuously passing in succession through the tube. It is, however, undesirable to permit more than one carrier to be in transit at the same time. Where the traffic is not sufficient to warrant the expense of an up and down tube, one tube only is worked in both directions in the following manner: The top

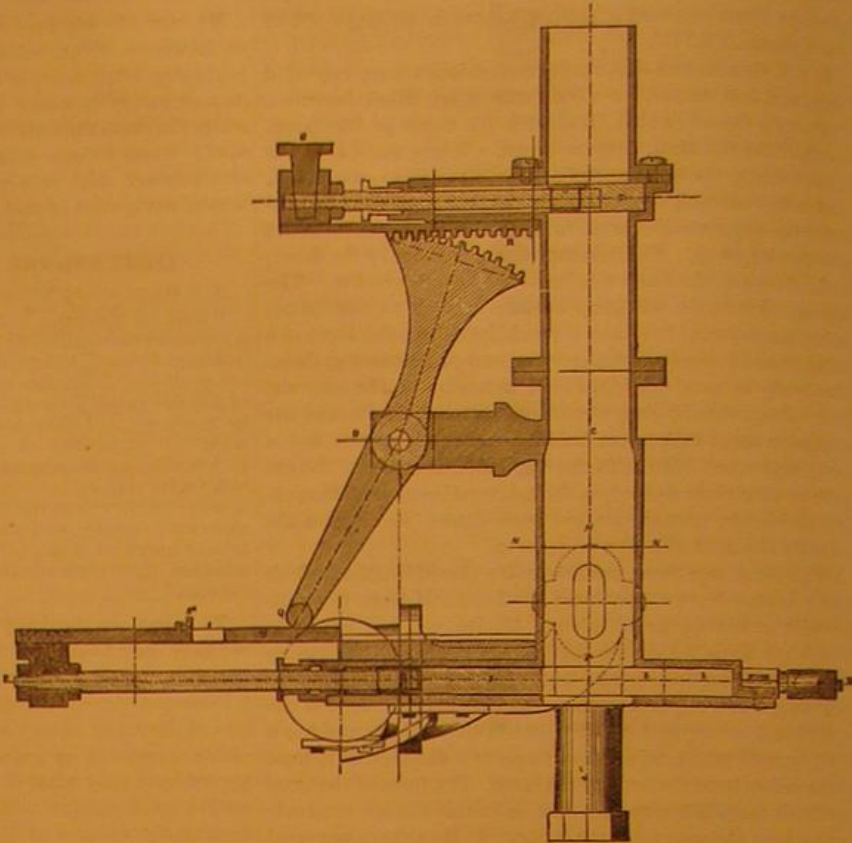


Fig. 5.—THE PNEUMATIC VALVE.

as previously described, and the handle, H, drawn forward. The sluice valve, S, first closes the orifice, P, after which the continuation of the motion opens the pressure valve, by means of the inclined plane on the slide rod, and the carrier is forced to its destination. The handle, H, is, immediately on the arrival of the carrier being signalled, pushed back sufficiently far to remove the inclined plane from between

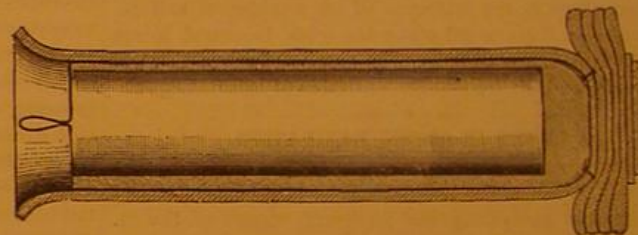


Fig. 7.—CARRIER FOR PNEUMATIC TRANSMISSION.

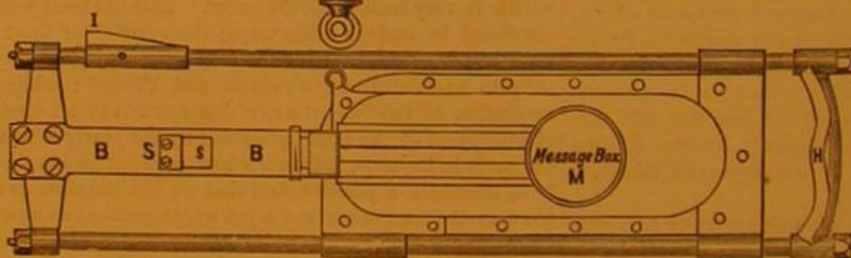


Fig. 6.—PNEUMATIC TRANSMISSION SLUICE.

sluice, T, is entirely thrown out of use. This is done by removing the plug, G. The rack, R, is then removed, and the sluice valve, T, drawn back, and held in that position by a small clamp made for the purpose. The tube is then in its normal state for alternate traffic, and entirely open to the atmosphere.

To forward a carrier, it is inserted in the message chamber

the rollers, so as to close communication between the message pipe and the pressure main, but not far enough to remove the sluice valve from over the mouth of the message chamber. By this means the compressed air which remains in the pipe expands to the atmospheric pressure through the distant end of the pipe only. To receive a carrier, the cock, D, Fig. 5, is opened, and a communication is thus established between the vacuum main and the message pipe. The carrier is pushed forward from the distant end, as in the case of the continuous working, and signals its arrival by striking the sluice. The vacuum is then cut off by closing the cock, D. On pushing back the handle the carrier falls out.

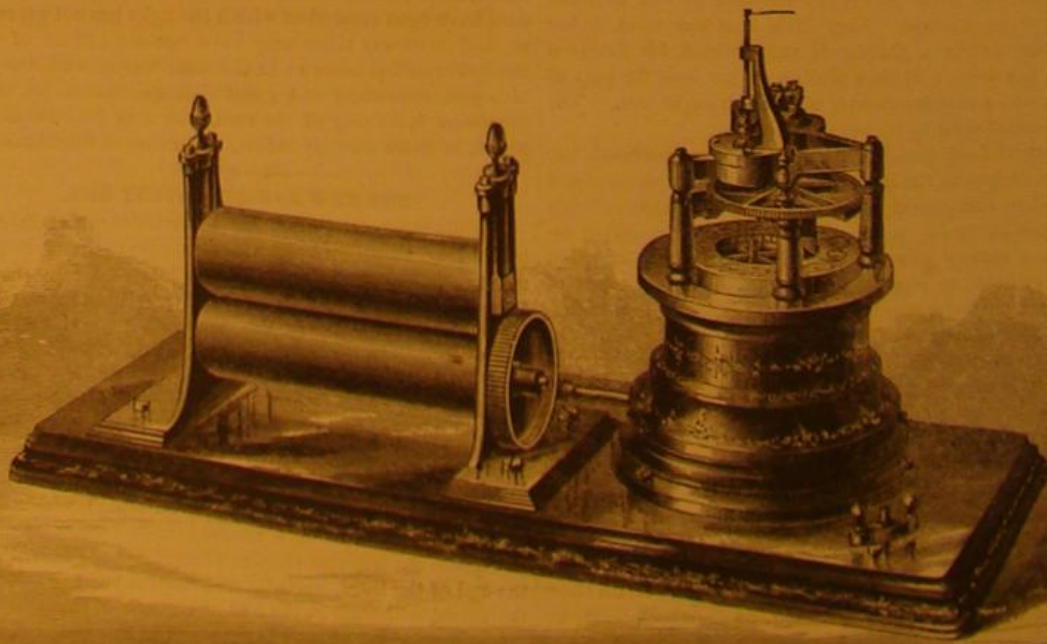


Fig. 8.—MESSAGE COPYING PRESS, DRIVEN BY AN ELECTRO-MOTOR.

A system of electric signals is used between the central station and the outlying stations, consisting of a single stroke bell with indicator, to signal the departure and arrival of carriers, and for answering the necessary questions required in the working.

The carriers or pistons in which the messages are placed are made of a cylindrical box of gutta percha, one sixth of an inch thick and six inches in length. A section of one of these carriers is shown in Fig. 7. The gutta percha is covered with felt or drugget, which projects beyond the open end of the carrier. This part expands by the pressure behind, causing it to fit the pipe exactly. The front of the carrier is provided with a buffer or piston, which just fits the brass tube. This buffer is formed of several pieces of felt. To prevent the messages getting out of the carrier, its end is closed by an elastic band, which can be stretched sufficiently to allow the message to be put in. At the branch stations, where no apparatus is required, the message tube terminates with the end downwards, above the counter or table, so that nothing can fall into it by accident.

Tubes are made of lead, iron, and brass. In London lead tubes are preferred. In Berlin iron only are used. In Paris both iron and brass are employed. In New York brass tubes are exclusively used.

All messages received at the offices of the Western Union Company for delivery, either by the tubes or by messenger, are written by the operator on the proper blank forms with copying ink, and a duplicate is taken, for filing, by laying a sheet of dampened unsized paper upon the message, and passing the two through a copying press. The latter consists of a pair of rollers, which are turned by steam power, an electro-motor, or by hand, according to circumstances. Fig. 8 shows one of these presses driven by a Phelps electro-motor. This method of taking duplicate copies is much neater, and is in many other respects preferable to the manifold process employed in Europe, which is only used in this country when a large number of copies are to be taken of the same despatch, as in the case of press news.

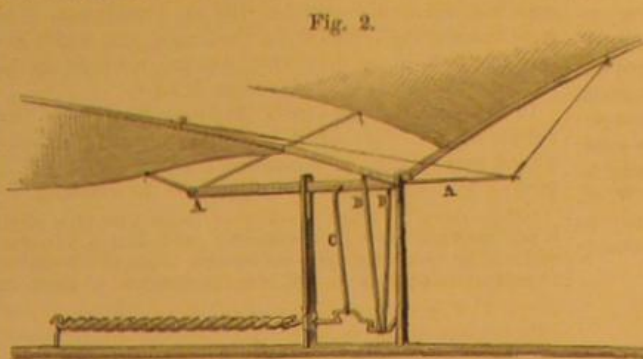
NEW EXPERIMENTS ON MECHANICAL FLIGHT.

M. V. Tatin has recently published a report of results of experiments conducted during the past year, the object of which has been the reproduction of the flight of birds by mechanical contrivances. He has studied, by the aid of small models set in motion by rubber springs, the best form of wing, in order to determine the nature of the large wings most suitable for use on a machine actuated by compressed air. After many trials, M. Tatin finds the larger proportion of advantage to be with long and narrow wings. Other investigators have already shown that a wing may be as effective when narrow as when broad, and Professor Marey has pointed out the fact that those birds which have small amplitude of wing movement always have very long and narrow pinions. With this form (Fig. 1) M. Tatin has rendered as short as possible the period during which his artificial wing takes the proper position to act on the air during its down stroke.

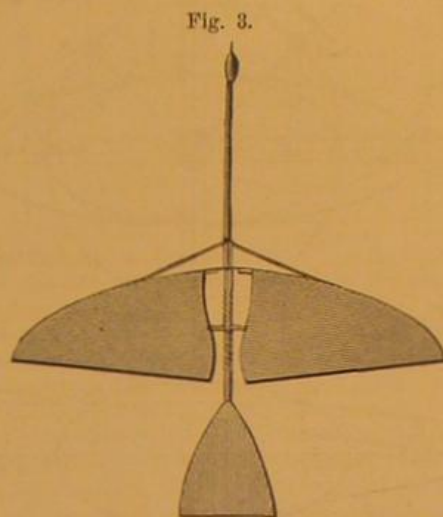
As a bird flies the more easily as his wings act upon large masses of air in shorter periods of time, it will be evident that the velocity of maximum translation will be the most advantageous pace in point of reduction of expenditure of power. M. Tatin, not being able to prevent his mechanical birds expending considerable power in order to obtain a useful velocity, seeks to remedy this difficulty by moving their centers of gravity forward. A bird in full flight then keeps the same equilibrium as one that soars, and its velocity is in one sense passive, new bodies of air, as it were, placing themselves under the wings. All the expenditure of power may then be utilized for suspension. In this way M. Tatin has been able to augment the weight of his apparatus without increasing the motive power.

The movement which the wing makes around a longitudinal axis, and which allows it to present always its lower face forward during the up stroke, is obtained by the apparatus illustrated in Figs. 2 and 3, which are respectively side

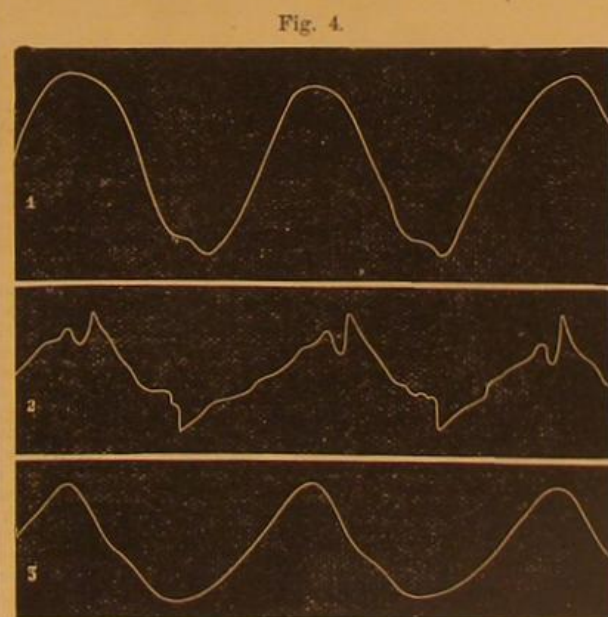
and down movement of the wings, which are movable around a common axis, A. The latter is inclined downward and rearward by the second crank, C, when the first is passing its dead point, and when the wings are at the lowest position during their stroke.



But the wing should not only change position in its entirety; each point on its area should have, especially during the up stroke, an inclination as much more marked as it is nearer the extremity. The portion nearest the body alone should keep a uniform obliquity. M. Tatin therefore con-



cluded that it would be necessary to produce this torsional movement by the wrist; and he therefore substituted, for the wings of silk hitherto used, wings of strong feathers,



which would not bend like the former, but which would slide one on the other during the torsion. This apparatus worked admirably in the model; but when tested on a larger scale the results were inferior, and led the author to return to the silk wings, which he now definitely adopts.

By means of many slight modifications in the shape of the wings, extent of their amplitude, etc., M. Tatin has finally brought his compressed air bird to a remarkable degree of perfection. He had previously made the apparatus lift a load corresponding to three quarters its own weight; now it lifts one equalling its weight. The only difficulty seems to be to cause the device to follow a horizontal course; but this can doubtless be adjusted by a suitable disposition of the tail. The value of M. Tatin's results is shown by a comparison of the curves, graphically produced on Professor Marey's registering apparatus by the motion of the wings of birds, and that of the flying machine. No. 1 in Fig. 4 is the curve produced by the up and down movement of a pigeon's wing; No. 2 is that of the mechanical wing actuated by a rubber spring; and No. 3 is that of the mechanical wing driven by compressed air. The analogy between Nos. 1 and 3 is striking. M. Tatin believes that he will soon reach a formula which will show definitely how many foot lbs. per second are necessary to cause the flight of a given weight.

FRENCH journals state that M. Henri Giffard is building a steamboat that will make 45 miles per hour.

A New Compressed Air Railway.

Some interesting experiments have lately been made in Geneva, Switzerland, on a new system of propulsion by compressed air, the invention of M. Gonin. The road upon which the invention is to be practically employed connects Ouchy, on Lake Geneva, with Lausanne, the line following a grade of 12 in 100. For two thirds of the distance, which is but 4,800 feet, traction is accomplished by metallic cables driven by hydraulic motors; over the remaining third, the vehicles are moved by a piston traveling in a long air tube and impelled by compressed air.

In the recent experiments, a section of the tube, 128 feet in length, was used. The interior diameter was 9.75 inches, and the thickness 0.46 inch. The total weight was 880 lbs. On the upper side a slit was made, with its edges flaring inwards, in which an angular valve fitted. The lateral faces of the valve were covered with leather; and it was pressed against its seat by coiled springs fastened on the outside of the tube. The piston inside the tube was composed of six cast iron disks, with leather washers between them, the latter being cut a little large so as to pack the tube tightly. The piston rod supported three rollers, which served as guides to keep the piston in the axis of the tube. Between rollers and piston, the propelling bar was attached. This was made of such a form as, when the valve in the slit above was lowered, to extend up between said valve and one edge of the slit. Its upper end then came in contact with the vehicle; and thus the motion of the piston was transmitted to the latter. In order to cause the lowering of the valve just in advance of the bar, the car carried a roller which pressed upon a band of metal which rested on the valve rods, the latter being extended up through the springs.

A small compressing engine supplied air to a reservoir, whence it was drawn at a pressure of about 12 atmospheres. The object of the experiments was principally to determine the staunchness of the valve, and in this respect, the *Revue Industrielle* states, they were entirely successful.

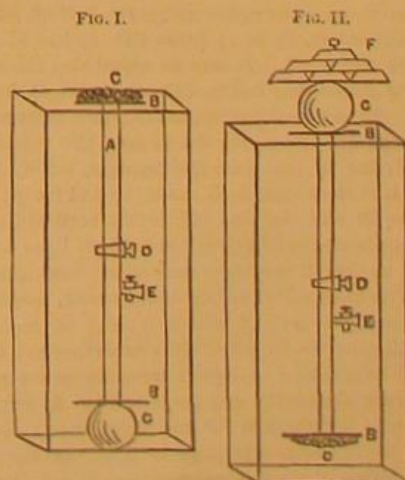
A NEW KEELY MOTOR DECEPTION.

Professor E. Stebbing writes from Paris to the Philadelphia Photographer as follows:

"For the last few days all the *élite* of Parisian science have been deep in thought, as an engineer has given the news to the world that he had discovered a new power which would revolutionize the art of the engineer. The inventor, M. Charles Boutet, is well known; he is the author of the project of a bridge over the Straits of Dover, which would probably have been finished but for the overthrow of the French Imperial Government. Since the war he has directed his attention to hydraulic machines, and upon the following experiment he has based his idea of a new engine: He takes an apparatus composed of a two-inch bore iron tube, of a yard and a quarter long; to each end is brazed an iron disk, intended to support two india rubber balls in communication, the one with the other, by means of the iron tube. This communication can be cut off at will by means of a tap (see Fig. I.); a small tap is also placed in the tube to inflate the india rubber ball. When this is done the apparatus is pressed down into a large tank of water (Fig. I.). This requires a force which can be calculated at about 10 lbs.

"A charge of 160 lbs. can be placed upon the upper ball; and when the communication cock is opened, the 120 lbs. will be raised up (see Fig. II.). By this simple experiment it is clearly proved that a gain of 120 lbs. of force can be obtained. The author intends to avail himself of this force, and to make a 20 horse power engine for the next Exposition of Paris in 1878.

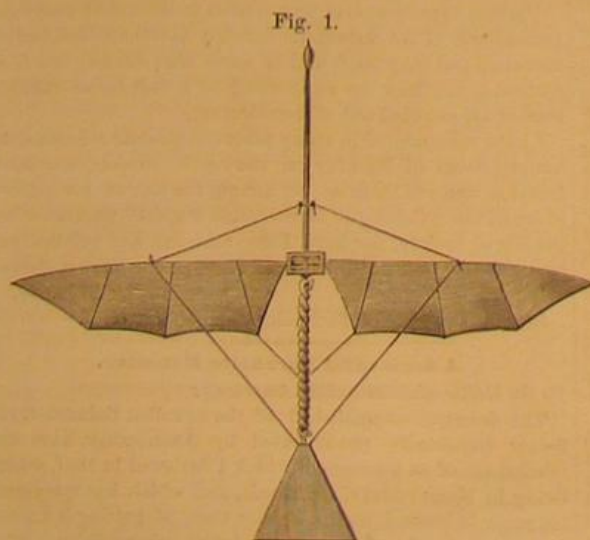
"Such is the invention of which every one speaks—a constant force obtained without expense. A machine of unlimited power, which feeds itself. No



A is an iron tube; B are iron disks; C are india rubber balls; D is the communication tap; E is the air cock; F is 160 lbs. weight.

smoke, no dust, no noise, no danger of explosion. Another crown to the glory of the nineteenth century."

To PROLONG the duration of ropes, steep them in a solution of sulphate of copper, 1 oz. to 1 quart of water, and then tar them.



and rear views. The device consists of a frame of light wood, on the forward part of which are two supports, between which is a shaft bent so as to form cranks at right angles. This shaft is rotated by the untwisting of the rubber spring shown. The forward crank, B, produces the up

Communications.

The Curve Described by a Point on a Connecting Rod.

To the Editor of the Scientific American:

In your issue of January 20 appears a note from W. H. P., in which he repeats the erroneous statement that the path of a point on the connecting rod, between the crank pin and crosshead centers, is always an ellipse: adding that an instrument constructed on that principle would be a most perfect elliptograph. A trial would convince him of his error, and that would do no harm; but as some one else may be misled into such an experiment, by supposing that W. H. P.'s diagram proves the truth of his assertion, it may be worth while to point out that, on the contrary, it clearly proves its fallacy.

Let the circle in Fig. 1 be the path of the crank pin; if we draw ordinates, AD, JC, FG, and bisect them, the curve, RXP, through the points of bisection, is an ellipse: and the equal ordinates, SD, TG, are equidistant from the minor axis. Now let o , the middle point of the connecting rod, EH, be the tracing point; then ok will be the greatest ordinate of the described curve, and equal to CX. But it will not be at the middle of ez , the length of the curve, nor will equal ordinates be equidistant from it. For instance, mg , nl are ordinates corresponding and equal to SD, TG. But the triangles, ABD, FIG, having the same hypotenuse and the same altitude, have equal bases; the triangle, HEC, has the greater altitude, CE, while the hypotenuse is the same, therefore its base, HC, is less than BD or IG, and as g , k , l are the middle points of these bases, gk is greater than kl . The curve in question, then, is not an ellipse, nor is it symmetrical with respect to any transverse line; if not "slightly wider" at one end than the other, it is at any rate slightly longer.

The deviation from the elliptical form may not be great under all conditions, but it exists in all cases, with one exception, and is sufficient to preclude the adoption of what is usually understood by the "crank and connecting rod movement" in an elliptograph. The exceptional case I mentioned in a former note; if the length of the connecting rod be equal to that of the crank, and the stroke of the crosshead four times as great, the described curve will be a true ellipse. Such an arrangement would hardly be adopted in a steam engine, but is perfectly practicable in a drawing instrument. The movement is shown in Fig. 2, which is lettered to correspond with Fig. 1. It is also clear that in this case the tracing point being as before at the middle of the connecting rod, the whole length, ez , of the described curve will be $1\frac{1}{2}$ times RP; and in order to prove it a true ellipse, it will suffice to show that all the abscissas are increased in the same proportion, the ordinates remaining the same as in RXP. Now, when the crank pin is at A, the crank and connecting rod, AC and AB, form two sides of the isosceles triangle, CAB, whose base, BC, is bisected at D by the ordinate, AD, of the circle: which, itself being bisected at S, gives SD, the ordinate of RXP, to which mg is equal. But AB being bisected at m , ms or its equal, gd , is the half of BD or of its equal, DC; that is, Cg is $1\frac{1}{2}$ times CD: and so of any other position of the crank. It may be added that the movement of AB, the connecting rod in this arrangement, is identical with that of the pencil bar in the common trammel, which will be seen by prolonging BA to meet the vertical center line in W; for in that case the triangle, CAW, being also isosceles, it is clear that, as B moves to and fro on the horizontal line, W will rise and fall in the vertical line: and if these points be compelled to travel in those lines by the slots as shown, the crank may be removed without affecting the result. The mechanical device of the crank, however, gives some advantages; one of which, it may be mentioned, is that, by altering the length of the connecting rod, the instrument may be adjusted to draw curves which are not elliptical, but very decidedly egg-shaped; Fig. 3, for example, would hardly be mistaken for an ellipse by any one.

It may be of interest to some to note that the result attained by either of the devices mentioned, and illustrated in Fig. 2, may also be accomplished in another manner. If the wheel shown in dotted lines, whose center is A in that figure, roll within the annular wheel of twice its own diameter, whose center is C, the points, B and W, will move in the horizontal and vertical lines, and m will trace the ellipse.

Stevens Institute, Hoboken, N. J. C. W. MacCORD.

THE average weight of 20,000 men and women, weighed at Boston, Mass., was: Men, 141.5 lbs., women, 124.5 lbs.

Supporting a Ball on a Blast of Air.

To the Editor of the Scientific American:

In looking up some other matters, I came across an account of some experiments in the direction indicated by the above title, which may possess some interest, and furnish some suggestions in connection with the experiments of the same character exhibited at the Centennial, and which have been discussed in the SCIENTIFIC AMERICAN within the last two months. See page 262, volume XXXV.

In the Glasgow Mechanic's Magazine for July 2, 1825, volume LXXX., page 338, in an article entitled "Account of several experiments, performed with a compressed gas apparatus, by John Deuchar, Esqr.," occurs the following:

"Experiment 1. When a common brass blowpipe nozzle is put upon the top of the condensing gas-holder, a mahogany ball will be supported upon the column of gas as it is allowed to escape; and when the ball is at the distance of from one

supported on a column of water. Now, so far as my information goes, Mr. Leslie leaves the far less singular circumstance of a ball being supported on a perpendicular column either of water or air, to be claimed as the discovery of those earlier philosophers, from whose ingenuity the Swiss and German schoolboys (of whom the correspondent in the *Chemist* speaks so highly) had learned their amusing recreation; but the Professor deservedly, I think, is entitled to the merit of first proving that a brass ball could be supported upon a column of water or of air, when that column is inclined even to an angle of 45° from the perpendicular."

In the volume of the *Chemist* referred to, which I chance to have also in my library, I find on page 15 the following:

"HYDRAULICS.—Curious Experiment.—The following experiment has recently been exhibited in the northern part of this country by a celebrated professor. A jet of water, by means of a great pressure, was made to spout upwards, and bear aloft, almost as high as the ceiling, a hollow copper ball as large as an egg; and sometimes an egg itself is used. The water was made to spout up in one unbroken jet, about

the thickness of a lady's finger. Striking the ball on the under side, it spread out into a thin shell or film, which invested the globular surface on all sides, and afterwards descended in rain or spray. The ball kept playing on the top of the jet, not leaping up and down, but vibrating a little from side to side, and generally it performed at the same time a slow vertical motion on its axis. It is remarkable that it is not necessary for the water to rise in a vertical direction. The experiment succeeded, and the ball was supported equally well, when the jet was inclined ten or fifteen degrees."

And on page 175:

"CURIOUS EXPERIMENT.—We mentioned some months ago an experiment exhibited in Professor Leslie's class room, in which a hollow brass sphere was balanced on the top of a jet of water, and made to play up and down, in a manner very striking and beautiful. We saw the Professor exhibit subsequently an experiment of the same kind with air, but of a more novel and singular description. Two or three atmospheres of common air were condensed into a close copper vessel, of a size which might be conveniently carried in the hand. A stopcock, with a very minute aperture, fixed on the top of the vessel, being opened,

the condensed air rushes out in a stream. If a wooden ball of the size of a schoolboy's marble, or larger, is placed by the hand in this current of air, it is not blown aside or suffered to fall, as we would expect, but continues to leap up and down some inches above the orifice, generally performing at the same time a vertical revolution round its axis. Though the air and water in the two experiments perform the same office, they act in a very different manner. The water, thrown up by pressure, rises in one unbroken filament, of the thickness of a slender rod, to the height of twenty feet or more; but the air being greatly condensed, the moment it escapes from the tube its particles exert a lateral repulsion, and, instead of pouring upwards in a uniform slender stream, it spreads out into the form of an inverted cone, in the axis of which, where the rarefaction is great, the ball plays up and down. So securely is the ball confined by the conical shell of air which invests it, that the vessel may be inclined at an angle of 30° or 40° , or carried about freely in the hand, without the ball falling off. The experiment has, in fact, something of a magical effect; for, when viewed at a distance of three or four yards, so that the whizzing noise of the air is not heard, the ball seems to leap and play, and attach itself to the vessel by some secret and invisible power of its own.—*Scotsman*."

The article alluded to as occurring on page 381 is simply a rather unamiable criticism on something which was not asserted concerning Professor Leslie, and is not worth repeating.

Various experiments closely related to the above under the general title of the pneumatic paradox have been frequently discussed and may be found in some text books; but it is curious to see how the supporting of a ball by an oblique blast of air has died out of recollection.

I have encountered in many places a general reference to investigations of Faraday on the above subject, but have found no trace of them as yet among the list of his papers given in the "Catalogue of Scientific Papers" published by the Royal Society, nor have I encountered any publication by Professor Leslie in relation to the matters quoted above.

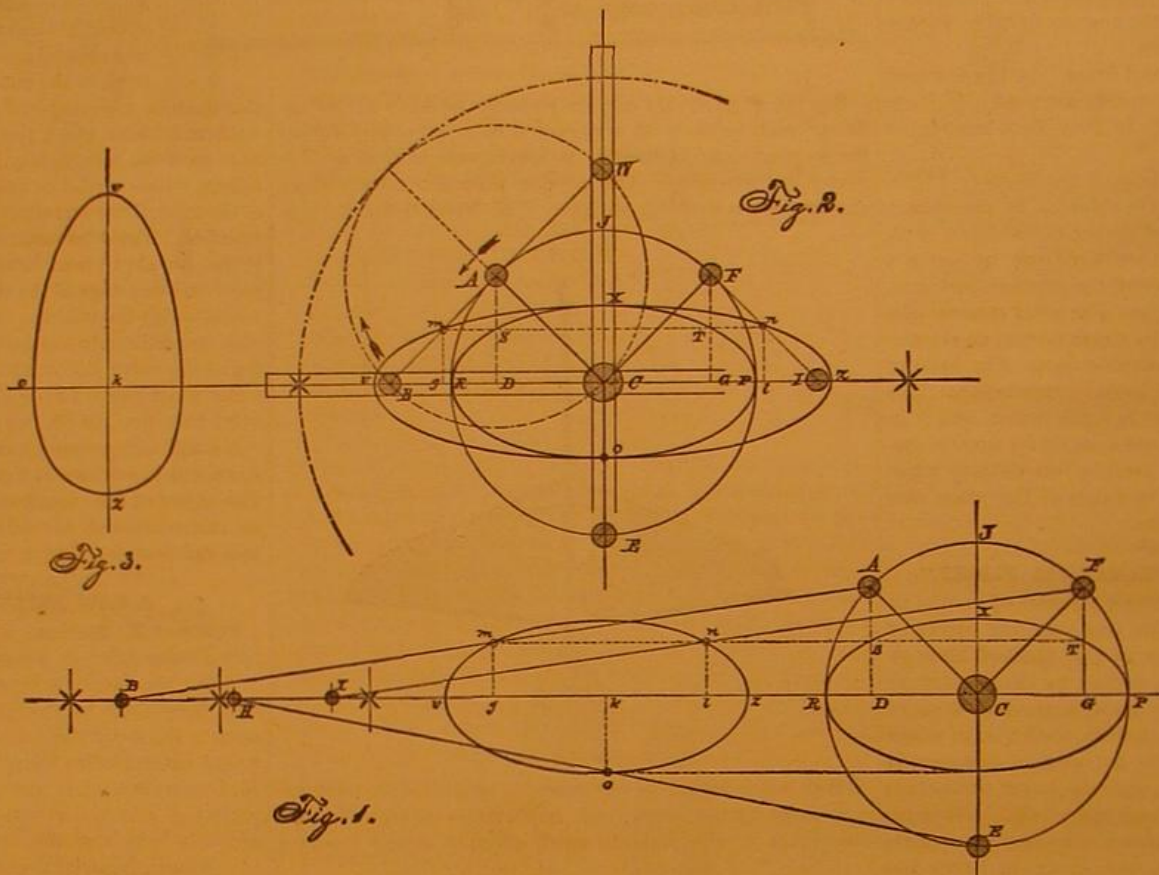
HENRY MORTON.

Stevens Institute of Technology, Hoboken, N. J.

A Segmental Parabolic Reflector.

To the Editor of the Scientific American:

The descriptions published of the so-called Balestrieri reflector (repeatedly pre-invented by Americans) have reminded me of an instrument which I designed in 1867, when living in Mono county, California, and which has remained on paper because I had no chance then of getting it made, and have ever since been occupied with other affairs. It is a reflector consisting of concentric parabolic rings or segments of copper, coated inside with nickel or silver, which are so curved and arranged that all solar rays falling upon them parallel with their axis are bent to a common focus. In consequence of the latter being behind the reflector and quite near to the same, manipulations which would be very



inch to one and a half inch above the opening, we may inflame the gas, and still the ball will be supported, and perform a double rotatory motion in the center of the flame (as shown in Fig. 1).

Although this experiment be continued for five minutes, yet the wooden ball is not burned, nor even much warmed. In order to mark the motion of the ball, it has a white ring round it.

There are two causes which operate here in keeping the temperature of the ball below the point of combustion. The first is the hollow nature of flame; it is on the outer surface of the gas alone that the combustion takes place, for there only it has the necessary supply of oxygen to carry on its combustion; the interior, therefore, in which the ball is situated, consists of a mixture of the gas, partially scorched or converted into smoke, united with some that has not been at all changed. And, secondly, the rapid rotatory motion of the ball further prevents the action of the interior unburning.

"Experiment 2. Repeat the last experiment, and, at the same time, incline the apparatus to one side, and we have the ball supported on a column of flame obliquely, even at an angle of nearly 45° (as shown in Fig. 2), from the perpendicular. The inflammation of the gas in this instance shows how correct Professor Leslie's ideas were with regard to the nature of the phenomenon which he, I believe, first noticed, of a column of air supporting a hollow brass ball at an angle of 45° ; namely, that the ball was enveloped by a sheath of the air; and the inflammation of the gas renders, so far, unnecessary any mathematical demonstration with regard to that point.

"Here is shown, in a very beautiful manner, the inflamed sheath of gas surrounding the ball, by the rapid motion and force of which it is that the ball is enabled to resist the power of gravitation even at the inclination of an angle of 45° ; but when we slant the apparatus more to one side, we then find that the attraction of gravitation becomes stronger than the propelling force of the inflamed gas, and we see the ball drop through the burning sheath in which it was previously enveloped.

"In alluding to the very curious observation of Mr. Leslie regarding common air, I cannot help stating that, in the *Chemist*, volume I., page 381, it has, by misrepresentation, been attempted to make it appear that the learned Professor had claimed the merit of discovering that a brass ball could be

difficult or impossible to perform in front of a concave mirror are rendered perfectly convenient. The reflector may be so mounted as to enable the operator to keep its axis directed towards the sun, and thus to maintain a complete focus for a considerable space of time; and means may also be devised for separating the solar rays by filtration through proper absorbing media. Any good physicist will know, without being furnished with a diagram, how to construct the instrument, which may, indeed, be done in somewhat different ways, it being necessary only to give to the concentric rings or segments (which might best be made by depositing copper upon moulds of wood, covered with plaster and correctly shaped on a lathe) such a curvature and position that the parallel rays, striking them at various angles of incidence, be reflected to the same point. There can be no doubt that, with a large reflector of this kind, it will be possible to produce calorific effects of which we have at present no conception; and the instrument may not only become an important aid to Science, but may also find some useful applications in the arts. By the Balestrieri reflector, which consists of concentric conical rings or segments, the solar rays can naturally not be brought to a focus, but only be collected in an axial line. Its proper purpose is to cast the light of a focal flame in a certain direction into space, and it must answer that purpose quite well.

A. PARTZ.

Paris, France.

Plant Vigorous Young Trees.

To the Editor of the Scientific American:

On page 70 of your current volume, you advise farmers and fruit growers to buy small trees rather than large ones. In a general sense you are perhaps correct; but practical pomologists know that to judge rightly of the value of a tree by its rings alone is quite impossible, there being other conditions of growth quite as important, and even more so, than the relative size and height of its trunk and branches. Having a pretty extensive experience in the planting and growth of young fruit trees especially, I have found the roots to be the most important consideration, and the best indication of vigor and quality; and were I compelled to purchase trees without seeing them, roots and all, I should much prefer seeing the roots than the trees proper; and indeed, with such evidence of their quality, I could not be greatly deceived. A tree with a fine mass of fibrous surface roots of a healthy, vigorous color, and thin, small, rather than thick, broken main roots, is sure to grow and thrive with any sort of fair treatment, and in almost any soil; but without such fibrous roots, and having only two or three large mutilated horns or prongs, and a heavy stub for a tap root, which must from necessity have been broken and skinned in removal from the nursery row, the tree were better thrown on the brush heap than given space and trouble in the orchard. In view of the fact that most of our nurserymen work their trees upon seedling root stock and leave them standing in the rows where first planted, it is easy to understand why so large a percentage fails to grow and thrive when removed to our gardens and orchards, and why in some cases, with the utmost care and attention, so many years of doubt and uncertainty must intervene before the fruit appears. In the deep fertile soil of the nursery, they send down long tap roots which, if left undisturbed, grow to the exclusion of anything in the shape of fibrous roots; and when the trees are finally removed for sale, this long tap root must of course be cut or broken off, and it is thus somewhat miraculous if the tree lives at all.

To buy only small trees will not entirely obviate the difficulty, although it is in every way poor policy to purchase or plant very large trees of any kind. But in procuring small trees, it is very important to know various other attending conditions: whether they are small simply from a stunted condition of growth and general lack of constitutional vigor, or because they are young, which of course is the only admissible condition. I have trees of three years which far surpass in vigor and size others of ten. I would certainly prefer even large trees, if vigorous, to small, stunted trees of like age. So it will be seen it is not safe to rely upon small trees altogether. A better rule would be perhaps to buy young trees rather than small, if, indeed, the matter can be narrowed down to one short invariable rule, which I very much doubt. Show me the roots of a tree, and I'll tell you how it looks above ground. Look at the roots first, then the wood and bark; do not care about the size so much, and you need not inquire very particularly about the age after having made the examination indicated. All reliable nurserymen are well acquainted with these facts, and should not mislead their customers in their catalogue classifications. The real, true quality of a fruit tree exists in its degree of vigor and thrift; and it is with reference to this, together with age, that the various grades and prices should be arranged.

Kingston, N. Y.

H. HENDRICKS.

STRAIGHTENING WROUGHT METAL PLATES.

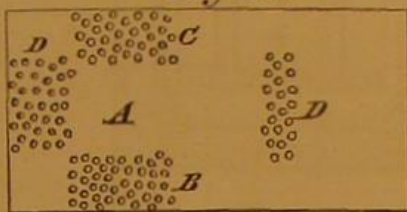
No. II.

As an example, let us take a plate, say 18 inches by 24, as in Fig. 10. The first thing to do is to ascertain where it is out of straight, which is done as follows: If it is a thin plate, say of 19 gauge, we rest one end of it on the block and support the other end in the left hand, as shown in Fig. 11; then with the right hand we exert a sudden pressure in the middle of the plate; and quickly releasing this pressure, we watch where its bending movement takes place. If it occurs most at the outer edges, it proves that the plate is contracted

in the middle; while, if the center of the plate moves the most, it demonstrates that it is expanded in the middle. And the same rule applies to any part of the plate. This way of testing may be implicitly relied upon for all plates or sheets thin enough to be sprung by hand pressure.

Another plan, applicable for either thick or thin plates, and used conjointly with the first named, is to stand the plate on edge with the light in front of us, but not overhead, as in Fig. 12; we then cast one eye along the face of the plate upon which the light falls, and any unevenness will be made plainly visible by the shadows upon the surface of the plate. The eye should also be cast along the edges to note any twist or locate any kinks. Perhaps our trial by these tests, employed either singly or in conjunction, demonstrates the plate to have the bulge in it, denoted in Figs. 10 and 11 by the inclosure within the line, A. This bulge is called a loose place; and if the plate is bent or springs back and forth a little, this spot will be found to move the most. The plate is, in fact, edge-bound, as it might aptly be termed; and hence, to straighten it, we do not attempt to batter the bulge down by placing the plate on a large block and hammering away at the convex side; but we place it on a small block and proceed to stretch the plate at and near the edges, and so remove the bulge or loose place without hammering it at all. The method of attack is to first hammer the plate, letting the first series of

Fig. 10.



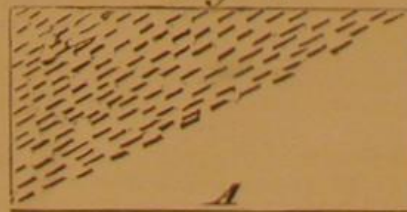
blows be delivered as denoted in Fig. 10 by the marks at B; and we then deliver the blows denoted by the marks at C and at D in the same figure. These blows will, if sufficient of them are delivered, remove the loose place. While giving these blows, the workman takes care to hold the plate so that his blows fall solid and do not "drum;" that is to say, if the spot where the hammer falls does not rest upon the anvil, the effect of the plate is similar to that produced by a drumstick upon a drum, producing no result save to jar the fingers holding the plate. And this jar is frequently sufficiently great to cause severe pain and sometimes injury

Fig. 11.



to the fingers. In removing the loose place, we shall find, in almost all cases, that we have induced contraction in the plate round about the spot marked D in Fig. 10; and this contraction we remove by a few blows, as denoted by the marks at D. In this operation, we have merely stretched the plate where it was necessary to release the loose place.

Fig. 11a.



Let us now suppose that our testing had shown the plate to be twisted. We then carefully note which edge of the plate is the straightest, and which is the one that is bent, and then place our plate upon the anvil, as shown in Fig. 11a, in which that part of the plate on the left hand side of the diagonal line is supposed to be the one that is bent, the bend lying downwards (the edge, A, being the straightest). We then attack the plate, if a thick one with the long cross face hammer, and if a thin one with the twist hammer; and in either case we deliver the blows denoted by the marks, the action of the hammer being to lift the plate in front of it. The blows at and towards the edges are always delivered first, the hammering being carried towards the middle, and being also wider apart as the middle of the plate is approached.

A plate is said to be contracted when the hand bending

process shows the edges to move the most; and in this case all that is necessary to remove the contraction is to strike the plate a few blows about the contracted part, as we did to remove the contraction at D in Fig. 10. The blows in this case, however, may fall perpendicularly, and be delivered (for fine work) with a broader faced hammer.

To remove a kink or crooked place at or near the edge of a plate, we proceed as shown in Fig. 12, laying the plate with the convex side of the kink resting upon the anvil (the shaded part, A, representing the kink), and delivering the blows denoted by the marks at B, in Fig. 12a. We next turn the plate upside down, and strike the blows denoted by the marks or dashes at C, Fig. 13; and the kink will be removed.

Fig. 12.



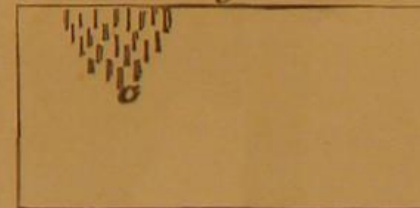
To straighten the plate shown in Fig. 9, we place it upon the anvil, as shown in Fig. 14, striking blows as denoted at A, and placing but a very small portion of the plate over the anvil at first; and as it is straightened, we pass it gradually further over the anvil, taking care that it is not, at any part of the process, placed so far over the anvil as to drum, which will always take place if the part of the plate struck does not bed, under the force of the blow, well upon the anvil.

Fig. 12a.



We have now explained all the principles involved in straightening wrought metal plates; and no matter in what shape a plate is bent, it can be straightened by the application of these rules, applied either singly or in combination. As a rule, they require to be used in combination: thus a plate may have a loose place and a kink, or a kink and a twist, and in these cases the operation to remove the one is

Fig. 13.



performed conjointly with that necessary to remove the other, either being slightly modified to suit the other operation. The anvil, it will be seen, must be small enough to permit of the plate being attacked in individual spots or places; for the plate must always lie so that the part being struck is solid upon the anvil. In consequence of this requirement, the holding of the plate becomes an important element; for, with a good helper, the plate may be quickly and readily adjusted, thus saving much time and labor.

Fig. 14.



A rude system of straightening is sometimes performed by the aid of a trip hammer, the finishing process being performed on a large iron block. This plan is crude, however, and is more productive of hammer marks than it is of true work. Very thick plates, those too thick to be readily affected by the blows of a sledge hammer, are made red hot and straightened upon iron blocks larger than the plates. For this operation large wooden mallets with very long handles are sometimes used.

J. R.

OVER 13,000 applications for space have already been filed by the authorities of the French Exposition next year; 7,800 are from the city of Paris alone.

NEW ROTARY PUMP.

We extract from the *Revue Industrielle* the annexed engraving of a new rotary pump, which is quite simple in construction, and which, our contemporary states, has successfully withstood quite severe tests.

Placed eccentrically in the cylinder is a drum, as shown in Fig. 2, to which are hinged three bronze pallets which close into recesses in the drum. These, as the drum rotates, draw in the water through the ball valve in the suction pipe below. The drum shaft is mounted independently of the pulley shaft, Fig. 1, so that any strain on the latter, by the belts, will not tend to throw the pump mechanism out of line. The connection between the shafts consists simply of the end of the drum shaft entering a socket in the end of the pulley shaft.

The pallets may be easily removed without taking the drum from the cylinder. The joints of the cover are packed by rubber packing, which fits in a groove made half in the cover and half in the cylinder.

Dyeing Raw Cotton.

The following is considered the best and easiest way for dyeing raw cotton. Boil with 22 lbs. extract of logwood for 100 lbs., till it is all well penetrated, then dry; then boil slowly with 10 lbs. chromate of potash and 5 lbs. soda crystals; make run the liquor, take out, and keep over night, or one or two days; then wash well. That is the best and fastest black, and stands well.

A NEW PHYLLOXERA REMEDY—DECORTICATION.

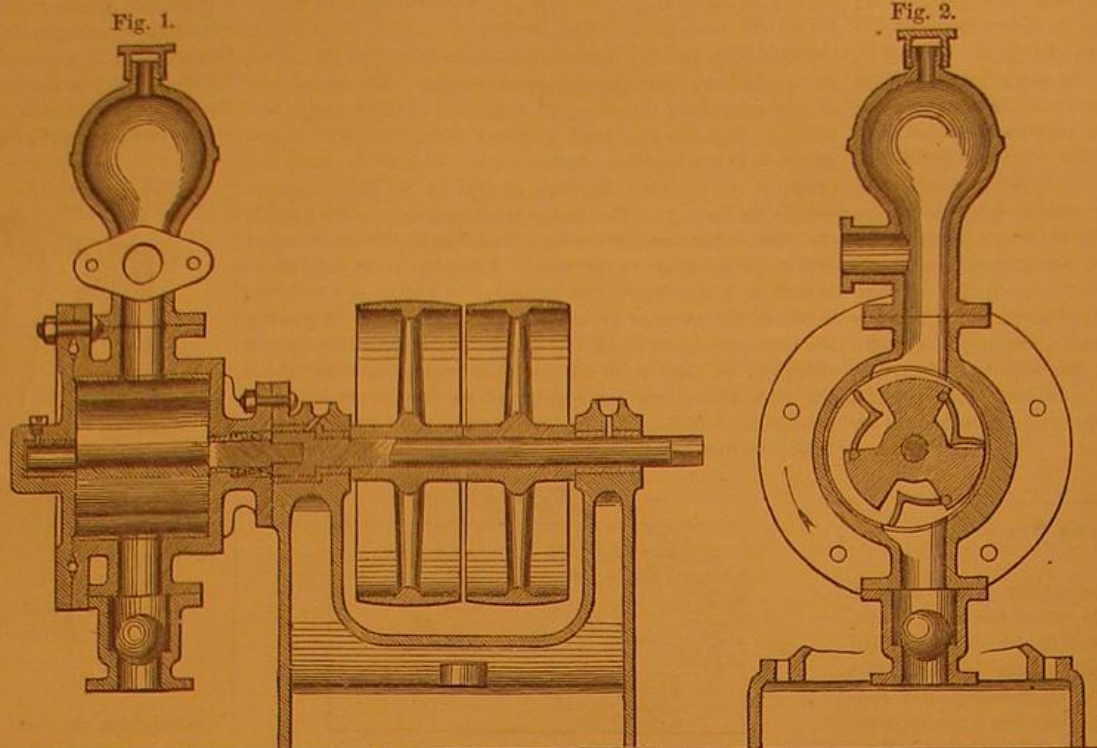
It was recently announced in the French Academy of Sciences that the decortication or removing of the bark from



Fig. 1—SABATE'S DECORTICATING GLOVE.

grape vines is a valuable preventive of phylloxera ravages, and that the vines thus treated also soon showed very perceptible signs of improvement in vegetation. M. Sabaté now gives, in *La Nature*, some positive facts regarding the efficacy of this process, based on actual trials in his own vineyards. He states that a plot of about 20 acres had its vines (white grape, age 60 years) nearly destroyed in 1875. During the winter of 1875-6, the vines were barked during the coldest weather. They have since become in a flourishing condition, and last autumn yielded an amount of grapes double that of the preceding year; and 48 acres of other vines (red grape, aged from 15 to 20 years) were similarly treated in February, March, and April. Since then they have not been attacked, and the old phylloxera points of lodgment have not enlarged, while a far larger yield was obtained. In general, the vegetation in both of these vineyards offered a striking contrast to that in adjoining ones where decortication had not been practised. Although the vines in the latter were planted in fully as rich soil, and were identical in variety and in age, they are now as badly attacked as

at any time during the past two or three years. Indeed, their production is lessened, and is scarcely 60 per cent of that of last year. These facts have attracted official notice, and a committee from different French vine growers' associations have lately undertaken and completed an extended course of experiments based upon them. These substantiate the conclusions drawn from the foregoing, and also show the further



HOUYOUX'S ROTARY PUMP.

benefit that, by removing the bark, a large number of harmful insects, which take refuge therein in winter, are at the same time destroyed.

The modes of decortication the vines are represented in the annexed illustrations. The workman wears a glove, Fig. 1, made of mail or rings of galvanized iron. It weighs about 20 ozs., and with it a man can easily bark 500 large three-branched trunks per day. Fig. 1 shows how the bark is removed by rubbing the branch longitudinally. In order to reach crotchets and sharp angles, the bow, shown in Fig. 2, is used, the cord being a twisted line of galvanized iron wire.

A Machine Switchman.

About as curious a railway signal as we have ever seen has recently been patented through the Scientific American Patent Agency by Mr. J. D. Hughson, of Prairie City, Ill. This inventor believes that, where an engineer might fail to heed the indication of a semaphore or some other purely mechanical apparatus, he would be sure to notice the frantic gestures of a man posted beside the track. As men of flesh and blood cannot probably be found who would be willing to stand on a high pedestal for indefinite periods of time and wave their arms at exact intervals, a machine man has been contrived who flourishes a flag, hammers a bell, and displays a changeable light in his hat with unfailing regularity. The man owes his movements to clockwork operated by weights, and the latter are controlled by electricity. When a train passes, it moves a little stop beside the track, which, by a mechanical connection, shifts a switch so that the current from a main line of telegraph wire is diverted into a short circuit. An electro-magnet inside the machine man is thus excited; and as it attracts its armature, the latter releases a detent. The weights then descend, and the man waves his flag and pounds his bell, while the light on his hat changes to red. When the train has passed, the current is broken from the short circuit, but the man keeps on his motions until a wheel in his interior completes its revolution and thus allows the detents once more to engage. Of course the time during which he waves his flag, etc., is long enough to allow the train that has passed to travel a considerable distance.

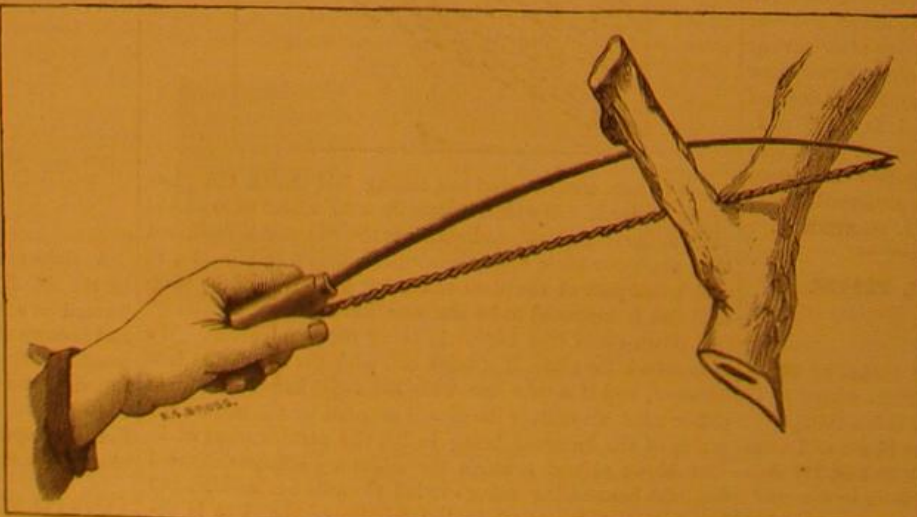


Fig. 2—SABATE'S DECORTICATING BOW.

The Coffee Photographic Process.

A correspondent in Switzerland lately sent some examples of this process, which, by reason of their depth, vigor, and richness, were equal to the best wet-plate photographs; and now both M. Haakman, the President of the Photographic Society at Amsterdam, and M. Victor Angerer, a well known Viennese photographer, bear testimony to the efficacy of the process. M. Haakman says he has given some attention to dry plates, for, as he practises photography simply for pleasure, these are generally more convenient to use than wet films. He has tried, he tells us, tannin, tea, tobacco, morphine, and several other substances in the preparation of his dry films; but none of these, to his thinking, afford such clean and satisfactory films as coffee.

M. Haakman prepares his plates in the simplest manner; and although we have several times published formulae in regard to the production of coffee plates, our readers may like to know the precise plan followed by M. Haakman. His coffee solution is made up of: Boiling water, 6 cubic inches; pure Java coffee (burnt), 77 grains; white sugar, dissolved in a little water, 39 grains. This infusion, when cold, is poured twice over the sensitized collodion films, which are then dried.

A NEW BATHOMETER.

We extract from *La Nature* the annexed engraving of a new and simple instrument for measuring great sea depths. It is the invention of Dr. H. Fol, and consists of a spherical glass reservoir filled with a liquid very slightly compressible—water, for instance, or, better still, ether. The only orifice to the vessel is a capillary tube which communicates with a small reservoir above, which is filled with mercury. The latter, at the presumed temperature of the water at the sea bottom, should just stand at the level with the orifice in the pointed stopper inserted in the large reservoir. The upper surface of the mercury is exposed to contact with the sea water.

In using the device, it is simply lowered by a sounding line. The liquid within the large reservoir will be compressed as the apparatus descends, a given amount for each atmosphere of pressure, and a corresponding quantity of mercury will escape through the orifice and sink to the bottom of the large reservoir. This mercury on the apparatus, being hoisted, is accurately weighed, and its weight indicates exactly the pressure to which the device has been submitted. The pressure known, the depth of water is easily determined.



Do not Allow the Frogs to be Pared.

The frog of the foot of every horse is the natural support of the foot, and should never be cut away except to remove the rough edges which occasionally appear from common wear. At a late meeting of the farriers and horseshoers in Wilmington, Del., there was a great deal said in condemnation of the manner in which horses are shod, especially in the rural districts. A lecturer, a veterinary surgeon (according to the *New York Herald*), said that "the frog of the foot was often pared away so artistically to make a neat job that the tendon or muscle that extended down the leg, over what is known as the pulley bone, and gave the foot its motion, was often injured, and then the horse would be weak in the legs, and blunder. He severely characterized the habit of burning the hoof with a red hot shoe to make it fit, and said there ought to be a law passed to hang any blacksmith who would use red hot shoes in this way. The shoe should be fitted to the shape of the foot, rather than the foot fitted to the shoe."

An electric battery, famous because it was once owned and operated by Benjamin Franklin and other distinguished philosophers, has been in use at Dartmouth College for years, and is now employed almost daily for class-room experiments.

A PERSIAN DWELLING.

There is little to be seen in modern Persia that tends to substantiate the tales of ancient travelers concerning the magnificence and wealth of the cities ruled by the Shah. Colossal ruins attest the grandeur of former days, but centuries of misgovernment have reduced a people naturally industrious and energetic to a mere horde, existing under scarcely more than the semblance of civilization. Persia, or rather her cities, might be termed the abode of shams; for deception reigns everywhere, from the huge paste diamonds of the Shah to the imposing pillars of dust and straw which decorate the wretchedly constructed buildings.

An excellent idea of the exterior of a Persian dwelling of the better class in Teheran is afforded by our engraving. The courtyard, and probably the most attractive portion of the structure, is represented; and the picture shows nothing of the intolerable filthy surroundings of even the finest private grounds. The materials of construction used are sun-dried bricks, which have little cohesion, and which before long render the walls in a very dilapidated state. The elaborate cornice and columns represented in the engraving are scarcely more stable than so much theatrical scenery, being merely of wood stuccoed over with mud. In some structures stone is used, and tiles are employed for decorative purposes; but this more substantial mode of building is confined to the houses of dignitaries, or to the bazaars or mosques. In the latter the relics of past magnificence are yet discernible, and one edifice is asserted to be roofed with plates of pure gold. In view of the acquisitive nature of Persian officials, and the unconcealed corruption which reigns in every department of the government, the statement that so much treasure is allowed to remain unappropriated to some one's private use is rather questionable. Persian architecture, however, is not without its importance; and as it involves the application of the singularly beautiful arabesques known the world over as Persian patterns, it presents suggestions to our designers and decorators, of which at the present time advantage is widely being taken. The arches shown in our engraving are by no means of the conventional pattern, and are exceedingly graceful; while there is a harmony of design between the general form of the building and its flat decoration which appeals strongly to correct taste. To perceive to what excellent use it is possible to turn the Persian arabesque and the closely analogous Moorish designs, the reader has only to examine the architecture of some of the larger Jewish temples in this city. There—where, as a matter of course, the Gothic and other well known styles which, by custom, are almost wholly appropriated to Christian churches, would not be suitable—architects have been compelled to seek other sources for every variety of decoration; and the results are adaptations of Oriental design, pleasing both intrinsically and because of

their non-conventionality. Workers in other branches of art have likewise recently resorted, to an unusual degree, to Persian ornamentation, and some of the most exquisite productions in *repoussé* silver and niello work are based entirely upon Persian patterns.

Individual design apart, the aspect of groups of Persian houses is not inviting, but rather monotonous; and the eye finds its only relief in the courtyards or in the gardens, where trees are allowed to grow. The interiors of the dwellings, especially those of the richer classes, often, however, bespeak an unlooked-for degree of comfort: that is, if comfort can be had in any structure which is liable to fall down unless constantly repaired. The courtyard represented in the engraving is entirely inclosed by the dwelling, and is reached from the street by a narrow corridor. On two sides of it are simple blank walls; on the others are the fronts of two distinct buildings (one of which is represented), one belonging to the master of the house and the male portion of the household, the other to the harem. Each consists of a large saloon, separated from the courtyard by glass windows, with two smaller apartments on the ground floor, and a balcony chamber above. The flat roofs are reached by an uncovered flight of steps, and are places of frequent resort in the warm season after nightfall. In winter the rooms are heated by jars of charred fuel, half buried in the floor. The houses of the richer classes in Teheran are seldom occupied during the summer, as, owing to its filthy condition, the city then becomes unhealthy. The monarch and aristocracy then betake themselves to tents on the neighboring plain of Sul-tanieh; while the rest of the population accept the ravages of pestilence with that fatalistic indifference peculiar to Oriental races.

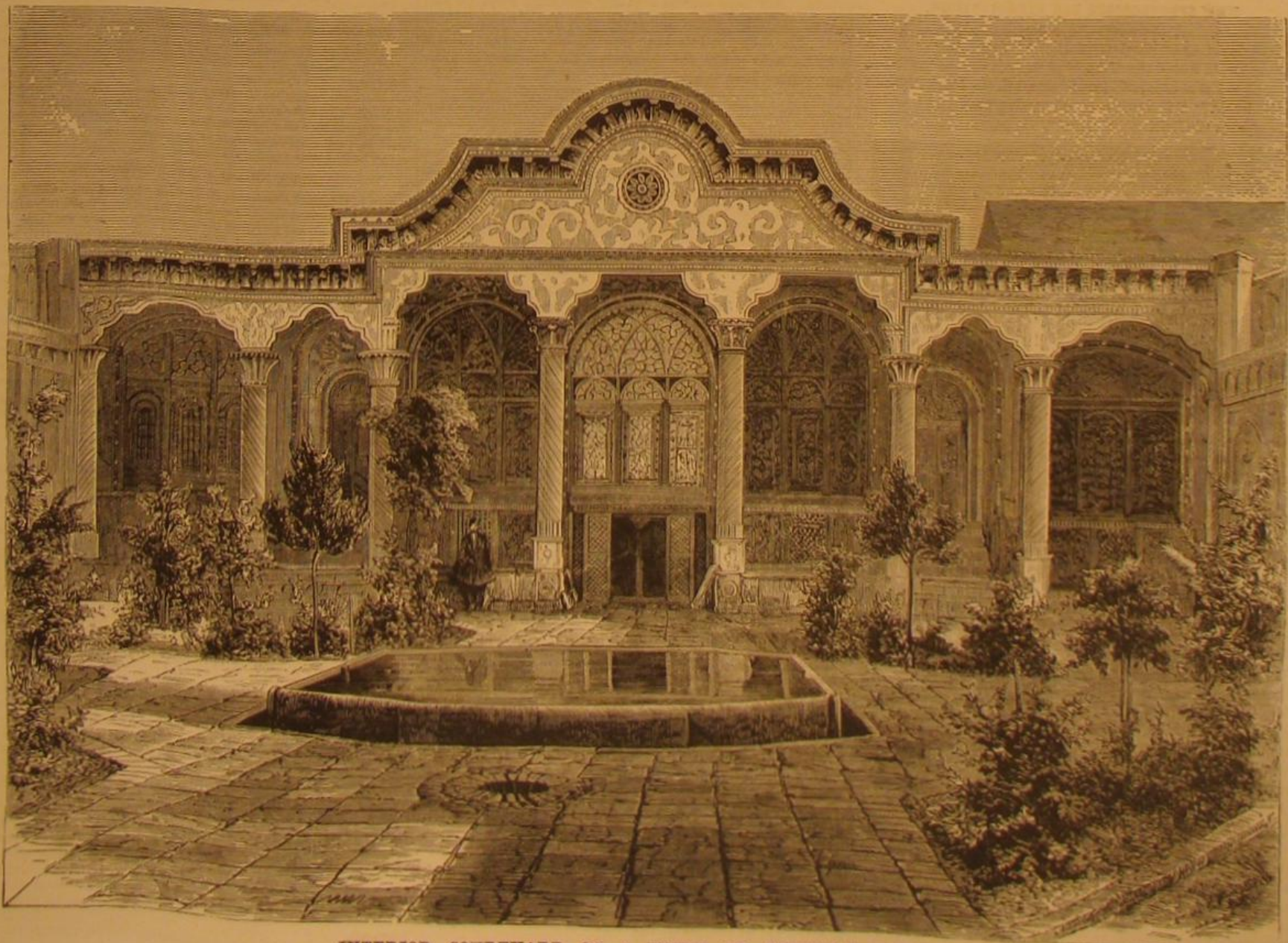
Some Astronomical Notes for March.

A writer in the New York *Tribune* says that March is in many respects an important month. The sun, which has all winter long been south, is now rapidly approaching the north, and will cross the equator at 7:16 (New York time) on the morning of March 20. This point is called the vernal or spring equinox. Many of our young readers know that there are two equinoxes in a year, the verbal equinox in March, the autumnal in September. A simple illustration will probably help them to understand better the meaning of the terms equinox and equinoctial points. Take two large hoops. Place one inside the other, and hold them horizontally. Now tilt the inner hoop a little, so that half of it is above and half below the other hoop, which remains horizontal. Let the latter represent the equator; then the tilted hoop will stand for the ecliptic round which the sun travels in a year. A glance at the two hoops will show that the ecliptic can only cross the equator at two points. These are known as the equinoctial points, and also as the equinoxes,

because when the sun is in these points the days and nights at all places are supposed to be equal. Not that they are exactly equal then, though they would be if the sun were only obliging enough to stay on the equator when it reached it. As a matter of fact, however, the sun's motion north or south when crossing the equator is more rapid than in any other part of his path, and so the days and nights are not quite equal at the equinoxes. Take the equinoxes this year as examples: At New York, on March 20, the sun rises at 3 minutes past 6 A.M., and sets at 12 minutes past 6 P.M., making the day 12 hours and 9 minutes long. Since the sun sets on the 20th at 6:12, and rises on the morning of the 21st at 6:02, the night of the 20th is only 11 hours and 50 minutes long, or 19 minutes shorter than the day. Again, on September 22, the sun rises at 5:48 A.M. and sets at 5:57 P.M., the day being 12 hours and 9 minutes long. But as the sun rises at 5:49 A.M. on the 23d, the night of the 22d is only 11 hours and 52 minutes long, or 17 minutes shorter than the day.

The place in which the sun crosses the equator in Spring is also known as the first point of *Aries*. *Aries* is the constellation of the Ram. But when on the 20th of March this year the sun crosses the equator, it will be in the constellation of The Fishes, almost in a direct line beneath the Alpherat and Algenib in the square of Pegasus. Why do astronomers call this place, then, the first point of Aries? Well, the two points in which the sun crosses the equator are not stationary, but are changing every year. The earth is like a big top spinning around on its axis at a great rate, and at the same time running around the sun along that tilted hoop called the ecliptic. But the top isn't quite steady; as the boys would say, it wobbles a little bit, and the effect of the wobbling is to make the equinoctial points go backward a trifle every year. This going backward—or from east to west—of these points on the equator is called the precession of the equinoxes. But some bright reader will say: "Precession means going before, and these equinoctial points go backward! Why not call it retrogression of the equinoxes?" Well, perhaps that would be a better title; but "precession" here means that the equinox of to-day "precedes" that of to-morrow; that of to-morrow "precedes" or is east of the place of the equinox the next day, and so on. This change of place is constantly going on, but so slowly that it only amounts to 50½ minutes of arc in a year—a quantity so small that it will take nearly 26,000 years for these points to go entirely round the equator.

The man who first found out about this precession of the equinoxes did it a very long time ago. His name was Hipparchus. He was a disciple of the great school of Alexandria, and lived about 140 years before Christ. And he found it out in this way: Some 170 years before his time another astronomer named Timocharis had calculated the distance of



INTERIOR COURTYARD OF A HOUSE IN TEHERAN, PERSIA.

Spica, in the Virgin, from the sun at the time of the autumnal equinox. Hipparchus also measured this distance and found it to be greater than Timocharis had made it. The difference between the two measurements was too large to lead him to suppose that Timocharis had made a mistake, and he was thus forced to the conclusion that the sun and Spica were really further apart than they were a hundred and seventy years before. And he found further that by dividing this difference by the number of years which had passed since the first measurement was made, the annual precession was 49 minutes—which was only a very little wrong. Now, in the days of Hipparchus the sun really was just entering the Ram at the spring equinox, which was then, therefore, the first point of Aries. In the 2,000 years since this point has gone westward nearly 28 degrees, which brings it into the constellation of The Fishes; but the old name has not been changed.

"Hipparchus was a very clever astronomer," says the writer. "It would take too much room to tell all about him, but I may mention one other good thing he did: he made a catalogue of the principal stars—the first of its kind—and calculated their positions. This passed three hundred years later into the hands of another old astronomer named Ptolemy, who made a better catalogue, which has been very valuable in enabling modern astronomers to find out the changes which have taken place in the apparent places of the stars during the past two thousand years."

The first point of Aries is important, because it is the point from which the right ascensions of all the heavenly bodies are reckoned. To mark places on the earth we speak of their longitude and latitude. The position of a star is expressed by its right ascension and declination. Declination means distance north or south of the equator. Right ascension is the distance from the first point of Aries measured on the equator, always to the east, and is usually stated in time, one hour being equal to 15 degrees of arc. In consequence of this going backward of the equinoxes, the right ascensions of all the stars are constantly increasing, and will of course go on increasing till the first point gets back to Aries, or right ascensions are reckoned from a fixed point.

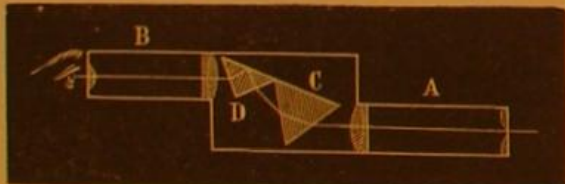
Orion is still the most conspicuous constellation, and may be found in the southwest soon after dark, with Sirius in the Great Dog nearly south. Other prominent stars visible on fine evenings are Mirfak in Perseus, Alcyone in the Pleiades, Aldebaran in the Bull, Capella in the Wagoner, Procyon in the Little Dog, Castor and Pollux in the Twins, Regulus in the Lion, Arcturus in the Hunter, and Spica in the Virgin. The moon is in conjunction with Jupiter and Mars on the 7th, and will occult one or two of the smaller stars in the Pleiades a little after 9 o'clock (Washington time) on the evening of the 19th.

[For the Scientific American.]

NEW SPECTROSCOPE FOR DIRECT VISION.

BY PROFESSOR A. RICCO.

This instrument consists of the following parts: A is a collimator, in which the distance of the slit for the admission of light to the achromatic lens is equal to the focal distance of the latter. C is a prism of dispersive flint glass, which decomposes the light of the beam made parallel by the colli-



mator. D is a prism for total reflection, which sends the decomposed light into the telescope, B, parallel to the collimator, A. If the field of view of the telescope will not hold the whole of the spectrum, the prism, D, is made to turn about an axis passing through the middle of the hypotenuse of its base by means of an external lever. By this means the different parts of the spectrum will be successively reflected into the telescope.

On account of its simplicity, this spectroscope is very easily constructed; and by reason of the shortness of the path which the light passes over in the glass, the loss of light is less than that which takes place in a five-prism Amici spectroscope for direct vision.

Modena, Italy.

Metallotherapy—Another Deception.

When the blue glass believers become tired of their hobby, as many of them doubtless already have of mesmerism and "movement," "grape," "will," and other "cures," which from time to time have furnished sensations for the gullible or held out vain hope to the afflicted, they will find a new field for their credulity in the metal cure lately invented in France, and which, according to one of our best French contemporaries, is working miracles. Here are some examples: A young woman was totally paralyzed over her right side. Her body was utterly devoid of feeling; and a sharp needle thrust in her body attracted no notice. Dr. Burg simply gave her a cylinder of gold to hold in the hand, she being blindfolded. In fifteen minutes, she felt a pin prick, then recognized the touch of a plurality of objects, and regained perfect sensibility. Another patient had her left side paralyzed. This called for a copper cylinder, whereupon she too was cured. Then a venerable lady, whose jaw was in a similar unfortunate condition, was cured by a lump of iron under her tongue and a bandage of iron plates on her

head. It should be observed that interchanging metals upon these people did not produce good results. Their "systems" required the metals named, and no others.

Cause, of course, electricity, it being the fashion to use that much-misused word to explain anything which is not readily comprehended, from blue glass radiations to love. "Electric homoeopathy" our contemporary calls this latest deception, while devoting several columns to its grave consideration.

The Obnoxious Franking Privilege Again.

The Sundry Civil Appropriation bill, which was hurried through Congress during the closing hours of the late session, has been made the means of putting through a measure, tacked on as an amendment, which is meeting with the wholesale reprobation that it deserves. It is a resurrection of about the worst feature in the hitherto defunct franking privilege—namely, that of allowing members of Congress to send public documents free through the mails. Luckily the period fixed by law wherein the postal service of the country can thus be turned into an express agency for Congressmen expires on January 1 next; so that, even if the measure be not repealed before that date, public opinion concerning it is sufficiently strong to prevent its subsequent renewal.

We have frequently pointed out how great an imposition on the government any such privilege as this is. The mere sending of Congressmen's letters is in itself no particular burden to the mails; but when it comes to forwarding tons of electioneering documents already printed, and now distributed at the cost of the people, or private packages, or even wash clothes (as used to be the case), and the brunt of all to be borne by a service already working under a deficit, the practice degenerates into an abuse, and there is no reason for its existence. Now, we suppose, the average member will flood his constituents with Patent Office reports and copies of his speeches in lavish profusion, and in marked contrast to his careful distribution of such favors when he had to pay the postage. Government presses will accordingly be kept running, and the people will lose, not only the member's small contribution to post office expenses, but will pay for the production and transportation of some thousands more useless books, which will follow their usual short circuit from the press to the paper maker.

And that is not all; pension agents, land agents, patent agents, and others doing business in Washington, will probably avail themselves of some friendly member's stamp or signature in mailing broadcast their circulars, etc. This was done before, and human nature has not changed.

Blue Glass in a Nut Shell.

General Pleasonton's blue glass theory is assailed by the SCIENTIFIC AMERICAN. His idea that electricity is generated by the passage of light through the glass is declared to be absurd. Nor have colored rays any beneficial effect on life, the reverse rather being the truth, as a pure, white light is best. The only good that can possibly come of blue glass is in its use as a shade for decreasing the intensity of solar light.—New York Sun.

PUBLISHERS' NOTICE.

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

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

In the article on the oleo-margarin industry in our last issue, the statement that "mixed fat of all kinds" is used should read "mixed beef fat"—this being the only variety employed at the factory described.

Inventions Patented in England by Americans.

From February 3 to February 19, 1877, inclusive.

ARTILLERY GAME.—W. Rose, New York city.
CIGAR MACHINERY.—J. F. Pygh, Philadelphia, Pa.
CIGAR-MAKING MACHINE.—J. S. Winsor, Providence, R. I.
CUTTING PIPES, ETC.—A. C. Wood, Syracuse, N. Y.
DRESSING MILLSTONES.—W. Griscom, Pottsville, Pa.
FIRE ARM, ETC.—E. T. Starr, New York city.
FRICTION COUPLING, ETC.—A. K. Rider, Walton, N. Y.
GAS STOVE, ETC.—E. B. Cox, Brooklyn, N. Y.
LOCK STITCH SEWING MACHINE.—C. F. Hollis, Boston, Mass.
MAKING SAWS, ETC.—G. F. Simonds, Fitchburg, Mass.
PADDLE WHEEL.—W. C. Thompson, Tipton, Tenn.
PAPER PULP BOX, ETC.—S. Wheeler et al., Albany, N. Y.
PARING APPLES, ETC.—G. Berger, Washington, Mo.
REFRIGERATOR, ETC.—C. L. Baker et al., New York city.
ROTARY ENGINE.—J. C. Thomas, Carlinville, Ill.
SCHOOL SLATE, ETC.—J. W. Hyatt et al., Newark, N. J.
SEWING MACHINE.—C. H. Wilcox, New York city.
SHUTTLE.—W. Beatty et al., Gray, Me.
SPINNING FRAME.—G. Draper et al., Hopedale, Mass.
YARN-WINDING REGULATOR.—S. Jackson, Lawrence, Mass.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHICLE GEARING.

David G. Wyeth, New Way, O.—The object of this invention is to provide a vehicle gearing in which a reach, fifth wheel, and ordinary form of bolster are dispensed with. The springs are coupled in pairs, and arranged in a triangular relation to the rear axle. The rear clips and front bearings of the springs are also constructed in a peculiar manner. For particulars, see patent.

IMPROVED MACHINE FOR JOINTING STAVES.

Edmund W. Gillman, Long Island City, N. Y.—In this device two rotary concave cutter disks are arranged facing each other, upon a single shaft, each disk being provided with knives arranged tangential to a circle of small diameter described from the center of the disk. A casing surrounds each disk, which is connected with an exhaust fan for removing the shavings. Adjustable guide plates are attached to the side of the casing for supporting the stave, and there is a pivoted frame for carrying the stave centering and clamping apparatus. The machine includes a device for centering the staves, and for clamping them while being jointed; and also an adjusting device, by means of which the ends of the staves may be narrowed more proportionately in wide staves than in narrower ones; and means for inclining the stave in opposite direction to give its edges the proper bevel.

IMPROVED FLOOR CLAMP.

William H. Tarrant, Eau Claire, Wis.—This clamp may be used for laying single or double flooring. It consists of an eccentric cam and lever that operate jointly a sliding bar for pushing the flooring board and spring-actuated and serrated cam levers that bind on the joists for securing the clamp frame rigidly in position during work.

IMPROVED SNOW GUARD FOR ROOFS.

George F. Folsom, Boston Highlands, Mass.—This consists of a wire bent at right angles at one end and sharpened, so as to be readily driven into the roof boards. At the other end it is bent in the opposite direction, and formed into a loop of peculiar shape, which projects upward from the roof, and is provided with a tongue which is capable of retaining a plate of metal, which will retain the snow until it melts, thereby preventing the sliding of large quantities of snow in a mass from the roof.

IMPROVED GANG SAW MILL.

Dudley J. Marston, Amesbury, Mass.—This relates to that class of gang saw mills that employ a series of vertically reciprocating saws for cutting a number of boards simultaneously from a log. The advantages claimed are, that long and slender logs may be sawed without difficulty, as the force is exerted equally from above and below. The gates, having oppositely arranged cranks, counterbalance each other, so that jarring is avoided, and the speed may be increased, and the strain on the frame being lessened, it may be made lighter than the frames of ordinary mills.

IMPROVED MACHINE FOR JOINTING STAVES.

Joseph S. Milton, Bardonia, Ky.—This consists of a swinging stave-supporting or bed frame, with ratchet shaped guides, operated by a hand lever, and swinging in guide grooves of the main frame. The stave is pressed against curved adjustable seats and held in bulged shape by a cam lever and spring ratchet, for being jointed by a plane guided along the table of the machine.

NEW TEXTILE INVENTION.

SOFTENING AND CLEANSING ANIMAL AND VEGETABLE FIBRE.

William Maynard, New York city.—This invention relates to the use of detergents previous to bleaching, by which cotton, silk, wool, and grasses (such as hemp, flax, etc.) may be softened, decolorized, and cleansed, without boiling and with greater economy of time, labor, and materials. The process consists in the use of sulphuric acid, hydrated, mixed with a centralizing proportion of an alkali, but principally soda, which mixture is used instead of a solution of the crystallized sulphite salt, and possesses peculiar advantages over the use of the latter in that it obviates the time, labor, and expense of crystallization, is much more effective in its actions, does not injuriously affect the fiber, and is not subject to the deterioration incident to the use of the crystallized sulphites, which, when kept, rapidly oxidize and pass into the sulphates.

NEW MISCELLANEOUS INVENTIONS.

PREVENTING ACCUMULATION OF CARBON IN RETORTS.

Watson Karr, Frostburg, Md.—The process consists in using a small quantity of semi-bituminous coal with the ordinary bituminous or soft coal in the retort. The hydrogen gas produced from the semi-bituminous coal combines with the carbon from the bituminous coal which would otherwise be deposited upon the roof of the retort. The process saves the labor and time required for removing the carbon formations from the retort in the usual way, and likewise avoids the consequent injury to the retort itself, so that its durability is greatly increased.

IMPROVED BALE BAND TIGHTENER.

John L. Sheppard, Charleston, S. C.—The object of this invention is to provide an improved device or apparatus for bringing together the ends of cotton bale bands and taking up the slack while the bales are in the press. The same consists in vertical sliding bars, attracted respectively to the front side of the platen and bed of the press, and provided with slots, or otherwise so constructed as to enable them to clutch the ends of the band, so that when they are slid towards each other the band will be tightened and the slack taken up.

IMPROVED STOCKING SUPPORTER.

E. Louise Demorest and Thomas W. G. Cook, New York city, assignors to W. Jennings Demorest, of same place.—This consists in the combination of a clasp pin attached to the ends of an elastic strap by means of clips, and a combined clasp pin and buckle that receives the elastic strap, which is double. The clasp pins at the lower ends of the elastic strap are fastened into the stocking, and the clasp pin that is attached to the buckle, is fastened to the under garments.

IMPROVED TOY WHIRLIGIG.

Charles E. Steller, Milwaukee, Wis.—This toy is so constructed as to give a rapid rotary motion, first in one direction and then in the other, to objects placed upon the revolving table or disks, to cause said objects to represent various beautiful and fanciful forms.

IMPROVED VETERINARY SURGICAL INSTRUMENT.

Lewis Woods Hamilton, Pendleton, Oregon.—This instrument is specially adapted for use in castrating animals. It consists of nippers having cup shaped jaws, and cutting blades which are formed on the opposite end of the same levers. Said levers are pivoted together intermediate of the nippers and shears, and the shanks of the latter are provided with a finger-loop and guard.

IMPROVED SAFETY GUARD OR COCKEY FOR HARNESS.

Fayette W. Knapp and Christopher Schallhorn, Fiddletown, Cal.—This consists in a peculiar construction of the cockey which connects the trace with the single-tree. The eye which embraces the single-tree is swiveled to the yoke, which is attached to the trace, and is provided with a spring-actuated follower, between which and the end of the eye the hook which is upon the end of the single-tree is embraced. The invention was described and illustrated on p. 118, vol. 36.

IMPROVED FLY BRUSH.

Daniel H. Mowen, Greencastle, Pa.—This consists in the arrangement of a vertical shaft carrying a horizontal brush arm, a lever for moving the same, and a clamp for attaching it to a table or chair. The said shaft is provided with a spring for returning it to its normal position after it is moved by the lever. There is also a new adjusting device, by which the brush arm may be readily adjusted to any height on the vertical shaft, and by which the said arm may be made to project more or less from the vertical shaft.

IMPROVED GAS TORCH.

Albert R. Weiss, Brooklyn, N. Y.—This consists of a gas-lighting torch worked by a fulminate ribbon, whose pellets are fed and ignited by a suitable mechanism. The latter consists of a sliding sectional piston rod, operated from a trigger of the handle guided in a curved tube, and reset by a spring of the feeding device.

IMPROVED REIN SUPPORT.

Joseph L. Ryder, Islesborough, Me.—This device is made of a single piece of metal bent to form a central guide piece, eyes, and guard tongues. It prevents the reins getting entangled under the whiffletrees, or under the horse's tail.

IMPROVED MIDDINGS SEPARATOR.

Peter Muller, St. Charles, Mo.—This consists in suspending the frame of a middings purifier by straps, and providing it with a cam wheel, pawl, shaft, and springs, arranged to reciprocate and jar the frame transversely to the flow of the material.

IMPROVED ELECTRIC LIGHTING APPARATUS FOR LAMPS.

Prof. William H. Zimmerman, Chestertown, Md.—This is a novel construction of self-lighting lamp, based upon the general principle of the employment of a hydrogen gas generator, together with a galvanic battery, in which the battery current heats a platinum wire red hot to ignite the jet of hydrogen, the flame of which latter impinges against and ignites the wick of the lamp. The invention consists, mainly, in locating the gas generator and the battery in twin supporting sockets attached to the brachial slide carrying the lamp, and in rendering the various vessels to be filled capable of independent support in upright position while being filled; in addition to which, the invention further consists in novel means for simultaneously bringing into operation both the gas generating apparatus and the battery, and instantly effecting the generation of gas, the flow of the electric current, and the lighting of the lamp. The self-lighting devices may be applied with slight modifications to all forms of lamps as well as to gas brackets.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HORSESHOE MACHINE.

John W. Chewing, Jr., Shadwell Depot, Va.—The present invention is an improvement upon that for which letters patent of the United States were granted to the same party August 26, 1876 (No. 181,641). The improvement relates to the construction of the contact surfaces of the swaging die and the combined former and ejector; also to the mechanism for reciprocating the swaging die.

IMPROVED CHAIN PROPELLER FOR VESSELS.

William B. Whiting, Milwaukee, Wis.—This invention is an improvement in that class of chain propellers in which the boat is bisected by a central longitudinal opening in which the chain propeller is arranged. The novelty consists partly in the improved construction of the propeller, designed with a view to strength and smoothness of operation; and also in arranging the endless chain propeller about an inclined compartment connecting the two portions of the boat upon opposite sides of the central channel, which compartment rises toward the stern so as to secure the double result of facilitating the return of the paddles to the forward end of the boat upon the inclined deck railway, as well as the withdrawal of the paddles vertically from the water, which obviates the carrying of "dead water."

IMPROVED QUILTING ATTACHMENT FOR SEWING MACHINES.

John Douglass, Millport, Mo.—The quilting frame is attached to and pendant from a traveling carriage, which is supported upon an extensible horizontal beam or frame, in such manner as adapts it to be used in connection with a sewing machine. The quilting frame is moved back and forth to carry the quilt under the needle and return, and may be hung up out of the way when not required for use. The beam on which the carriage runs may be easily taken down when required.

IMPROVED APPARATUS FOR CONVERTING MOTION.

Peter Gregersen, Wauzeka, Wis.—This is an apparatus for converting reciprocating motion to continuous rotary motion; and it consists in the combination of movable racks with a sliding frame that is attached to the piston rod of an engine. The device also consists in a mutilated pinion that meshes with the movable racks, and is provided with a double cam, by which the motion of the shaft rotated by the said racks is reversed.

IMPROVED MACHINE FOR SHEARING SHEET METAL.

George Summers, Niles, O.—Threaded rods are provided upon which the feet are formed. These feet are fastened to the fixed jaw of the shears by means of bolts, and project therefrom at right angles. Guide plates are fitted loosely to the rods, and are held in place by means of nuts. Several sets of guide plates may be provided, that increase in height as they are placed farther from the blade of the shears, so that a number of widths may be cut without readjusting the gage.

IMPROVED EARTH AUGER.

James McCullough, Pensacola, Fla.—By turning the center shaft in one direction, the auger is opened for work, taking in the sand, earth, and water, and retaining the same, by turning the shaft in opposite direction and closing the openings of the auger by a valve. The auger is then raised for being emptied, the center shaft being attached to the auger, to prevent displacement of the valve in vertical direction by a collar, keyed to the shaft below the yoke.

IMPROVED EARTH AUGER.

Edward Cox and Henry Cox, East St. Louis, Ill.—This consists of a box auger attached, by a yoke, to a vertical shaft, at the upper end of which another yoke is attached that is made to revolve by bevel gearing. The upper yoke is provided with a horizontal shaft, having at its outer end a pinion that travels upon a series of cogs formed at the edge of the circular openings in which the yoke is suspended. An endless chain, carrying buckets, passes over a pulley on the horizontal shaft and around a pulley in the yoke that supports the auger. The whole is supported by a derrick, which is provided with a windlass for raising and lowering.

IMPROVED COTTON CLEANER.

James A. Bowers and Milton Adair, Princeton, Ark.—This consists of a slotted and ribbed stationary concave and a revolving cylinder with beaters, combined with a feeding and discharging case, in which the cotton feeds from a hopper at the top and escapes at the side, while the dirt and trash which are beaten out of the cotton by the beater cylinder and ribbed concave fall through the spaces and escape.

IMPROVED WATER ELEVATOR.

John F. Long, Bridgewater, Va.—This consists in the arrangement of two pulleys, one placed in a curb over a well, and the other at the bottom of the well, over which runs an endless belt carrying buckets that dip up water and deliver it to the spout in the curb.

IMPROVED WATER ELEVATOR.

Thomas J. Held, Lexington, Ind., assignor to himself and John Mallick, of same place.—This relates to that class of elevators that employ a windlass and bucket for raising water. The windlass has two drums, of different diameter, journaled in the upper portion of the curb. Upon the larger drum a rope is wound, by which the bucket is raised or lowered, and upon the smaller drum a strap is wound in a contrary direction, which is attached to a curved lever, by which the elevator is operated. There is also an arrangement of wire guides for the buckets, that extend from the top to

the bottom of the well. A slide runs upon the said wires, to which the bucket is hinged, and a catch receives and retains the slide when the water is emptied from the bucket.

IMPROVED STEAM GAGE.

Frederick H. McIntosh, Atlantic, Iowa.—This invention consists of a steam gage, whose pressure-indicating spring rod is guided in a screw sleeve at the top, which screw adjusts the tension of the spring until indicating the correct pressure. A link is screwed on to the threaded end of the pressure rod to apply the scales to the gage.

IMPROVED WATER WHEEL.

Elihu B. Shattuck and Isaac Stahlman, Mount Pleasant, Mich.—In this device it is claimed that increased power is obtained, the water freely discharged, and a larger percentage of the water power utilized. The invention consists of a double wheel, in which the buckets of the upper wheel connect with an inner tube and spiral buckets around the shaft, while the lower wheel connects with an outer cylinder or tube. The wheel is concave or dishing, and provided with vent holes at the top to accelerate the discharge of the water.

IMPROVED PILE DRIVER.

John Gregg, Riverton, Iowa, assignor to himself and James Miller, of same place.—When this device is used as a pile driver, guy-ropes are fixed in eyes attached to the ends of the bolt, on which the pulley sheave works, and the derrick is inclined, so that its top is directly over the place when the pile is to be driven. A clamp is then loosened, and guides are allowed to swing into a vertical position, where they are secured by the clamp engaging braces. The weight is raised by turning the windlass by means of a lever, a rope being attached to it, and running over the sheave, and attached to the hammer moving in the guides.

IMPROVED METHOD OF PROPELLING BOATS.

Albert Belz, Appleton, Wis.—The paddle wheel shaft is provided with ordinary paddle wheels. A spur wheel, which is keyed to the shaft and takes its power from a similar wheel, which is fixed upon the shaft. Cranks are placed on opposite ends of the shaft, and are worked by hand levers. The whole apparatus may be easily detached from the boat when desired.

IMPROVED BALANCED VALVE FOR STEAM ENGINE.

William Jackson, Millersburg, Pa.—This consists of a valve the back of which is beveled, and whose central or exhaust space extends to the rear in a beveled cover placed at the back of the valve, between which and the valve seat the valve moves. The whole is inclosed in the steam chest, and all of the exposed sides of the valve are subjected to the same pressure, so that the valve is balanced, and little power is required to move it.

IMPROVED ROTARY ENGINE.

John C. Thomas, Carlinville, Ill.—The wheel or disk within the casing has deep transverse grooves in which radial pistons work, the rods of which pass through stuffing boxes in the wheel. The rods are attached to hollow boxes in which are springs which act upon bars. Said bars pass through slots in the boxes and through slots in the radial bars or spokes of the wheel and connect.

IMPROVED HEMMER FOR SEWING MACHINE.

Charles L. Goethals, Los Angeles, Cal.—This is an improved adjustable hemmer for sewing machines, by which folds of different widths may be hemmed and the fabric fed in regular manner to the needle after being started. The invention consists of a base part, with sliding folding part, that folds and feeds the fabric to the needle, and a pivoted guide piece, that regulates the folding of the fabric.

IMPROVED PUMP.

Swan Petersen, Knoxville, Ill.—The lower and the upper pump stock are coupled together by a tube joint. A rim extends around the tube immediately between the ends of the pump stocks, which are tightly seated against the rim by packing rims. The strong and rigid connection of the pump stocks is obtained by projecting metallic lugs, secured by bands extending around the ends of the pump stocks. The lower pump stock is secured to the walls of the well by a brace, which is rigidly wedged in place. The convenience of releasing the brace and taking out the lower pump stock for repairs, as well as the reliable and effective working of the pump when properly coupled at the tube joint, furnishes a pump of substantial, durable, and convenient construction.

IMPROVED ROTARY ENGINE.

Hodgen I. Willson, Harrisville, Tex., assignor to himself and L. J. Russell, of same place.—The operation of this rotary engine is as follows: Steam passes through a passage in a rocking valve on the upper side of the cylinder, and through one or two passages in said cylinder into the steam chest; thence through a port in a side valve, and through a passage in a guide, and into the cylinder by way of a passage in the abutment. When the piston has moved through a half revolution, a cam quickly shifts the rocking valve, so that steam is admitted to the other of the two passages. The steam acts upon the piston, shifting the abutment, and admitting steam to the cylinder, forcing the piston through the remainder of the stroke. While this takes place the steam from the first passage is allowed to pass into the exhaust.

IMPROVED WATER WHEEL.

Nelson L. Greene, Edmeston, N. Y.—By new devices in this wheel, a body of water of varying cross section may be thrown without obstruction or diminution of power on the wheel. The escape of water at the top of the casing is also prevented, and a full utilization of the reaction of the water at the lower part of the wheel is claimed to be obtained.

IMPROVED TRUSS BRIDGE.

Lyman W. Densmore, St. Joseph, Mo.—The principal novel features of this bridge are: First, forming the truss chord of metallic rods having their ends extended past each other and through the girders or couplings, and fastening them upon the opposite sides of said girders or couplings by means of nuts; the chord rods being increased in number toward the center, but always arranged about a common center of tension; and secondly, the fastening of one of the tension rods in each panel, whose struts carries a cumulative horizontal thrust to an independent angle block carrying said strut; and thirdly, the particular arrangement of a detachable girder beneath the couplings.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN HARVESTER.

James Plenkhar, Columbus, O.—The corn stalks are severed close to the ground and carried back on to a platform by means of a rotating arm, and a vibrating carrier provided with hooks or curved arms. The platform is made in two parts, of elliptical form, each of which turns horizontally, and tilts to discharge the "shock" upon the ground. The platform is tilted by a suitable device under the control of the driver.

IMPROVED SEED PLANTER.

James H. Sale, Boydsdale, Ky.—This invention belongs to that class of seed planters in which a given quantity of seed are lifted from the hopper by means of a pivoted reciprocating seed cup, and are dumped into a pipe or chute leading to the furrow. The improvements consist, mainly, in the particular construction and arrangement of the feed bars, hollowed out at their upper ends to form seed cups, which bars are pivoted below to the cranks of the main driving axle and extend upwardly through openings in the bottom of the seed box, in which openings they loosely slide, and about which point the feed bars also oscillate as a fulcrum from the revolution of the

cranks carrying the bars below, so that the upper ends of the bars, provided with the feed cups, have a compound motion which causes them alternately to rise and move forward to dump the seed, and then recede toward the center of the box and descend to be filled again.

IMPROVED RECIPROCATING CHURN.

John Henry Sheffer, Cairo, Ky.—This relates to gearing for converting the rotary motion of a hand crank into the reciprocating motion required for driving the dasher. It consists in a crank disk that is attached to a shaft that is journaled in a standard attached to the churn cover, and driven by spur gearing turned by hand power. There is also a slotted cross head that is driven by the crank, and is connected with a jointed dasher rod.

IMPROVED HARROW.

Charles Keechener, Roseville Junction, Cal.—The new feature here is a harrow section formed of converging rods connected by cross rods, the other rods having their nearer ends hooked, and the inner having their farther ends hooked. The middle rod is provided with a hook at one end and an eye at the other end, so that by alternately reversing the sections they may be connected at the sides as well as in alignment.

IMPROVED CORN PLANTER.

August J. Hintz, Lemont, Ill.—In using this planter, the jaws are thrust into the soil up to a stop attached to a stationary jaw. The upper end of the planter is then carried forward, which swings the stationary jaw backward, allowing the seed to drop into the soil, and, at the same time, loosening the soil, so that it will fall into the hole formed by the jaws as the same are withdrawn. As the jaws are withdrawn from the soil a spring closes the said jaws, ready to be again thrust into the soil, and, at the same time, draws forward an arm, bringing the dropping hole within the body, to be again filled with seed.

IMPROVED CORN PLANTER.

Jesse G. Stokesbury and John H. Stokesbury, Millersburg, Iowa.—This corn planter is so constructed as to drop the seed automatically as the machine is drawn forward. It is easily controlled, and enables the hills to be planted in accurate check row.

IMPROVED HAY GATHERER.

Harlin Butner and James J. Ray, Clarence, Mo.—This is a rake for collecting the hay and drawing it to the stack. It is so constructed that the weight of the load will raise the points of the teeth from the ground, so that they will not catch, and so that it may be readily withdrawn from the load when desired.

IMPROVED SHOVEL PLOW.

Thomas H. C. Dow, Tampico, Ill.—This implement is so constructed that it may be adjusted for use as an ordinary shovel plow, or turned toward either side to form a right or left hand plow, as the particular work to be done may require.

IMPROVED COTTON PLANTER AND FERTILIZER DISTRIBUTER.

Joseph A. Shine, Mount Olive, N. C.—This machine is so constructed as to open a furrow, distribute cotton seed and guano into it, and cover the seed. It includes a new construction of the hopper and attached mechanism.

IMPROVED FARM FENCE.

Charles Cremer, Red Bluff, Cal.—This fence is made without posts or nails, and is so constructed that it may be used as a stock fence, as a protector for young hedges, and as a sheep shed. It is not liable to be pushed or blown over. To the notched outer edges of the supporters the side boards are attached. Said boards are beveled at their ends to overlap each other edgewise in said notches, and are secured to each other and to said supporters by wires.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FOLDING CHAIR.

John A. Ware, Morris, Ill.—It consists of a chair having the rear legs and back made in one piece with a seat hinged to the same at the rear and free to fold upwardly at its front; in connection with which elements are arranged a set of front legs with tenons at their upper ends which enter mortises in the chair seat, the said front legs being connected with the seat and back by means of side braces pivoted to the front legs, the middle part of the seat, and the back of the chair, and provided with an upwardly folding toggle joint whereby the parts of the chair may be folded compactly, and in such manner as to stand alone upon its four legs.

IMPROVED FRUIT JAR.

Adam Dicker, Middletown, O.—This is a fruit jar composed of black opaque glass, which excludes light from its interior. It combines all of the advantages of transparent glass, metal, and earthenware, with none of their disadvantages—i. e., it prevents the fading and deleterious effect of light upon the fruit incident to transparent jars, obviates the corrosive action and metallic taste produced by the acids of the fruit upon metal cans, is free from the clumsiness of earthenware jars, and the objectionable action of the acids upon the glaze on the one hand, or the difficulty of removing the germs of ferment on the other when left porous.

IMPROVED BUTTER DISH.

Westel E. Hawkins, Wallingford, Conn., assignor to Simpson, Hall, Miller & Co., of same place.—In this butter dish the cover of metal is made in two parts, pivoted at their angles to the opposite sides of the body of said dish, so that they may be turned down upon the outside of said body. Segmental gear wheels at the angles of the parts of the cover cause said parts to move together upon their pivots. Suitable devices are provided for fastening the cover in desired position.

IMPROVED BLANKET.

Nathaniel Wickliffe, Waterproof, La.—This consists of a couple of light blankets of wool with a lining between or outside of them of paper, laid on a sheet of gauze adapted to strengthen the paper, to prevent it from tearing by the handling of the blankets. The paper and the cloth layers are suitably fastened together detachably by buttons, to take them apart to remove the paper for washing the cloth. The paper, being of such close texture as to prevent the passage of air, makes the blanket much warmer for a given weight of material.

IMPROVED WASHBOARD.

Westly Todd, Wauseon, O., assignor to himself and H. H. Williams, of same place.—The object here is to improve the construction of the washboard for which letters patent were granted to same inventor July 18, 1876, so as to make it stronger and more durable without increasing the cost of manufacture. The improvement consists in short parallel corrugations formed along the side edges of the zinc facing, between or within the main corrugations.

IMPROVED ROCKING CHAIR.

William Shanb, Nashville, Tenn.—This consists of a rocking swing, made of round rockers secured centrally to the posts of the seats, and at the ends to the extended foot and seat rests. The seat rests are braced by inferior strengthening pieces. The swing cannot upset, and is readily portable from place to place.

IMPROVED WASHING MACHINE.

John W. Modlin, Albion, Iowa, assignor to himself and Simon C. Gillespie, of same place.—By means of a lever, a corrugated rubber is caused to work over a concave bed of rollers. By suitable construction the rubber accommodates itself to the thickness of clothes beneath it.

"Mount Union College brings thorough integral education within reach of all," said Chief Justice Chase. Departments: Classical, Scientific, Philosophical, Ladies: Normal, Music, Industrial, Fine Arts, Preparatory. Museum worth \$400,000. Board and Tuition almost nominal rates. Students, 1,000 accommodated; can earn by teaching winter all expenses of College Year of Spring, Summer and Fall Terms, without losing time. For Catalogue, address Pres. Hartshorn, LL.D., Alliance, Ohio.

Business and Personal.

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

Second-hand Achromatic Telescope, 2½ or 3 inch objective, wanted by Wm. Erwin, Groves, Fayette Co., Ind. Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Transit and Clock wanted—Box 913, Springfield, O.

For Sale—Shop rights to make and use a device for packing bottled goods in sawdust, short shavings, rice husks, etc. Send to R. T. Penick, St. Joseph, Mo., for circular.

Wanted—A Hand Hoisting Machine for Grain and Provision store. Send circulars and prices to J. H. Morgan, Ogdensburg, N. Y.

An English gentleman, of many years' experience, who will return to Europe in a few weeks, desires to negotiate with American manufacturers for the sale of their goods in England, France, and Germany. Address Field, care of James Littlejohn, Esq., P.O. Box 2703, New York City.

Wanted—New or Second-hand Iron Planer, 4 to 7 feet bed. Send cash price and description to the Galen Agricultural and Manufacturing Co., Lock Box 24, Clyde, N. Y.

\$3,000.—Wanted a partner with this amount in a Machine Shop, the inventory of which is estimated at least at \$5,000, for manufacture of patented articles. Address A. D., 353 Morris avenue, Newark, N. J.

Send for James W. Queen & Co.'s Catalogue of Drawing Instruments and Materials; also catalogue of Microscopes, Field Glasses, Telescopes, and other optical instruments. 924 Chestnut St., Philadelphia, Pa.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

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

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

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

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

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand St., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings, at about the same price. See their advertisement on page 159.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

The Zero Refrigerator was awarded a grand Centennial medal. Send for book. Lesley, 235 W. 23d St., N. Y.

See Boul's Patent, Moulding, and Dovetailing Machine at Centennial, B. 5-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.



H. B., Jr., will find a good recipe for aquarium cement on p. 332, vol. 28.—C. R. is informed that the apparent spontaneous cracking of glass tumblers is by no means an uncommon occurrence.—P. B. B. will find directions for brazing hand saws on p. 194, vol. 31.—C. H. B. will find directions for removing inkstains from clothing on p. 410, vol. 32. For polishing castings, see p. 57, vol. 34.—F. B. S. does not send data enough as to his engine. He will find a formula for ascertaining the horse power on p. 33, vol. 33. For a rule for calculating the dimensions of a flywheel, see p. 251, vol. 32.—J. P. N. will find a recipe for prepared glue on p. 43, vol. 32. For a recipe for manure, see p. 27, vol. 34.—R. P. C. is informed that the only non-conductor of magnetism is a sufficient interval of space.—E. G. will find an explanation of horse power on p. 33, vol. 33.—A. J. will find something on tempering chisels, etc., on p. 230, vol. 31.—H. L. H. should address a pump manufacturer.—H. H. will find directions for making shoe polish on p. 107, vol. 36. To season timber of all kinds, follow the directions on p. 58, vol. 32.—F. C. will find a formula for the lifting power of coal gas on p. 65, vol. 32.—C. H. B. will find directions for removing inkstains on p. 410, vol. 32. Brass castings can be polished by following the directions on p. 57, vol. 34. Steel can be etched by the process described on p. 250, vol. 37.—F. J. S. should send us a sample of the efflorescence on the ash heap.—D. W. will find a description of making gas with a hydrocarbon fluid on p. 65, vol. 32.—R. W. K. will find answers to his queries as to ice boats in No. 63 SCIENTIFIC AMERICAN SUPPLEMENT.—U. D. M. is informed that oxychloride of zinc may be used to cement silica together; but we do not think he will succeed very well with the material of which he sent us a sample.—J. C. B. can solder brass by

the process described on p. 251, vol. 28. To mend rubber boots, follow the instructions given on p. 203, vol. 30.—A. L. F. will find on p. 119, vol. 28, a recipe for a cement for mending leather shoes.—C. A. D. will find a recipe for red fire on p. 171, vol. 36.—J. D. will find directions for fireproofing clothing on p. 282, vol. 32.—A. D. A. will find directions for mounting chromos on p. 91, vol. 31. This also answers T. S. R.—G. K., who asks as to the U. S. Coast Survey, should sign his letters with his name and address.—E. C. S. will find on p. 319, vol. 33, a recipe for a cement wash for woodwork.—A. B. C. will find formulae for the passage of water through pipes on p. 48, vol. 32.—W. L. B., A. J. W., W. G. L., E. K., C. F. W., J. G., N. T., W. P. B., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) T. A. D. asks: 1. What kind, diameter, and focus should a lens be for a photographic camera to take photographs 4½ inches by 3½ inches, principally landscape views? 2. An achromatic of about 1½ inch diameter and 5 or 6 inches focus. 2. At about what distance should the lens be placed from the photographic plate? 3. Where the image will be sharpest on a ground glass, placed where the photographic plate is to be. 3. If stops or diaphragms are used, what kind is necessary and where should they be placed? 4. If the instrument is a double combination, the diaphragm should be placed midway between the lenses. If a single lens, place it in front. A piece of cardboard with a round hole in the center is all that is wanted. The smaller the diaphragm, the sharper the picture will be, and the longer the necessary exposure.

(2) F. I. E. says: I have several photographic lenses; and wishing to form some kind of instrument on the principle of the "Wonder" camera, so that objects and pictures may be projected on a screen without much trouble or expense, I would like to know how the glasses are arranged, and what kind of light is best? A. Your ¼ portrait lens is just what is wanted for the objective. Then, in addition to this, you need two condensing lenses, and (if gas or oil is used) a reflector behind the light, the same as in a magic lantern by the "Wonder" attachment.

(3) A. B. C. asks: Can stereoscope lenses, or the lenses of a small spyglass, be used in constructing the home-made magic lantern? A. The usual stereoscopic lenses cannot be used, because they are ground thicker on one side than the other. The lens of a small spyglass would do if not too long focus. It will make the picture small unless the lantern is placed at some distance from the screen. A lens of about 6 inches focus is the best; and in small rooms, even shorter focus is preferable.

(4) E. J. B. asks: Will a photographic camera, with three lenses and four inches focus, do as an objective for a magic lantern? Will the "Wonder" camera as described in *Science Record* for 1875 do? Could the object glass of an opera glass be used for the purpose? A. If the photographic combination was made for a portrait camera to be used without a diaphragm, then it will answer the purpose very well. Also the opera glass objectives may be used, either singly or in combination. If one will make the picture on the screen as large as you wish, it will give you more light than the two together.

(5) J. L. K. says: I would like to make a 1 inch hole in a window pane, and have tried several ways, but broke the glass every time. How can it be done? A. Bore a hole in the center by means of a hard steel drill moistened with turpentine. Cut the circle with a good glazier's diamond guided by a small piece of copper wire centered in the hole just bored, and by means of cuts radiating from the center to the circumference divide the circle into numerous small sectors. Then, with a small piece of metal, tap the glass on the posterior side gently, following each cut throughout its extent. When this has been properly done, fasten a piece of putty over the area of the circle on the cut side of the glass; and, while holding the putty, tap the glass on the other side firmly in the center of the circle. Too much pressure on the diamond will cause it to scratch without cutting the glass.

(6) E. B. asks: 1. How shall I treat hickory to prevent its becoming powder-post, as we term it? A. The trouble is due to a diseased state of the timber, which reduces its substance to a mass of dry dust, by the decomposition of its fibers. It is caused by the growth of a species of fungus in those parts of the timber which have not been properly dried or seasoned. One of the best preventives of this disease is a solution of corrosive sublimate forced into the pores of the wood by means of an air pump. 2. When shall I cut it? A. It is best to cut the timber in the late fall or early winter.

(7) E. T. says: In speaking of leaky roofs, you say that the best job would be to put on a new tin roof in small sheets. Which kind of tin is most durable, the leaded or dark lead-colored tin or the bright light-colored tin? A. Use the best charcoal tin, which is bright-colored, and solder the joints securely.

(8) J. H. W. says: We have had an explosion in our foundry that we are not able to explain. The shop is a frame building 50 feet square. We had not made a heat for 24 days; and when we made one and proceeded to drop the bottom as usual, the instant the doors dropped we had a tremendous explosion, breaking some 250 panes of glass. It tore a door that was standing open off its hinges, and made a report that was heard at a distance, shaking the windows in houses squares away. Our shop is quite open, and two doors were standing open at the time. The prop that the cupola man used in dropping the bottom was some 10 feet long and 4 inches square. It was shivered up just as though it had been struck by lightning. There was some ice under the cupola at the time; but we threw, as we thought, sufficient sand on it to prevent the iron coming in contact with it. Are such explosions of common occurrence in foundries? A. We imagine that explosions of such violence are not usual, although those of similar kind are not uncommon, when heated iron comes in contact with moisture. Possibly some of our readers may have knowledge of explosions quite as violent

as the one described above, and will favor us with descriptions.

(9) J. M. L. says: I wish to build an air stack with sufficient draught for two furnaces. Can you give me the proportion existing between area of stack at bottom and top and height, and the areas of the flues from furnaces? A. It will be sufficient to make the cross section of the stack equal to the combined cross sections of the flues. You can decrease the cross section towards the top if desirable, but there will probably be no advantage in doing so. Build the chimney at least 40 or 50 feet in height, and as much higher, up to 100 feet, as is convenient.

(10) J. J. says: 1. I wish to make a pair of sleigh runners. I have been told that the rim of a wagon wheel steamed and straightened out is very good to make them out of. But I do not know how to straighten them. Could not I get two pieces of oak, of the same thickness and width of a rim of a wheel, and bend them? A. When the wood is softened, secure it by clamps to a former. Perhaps it cannot be bent into shape all at once, but must be heated several times. 2. For a small 1 horse cutter, how far apart should the runners be at the bottom, and how far at the top? A. Distance between runners, 30 to 36 inches at top, and from 2 to 4 inches more at bottom.

(11) W. S. says: 1. I am building a ditcher for drain tile. It is to be drawn by a rope passing a sufficient number of times around a capstan to prevent its slipping, the free end being wound on a reel. The capstan is to be 18 inches in diameter, and the levers 12 feet from center of capstan to where the horses are hitched. What kind and size of rope will be best if two horses are used, and also if our horses are used? A. You can use hemp rope 1¼ inches in diameter for 2 horses, and 2 inches in diameter for 4 horses. 2. If wire rope should break, how can I mend it? A. By splicing.

(12) E. L. L. asks: Do the rubber covers upon telegraph instruments increase the sound perceptibly? A. No.

(13) C. F. A. asks: 1. What size of boiler should I use for an engine of ¼ inch bore and 4 inches stroke? A. Make one 12 inches in diameter and 20 inches high. 2. Can you recommend to me a book on the construction of the marine engine? A. We do not know any work that covers the construction of the modern marine engine. You will find much that is useful in Bourne's and Burgh's treatises.

(14) G. F. asks: 1. What I wish to know is how much power could I expect from an engine 2 x 5 inches, 60 lbs. pressure, 150 revolutions? A. From ¼ to ¾ of a horse power. 2. What size of boiler would I require if it were a plain cylinder, set in brickwork? A. Make a cylinder boiler with about 11 square feet of heating surface.

(15) W. H. K. asks: Which will bear the greater weight, applied laterally, a round or a square rod of metal or wood, of the same circumference? A. The round one.

(16) J. N. A. asks: What has been the highest result in foot lbs., by any steam engine, per 1 lb. of best coal? A. A horse power for 15 lbs. of coal per hour is among the best results; this corresponds to foot lbs. per pound of coal.

(17) C. P. P. says: What size of boiler would run to best advantage an engine 3 x 1¼ inches? Of what should it be made? A. You can use a vertical boiler, made of wrought iron, 10 inches in diameter and 18 inches high.

(18) C. R. W. asks: Please tell me how to calculate the number of yards of excavation in digging a pond or lake 100 feet by 80, in form an ellipse, 9 feet deep with banks sloped 1½ feet to 1 foot of depth? A. Add together the top area, the bottom area, and the area of their mean proportional, and multiply the sum by ⅓ the depth.

(19) W. L. F. says: I am making an electro-magnetic machine for medical purposes. I made a spool of wood about 5 inches long, the core of which is a hollow cylinder ¾ of an inch in diameter, containing a bundle of iron wire. For the first coil, I wound about 50 feet copper wire (insulated No. 16) around this, and separate from it. I wound about 500 feet silk insulated wire, No. 22. I connected the ends of the primary coil with 1 cell of carbon battery, but could not get a secondary current. Please tell me where the difficulty lies? A. Your arrangement will give you a secondary current by breaking and making the primary. If you require more power, increase the length of your secondary wire and use more battery.

(20) A. S. asks: I have a battery with two copper cylinders 8 inches and 3 inches in diameter, and a zinc cylinder 16 inches in diameter. What must I put in it to make it work? A. Blue vitriol and water.

(21) L. G. W. says: In making a Camacho electro-magnetic engine, can I construct the tubular magnets, and what should be the size of and length of wire used in making magnets? A. It is not worth while to make the magnets less than an inch in length. Wind each tube separately and then place one over the other. No. 23 silk covered wire will do. The turns on each tube should be in the same direction.

(22) J. S. W. asks: 1. Which will give the longest spark, an induction coil made with 2,000 feet of No. 32 wire or with 2,000 feet of No. 36? A. One with the 2,000 feet No. 36. 2. Will 4,000 feet No. 32 give a longer spark than 8,000 feet No. 36? A. No, not with same primary. 3. Which is best for the primary coil, No. 16 or No. 18 wire? A. That depends upon the size of the core and battery used. Make the resistance of primary about the same as that of the battery. 4. How long a spark ought 2,000 feet of No. 32 wire to give? A. Up to a certain limit, about 1 inch spark per mile of secondary can be obtained.

(23) A. R. asks: 1. Does the Atlantic telegraph work upon the same principle as do telegraph lines in general? It has been stated that the electricity is drawn from the cables. A. The batteries are not connected directly to the cable, but to one side of a condenser and to earth; the opposite side of condenser is

connected to the cable. 2. What is the strength of the current used? A. Ten or twelve cells is about the number used to charge the condenser. 3. What is the strength at the receiving station as compared with that at the sending station? A. About 99.5 per cent after 3 seconds contact with battery.

(24) H. S. C. says: In your answer to F. H., you say that an engine generally works more economically when running at its full capacity. This is undoubtedly true of single valve engines, as a single valve cannot cut off at less than ¾ stroke without choking the exhaust and impairing its efficiency in a greater or less degree, according to the point of cut-off. But with an automatic cut-off, or even with a fixed one, I think it can be demonstrated theoretically, as it has been demonstrated practically, that there is great economy in having considerable surplus power in your engine. A. You have misunderstood our reply to F. H. The idea we intended to convey was, that under given conditions there is a point at which an engine will work most economically. This is the point at which it should be run, a point probably far within its full capacity.

(25) I. H. D. asks: 1. Why is a chamber used in a condenser for the exhaust steam to flow in? A. With a view to economy of space and efficiency of action. 2. Could not the steam be condensed in an exhaust pipe, and this pipe be connected with the air pump? A. Yes. 3. How much pressure must be given to a jet of water in the combining tube of an injector, so that it will gain velocity enough to enter a boiler, without flowing back into the overflow? A. It depends upon the proportions of the parts. As usually made, the injector will readily force water into the boiler from which it draws its supply of steam, and could be arranged so as to force against much higher pressure than that under which it was working.

(26) G. F. asks: 1. How large an engine could I supply steam to from a plain cylinder boiler, 9 feet long and 14 inches in diameter, of ¼ inch iron? A. You can use an engine of from 2 to 3 horse power. 2. Is a plain boiler safer than one with flues? A. Not necessarily.

(27) G. L. K. asks: 1. Can steam from a boiler with 60 lbs. force water into a cold boiler? A. Yes. 2. Is it possible to get a pressure in the cold boiler above the steam pressure in the steam boiler? I have seen an injector that is said to have forced water into a boiler having 80 lbs. pressure, the injector being operated from a boiler with 20 lbs. pressure. A. Yes. The philosophy of the matter is that a great deal of steam is used, and comparatively little water is forced into the boiler. It is something like a steam pump in which the water cylinder is only ¼ as large as the steam cylinder, so that the water pressure can be 5 times the steam pressure.

(28) H. C. asks: 1. What pressure will a locomotive boiler of copper plates of ½ of an inch thick, 6 inches in diameter, double riveted, stand? A. 40 lbs. 2. How large an engine will it run with firebox 8 x 8 inches and 8 inches high, and 22 half inch tubes 12 inches long. A. Make one 2 x 3 inches. 3. Which of these two engines, 5 x 6 or 4 x 8 inches, is best for a boat 25 feet long and of 6 feet beam, drawing 6 inches at bow and 24 inches at stern? A. If you wish to compare them when running at the same power, we think the first is preferable on some accounts.

(29) O. A., Jr., says: 1. I have a steam engine with a plain slide valve. The cylinder is 7 inches bore by 9 inches stroke. Steam ports are ¼ by 5½ inches, exhaust port is 1 inch by 5½ inches. Valve travels 1½ inch; lead of valve is about ¼ inch, lap about ½ inch, cutting off at about ¼ stroke. Engine runs about 240 revolutions per minute with 70 lbs. steam. Can I get more power out of the engine by changing those proportions? A. We do not think, from your account, that there is any need of a change. 2. Which kind of a return flue boiler is the most economical in fuel and water: the boiler that will hold 1¼ barrel of water or the boiler that will hold 4¼ barrels, the heating surface being the same in both boilers, and each being of 10 horse power? A. We imagine the difference, if any, would be unimportant.

(30) G. W. A. says: We use 60 lbs. steam on a 12 x 30 inches engine, running three burrs. If we keep just 60 lbs., it is pretty hard work; and it seems easier to let the engine stand and generate 80 lbs. What is the cause of this? A. Generally, an increase of pressure decreases the steam used per horse power, so that although it takes a little more fuel to make 1 lb. of steam at the higher pressure, there are fewer lbs. used to do the same work, and the high pressure is the most economical.

(31) J. R. B. says: I propose running a boat by a screw. She is to be 16 feet long and of sharp bow; of how large a diameter should the screw be? A. Make one 18 to 22 inches in diameter and of 2½ to 3 feet pitch, with a length of blade of 5 or 6 inches. Run it at 300 or 400 revolutions per minute.

(32) C. W. H. says: A boat is 100 rods from a stationary stump. A man in the boat is pulling 50 lbs. on a rope attached to the stump to pull the boat to the stump; and two men are in two separate boats 100 rods apart. Each man is pulling 50 lbs. on opposite ends of a rope between the boats to pull the boats together. The two boats are of equal weight, and all other conditions are equal. Will the one boat arrive at the stump sooner, later, or at the same time as the two boats come together? If not at the same time, how much sooner or later? A. As you have stated the proposition, the two boats would approach each other twice as fast as the single boat approaches the stump—for the reason that the rope is hauled in twice as fast in the first instance, as there are two men hauling it in, one at each end; and in the second instance only one man is hauling in rope, at one end, at the same rate as is employed by each of the two others.

(33) J. J. T. says: I wish to build a locomotive engine with vertical boiler 2 feet high. The cylinders are to be 2¼ inches bore by 5 inches stroke. What diameter will the boiler be, and how many 1 inch tubes should I use to get the most power? How much will such a boiler, with all attachments and full of water, weigh? How much power will it develop, if well

bull, with pressure of 100 lbs. to the inch? A. The data sent are rather incomplete, but you will find rules by which you can calculate the answers to your questions on p. 225, vol. 33.

(34) S. D. C. asks: What is the complete formula for finding the radius of the earth at any place, when the force of gravity at that place, and at the equator, and the equatorial radius, are given? A. La Place's formula for the radius, at the latitude L , is: radius in feet = $20888235 \times (1 + 0.0016742 \times \cos. 2L)$. As we understand the premises in your other query, we do not think they are correct.

(35) W. S. says: I am building a model horizontal engine $1\frac{1}{2} \times 3$ inches, and wish to make a boiler for it capable of 65 lbs. pressure. What should be the size and the number of flues? A. You can make flues $1\frac{1}{2}$ inch in diameter, or less. 2. What would be the best speed to run it at, in order to get the most power? A. From 400 to 850 revolutions per minute.

(36) J. N. W. asks: How much suction power has a fan 2 feet in diameter, with four wings, 8 by 14 inches, revolving 2,000 times in a minute? The induction orifice is 1×24 inches. How many lbs. pressure can I produce at the orifice? A. If you wish more pressure than 1 lb. per square inch, it will be advisable to use some other form of blower.

(37) J. F. & G. W. M. says: There are two tanks for water located 900 feet apart. Each holds about 15,000 gallons. The bottom of one is 11 feet above level of ground and the tank itself is 14 feet high, making 25 feet from top of tank to level of ground. A pipe runs from this tank down into the ground, to sufficient depth to prevent freezing, and thence along on a level, 900 feet, to the other tank. The bottom of the last-named tank is 3 feet above top of the first-named tank, or 28 feet from level of ground. What size of pipe must I use to empty the water of the second tank into the first tank in 12 hours? What size of pipe will it take to do the same in 24 hours? A. To discharge the second tank into the first in 12 hours will require a pipe of 2 inches diameter, and in 24 hours $1\frac{1}{4}$ inches diameter. The bends in the pipe should be easy, and no contraction of size, by valves or otherwise, should be allowed.

(38) W. J. M. asks: Do steam heating pipes consume the oxygen of the air, or is a degree of heat greater than that of pipes heated by steam necessary before the consumption of oxygen begins? Why is it that in an office, if doors or ventilators be closed for a few minutes only, the air becomes very oppressive and stupefying, while the temperature is yet not very high, and not as high as could be borne without any discomfort in a well ventilated room? Would a ventilating shaft, constructed so as to draw from a register in the floor, be of any benefit, or would the air, at the height of a man's hand, remain undisturbed and oppressive? A. Air when heated expands and becomes less capable of supporting animal life, because of the limited quantity of oxygen it then contains in a given volume. The breathing of persons engaged in a sedentary employment is slow, and a dense air would afford greater aliment to the blood in their case. There is no reason to believe that steam pipes, when heated, consume the oxygen of the air to a greater extent than other heating surfaces. But there is, without doubt, a minute quantity of moisture driven from the pipes by the internal pressure, which soon renders the air humid, and this has the effect of making breathing more difficult. It is easily inferred from this that supplying fresh air brings no remedy, unless the strong dense air thus admitted is preserved in this state, without being rarefied by the heated pipes. By gradually accustoming yourself to a lower temperature, some relief may be found, or by adopting the plan of the open fireplace, you may be able the more effectually to preserve the air of your room in its natural state, neither too dry nor too humid for easy respiration.

(39) A. B. asks: What are gold and silver alloyed with at the United States mints? A. The gold coinage is $\frac{9}{10}$ pure gold and $\frac{1}{10}$ alloy. The alloy consists of $\frac{1}{10}$ silver and $\frac{1}{10}$ copper. The silver coinage also contains $\frac{1}{10}$ alloy, which is copper only.

(40) J. McT. says, in reply to M. G. P., who asks if meerschaum pipes, after they have been used a time, are not subjected to some process to bring out the color: I have seen meerschaum and imitation meerschaum pipes colored by the following process: Fill the pipe and smoke down about one third, or to the height to which you wish to color. Leave the remainder of the tobacco in the pipe, and do not empty it or disturb it for several weeks, or until the desired color is obtained. When smoking, put fresh tobacco on the top, and smoke to the same level.

(41) E. McD. asks: 1. What quantity of oil of vitriol should be used to the gallon of water, for sprinkling guano for artificial manure? A. Dilute the strong acid with about 30 parts of water. 2. Is it necessary to distribute the dilute liquid throughout the body of material, or merely sprinkle the surface? If the latter, how deep should the layer be? A. Spread the guano into a layer about 3 inches in depth, and sprinkle; then put together again. 3. What quantity of the dilute liquid would be required for 100 bushels? A. This depends upon the amount of ammonia or its volatile salts which are contained in the guano. If it contains 6 per cent, it will require about 32 pints of the acid solution, about 2 gallons to the ton. 4. Would superheated or dry steam do as a dryer? A. Heated air would be more suitable. 5. Would it be advisable to make the deposit perfectly dry, or to allow a small percentage of moisture to remain? A. You cannot hope to expel all the moisture; and it is better not. 6. If the natural state of the deposit is 50 per cent water and 6 per cent ammonia, would not the evaporation of the water double the percentage of ammonia? Yes. 7. After the deposit is dried, could it not be put up in bags and shipped without fear of deterioration? A. If not exposed to the weather or very moist air, it will not absorb moisture after drying to any extent if tightly packed in strong bags.

(42) M. B. says: Given two lamps, one with a round and the other with a flat wick, the same number of threads in each, and everything else equal, is

there any difference in the amount of light? If so which gives the most? A. There will be a difference in favor of the round wick if properly adjusted; but it will consume more oil.

(43) H. C. asks: Is there a way of softening rams' horns so as to be able to mould them? A. There is no practicable method whereby this may be accomplished.

(44) E. E. C. asks: What acids are most destructive to steel dies? A. Nitric, muriatic, and sulphuric acids attack and dissolve the metal most rapidly. Nitric, or a mixture of nitric and muriatic acids (*aqua regia*), are the proper solvents.

(45) T. H. S. says: 1. I am using a liquid made of 1 lb. sal soda and $\frac{1}{4}$ lb. lime to 1 gallon of water, which, when boiled, comes out as a lye. Of this liquid I use 2 or 3 spoonful for washing of a boiler of clothes of the capacity of 8 or 10 gallons, with plenty of water. Will the liquid be injurious to the fabrics? A. Under the conditions, the washing fluid will not injure the fabric to any extent. The fluid may be made stronger by boiling with excess of lime and carbonate of soda (sal soda). 2. I use chloride of lime in a liquid state for bleaching the cloth, letting the cloth remain in the rinsing water for an hour or more. Will the chloride water be injurious to the cloth? Please give a formula to make the chloride water of the proper strength. A. Pass the cloth first through a very dilute bath of sulphuric acid, and immediately through a bath of bleaching powder (chloride or hypochlorite of lime), made by dissolving the powder in 24 parts of cold water, and hang in a close room with as much exposure to bright sunlight as possible. When properly bleached, wash well in water and dry.

(46) C. H. B. asks: How can a sword blade be frosted? A. Clean and polish the metal, flow it quickly with dilute nitric acid; and, when the proper point is reached, wash well in running water.

(47) V. S. A. asks: 1. What will soften brushes after they are used in varnish or French dryer? A. Sweep the brushes for 24 hours in good benzole, and then, if necessary, purify by washing them with soap and warm water. 2. How can I preserve photograph proofs? A. Wash them well in cold running water, dry, and keep in a dark place. Or, after washing, fix them by immersing for a few minutes in a strong solution of hyposulphite of soda in water and wash or soak in a copious supply of cold water for 10 to 12 hours.

(48) A. P. asks: Can you furnish me a recipe to make a solution for setting the color of crayon drawings? A. Use a dilute aqueous solution of gum arabic in water, with the addition of a very little oil of cloves.

(49) A. R. asks: What can I use to repair a glass bath, that will resist nitrate of silver in strong solution? A. Warm the fractured edges of the glass uniformly, and join with fused gutta percha. The edges should be pressed firmly together and allowed to remain in the clamp for an hour, or until perfectly cool.

(50) C. asks: Will you give a chemical analysis of ox blood? A. In 100 parts of ox blood corpuscles there are: Water 68.8, solids 31.2. The solids are: Hematin (with iron) 16.75, globulin and cell membrane 0.3328, sodium 0.1052, oxygen 0.0667, calcic phosphate 0.0114, magnesian phosphate 0.0073. These blood corpuscles are suspended in a liquid containing, in 100 parts: Water 90.29, fibrin 0.405, albumen 7.884, fat 0.172, extractive matter 0.394, mineral substances 8.55.

(51) C. F. M. asks: Is there anything that will give raw hide a fine finish and at the same time be waterproof? A. Steep them in a strong, hot decoction of sumac, alum, and logwood, and dress with a mixture of beeswax, soap, oil, and ivory-black.

(52) P. S. K. W. asks: How may paper be prepared so that linseed oil will not soak into it and that the paper will remain flexible? A. Pass the paper rapidly through strong sulphuric acid and wash quickly with a copious supply of water. After drying, pass through an aqueous solution of dextrin, and then between smooth rollers heated to 500° Fah. The rollers should be under a very considerable pressure.

(53) C. B. W. asks: 1. Is it true, as a general thing, that dress goods, wall papers, etc., in which a green color predominates, are poisonous? A. No. Scheele's green (arsenite of copper), because of its brilliant hue, is often used as a pigment in painting and in designs on wall papers, but not so frequently on dress goods. 2. Is it necessary to use poisonous matters to make a green color? A. No. Fabrics which have been dyed with some of the aniline colors have, at times, produced poisonous effects, especially where they have been permitted to remain for any length of time in direct contact with the moist cuticle; but not otherwise. 3. Whence came the idea that all green dyes are poisonous? A. Cases of poisoning from Paris or Schweinfurt green, verdigris, and like compounds containing copper or arsenic (the prevailing color of which is green) have been so numerous that all similarly colored pigments, dyes, etc., have gradually come to be considered with more or less of distrust by the uninformed.

(54) J. A. W. asks: Is there an acid or chemical which will corrode paper postage stamps, but will not corrode gum arabic? A. No.

(55) G. W. S. asks: How can I make a loaf of bread which, after a year or so, I can lay my hand on and squeeze it down, and it will rise up again the same as when fresh baked? A. If the bread is not intended for food, such a loaf may be made from flour in the ordinary way, but with the addition of a little sulphate of copper (a very minute quantity only), glycerin, and a strong aqueous solution of salicylic acid.

(56) W. W. asks: What is the best covering for headed haystacks, portable, durable, waterproof, vermin-proof, and cheap? A. Try the following: Take any coarse fabric, steep it for a few hours in a strong aqueous solution of alum, dry, and coat the upper surface with a thin covering of tar.

(57) G. R. asks: 1. Will a soft metal, like copper, lead, or zinc, hold heat longer than a harder metal like cast or wrought iron of equal weight and the same shape? A. The loss of heat does not depend so much upon the hardness of the metal as upon its conductivity and the condition of its surface. If the surfaces of the metal be bright and polished, it retains its heat much longer than if it be dark and rough; or, in other words, the less rapidly will it part with its heat by radiation. The poorer the heat conductivity of the metal, the longer it will retain its heat, other conditions being the same. The conductivity of silver being 100, that of copper is 73.6, zinc 19.9, tin 14.5, steel 12.0, iron 11.9, lead 8.5. The time required to cool a large mass of hot metal is proportionately great compared with that required to reduce the temperature of a smaller mass the same number of thermometric degrees. 2. Will glass retain heat as long as soft or hard metals? A. Yes.

(58) C. A. B. says: I have eight or ten pieces of sponge rubber bought about two years ago; it was then very good and would clean paper very nicely. It is now hard, and slides over the paper without cleaning it. Can it be restored, so that it may clean paper as well as ever? A. No. The hardening is due to oxidation. The quality cannot be restored.

(59) O. H. N. asks: Is there any way of cleaning sulphur off horseshoes? When I weld the toe calk on, the sulphur gets under the toe calk, and I cannot weld it. A. Use common carbonate of potash or soda.

(60) H. & M. say: We wish to test the quality of different lots of coal oil sent from refineries. Could you give us a mode of doing this? A. Inexpensive instruments for this purpose are sold by dealers in thermometers, hygrometers, chemical utensils, etc. All that is necessary for ordinary purposes is to determine the specific gravity and point of ignition. The former is accomplished by means of an instrument resembling a hydrometer, and the latter by heating a small quantity of the oil in which the bulb of a thermometer is immersed to indicate the temperature, and a small ignited taper, held close to the surface of the oil, ignites the same when the temperature has risen sufficiently.

(61) M. N. asks: Is there any metal or composition which would stand the same usage as a cane, and could be moulded hollow? A. Steel or bronze would answer the purpose, if we understand you aright.

(62) C. B. P. asks: How can I platinize the silver plate of a Smees battery? A. Dip the plate in a strong solution of chloride of platinum, and expose it for a short time to the action of a stream of hydrogen or coal gas. 2. How can I prepare sulphur for making casts of coins, etc.? A. Fuse the sulphur and heat it to the point of sublimation, and while in this condition throw it into cold water.

(63) A. J. S. says: I have a lot of emery wheels that have been almost covered with japan dryer. What will remove the japan without injuring the wheels? A. Remove all you can by mechanical means, and then treat the parts with strong oil of vitriol (sulphuric acid) for a few minutes; then wash well, but quickly, in a stream of water. Repeat this treatment if necessary, and rub well with sawdust. The acid should not be permitted to remain for any length of time in contact with the stone, as it will injure it.

(64) C. W. C. asks: How can I keep lemons for 6 months or more? A. Packing them in salt and keeping in a cool place is one of the best methods; but even this will not always suffice.

(65) C. H. J. says: Some specimens of limestone rock were excavated from a quarry. The specimens taken out during the spring and summer, which were allowed to season, answered admirably, but those taken from the quarry during or just previous to a cold snap cracked by the action of frost. Can you suggest means by which these stones may be tested, other than by subjecting them to extreme cold? A. The cause of the cracking of the stone may have been the molecular energy of freezing water contained within cavities in the rock; but it is more probable that the rupture was due to the relaxation of strain to which the blocks had been subjected while in the quarry. Splitting up of blocks from this cause is by no means infrequent in some quarries. If the breaking is attributable to the action of frost, there is no other means than those you mention for testing the stone. If it is due to the unequal strain upon the block, the splitting cannot be avoided.

(66) M. asks: Can you give me a recipe for making concentrated starch? A. We do not know of any preparation by this name.

(67) G. S. says: I have some specimens of copper ore that are covered with verdigris. What shall I use to take it off? A. If it is really verdigris, a little dilute sulphuric or hydrochloric acid will remove it.

(68) C. V. W. says: Some of your correspondents ask for a method of finding the radius of a circle when the chord and versed sine are given. I give them a very simple formula based upon the well known property of the right angled triangle. Where $a = \frac{1}{2}$ chord, $b =$ height or versed sine, and $x =$ radii, $a^2 + (x - b)^2 = x^2 = \frac{a^2 + b^2}{2} = x$ or $\frac{1}{2}$ chord² + height² $\div$ 2 height

(69) J. H. M. says: I am running saws of 8 inches diameter, and smaller. I wish to know at what to run them in order to make the smoothest work? A. Nine thousand feet per minute, that is nearly two miles per minute, for the rim of a circular saw to travel, may be laid down as a rule. For example: a saw 12 inches in diameter, 3 feet around the rim, 3,000 revolutions; 24 inches in diameter, or 6 feet around the rim, 1,500 revolutions; 3 feet in diameter, or 9 feet around the rim, 1,000 revolutions; 4 feet in diameter, or 12 feet around the rim, 750 revolutions; 5 feet in diameter, or 15 feet around the rim, 600 revolutions. Of course it is understood that the rim of the saw will run a little faster than

this reckoning on account of the circumference being more than three times as large as the diameter. Shingle and some other saws, either riveted to a cast iron collar or very thick at the center and thin at the rim, may be run with safety at a greater speed. — J. E. E., of Pa.

(70) D. B. says: I notice an article stating that Dr. Siemens had succeeded in producing permanent magnets capable of suspending 20 times their own weight, by mixing with steel a small proportion of tungsten. Can this be so? A. Yes, so far as we know; small artificial magnets have been made to sustain one hundred times their own weight.

(71) C. W. C. says: If a telegraph wire passes over a building, or in close proximity to it, does it endanger it during a thunderstorm? A. No. So far as it has any influence, it acts as a protector.

(72) J. W. T. asks: Is there any electric battery that will heat and keep a $\frac{1}{4}$ inch wire red hot or nearly so? A. The question is very indefinite, as everything depends upon the length and material of which the wire is composed. Probably a Bunsen cell could be made sufficiently large to heat a short length of platinum of that diameter.

(73) V. W. S. asks: If a dwelling is surrounded by trees, from 10 to 25 feet higher than the ridge or the chimney tops, and within one or two rods distance from the house, are not these trees some protection against lightning? And if not, would not conductors in the trees answer a better purpose than is secured by the usual mode of attachment to the building? A. Properly constructed rods on the building are much better in every respect.

(74) T. B. A. says: What size of wire do I want to make an induction coil, to be used to heat platinum wire? A. Use a Grove or Bunsen battery. Either is better than a coil.

(75) A. A. W. says: I have a book that gives a rule for finding the safe working pressure of any boiler, but I cannot work it satisfactorily. The rule is: Multiply the thickness of iron by 0.56 or 0.70, according as the boiler is single or double riveted, multiply this product by 10,000 (safe load), then divide this last product by the internal radius less the thickness of iron. The quotient will be the safe working pressure in lbs. per square inch. A. Calling C a coefficient 0.56 or 0.70, as the case may be; T , thickness of boiler in fractions of an inch; R , internal radius of boiler in inches; L , safe load in lbs. per square inch. Working pressure = $\frac{C \times T \times L}{R}$

(76) J. P. asks: How can I make old copper and brass coins stick to a board without using tacks? A. Melt together in a suitable vessel equal parts of pitch or asphalt and gutta percha. Apply hot. Clean the coin with a little dilute nitric acid or oil of vitriol.

(77) J. Z. R. says: I inclose a small piece of carpet. I want to dye it some other color. Which will be the best? A. As the carpet already contains so many dark colors, it would be impossible to dye it any color but black, without first having bleached it; and this, in the present instance, is impracticable. My kitchen ceiling blisters and scales off. It has been whitewashed sometimes with lime and sometimes with whitening. What shall I do with it? A. This is very probably due to dampness, in which case the best plan is to clean and paint the walls.

I want to make a photo background. What is the best color to use? A. Any of the aniline colors may be used for this purpose; you can purchase them, already prepared and with instructions for use, of any druggist. Any oil paint may be rendered flexible, when dry, by rubbing it up with a little soap and glycerin over a fire.

(78) A. S. C. asks: 1. What amount of carbolic acid is used in a lb. of carbolic soap? A. Samples of these soaps, that we have examined, contained about three per cent of the crude phenol in combination as a soda salt. 2. How is it mixed? A. In the coarser varieties of these soaps, the phenol is added directly to the lye during the latter part of the saponification; but in these cases the acid is very incompletely distributed through the body of the soap. A complete and uniform dissemination of the phenol may be obtained by dissolving soap and carbolic acid in hot spirits of wine or wood naphtha, and evaporating the solution to dryness.

(79) B. F. W. says: Joshua Rose says, in relation to sawing staves for cylinder or pipe patterns: "It will save time to resaw the pieces to give them the required bevel, which may be done by casting the saw table." A better practice is to cant the table before sawing at all, and then the staves will be of the right shape, with a saving of nearly two thirds of the sawing and considerable timber.

(80) C. H. says: We have in our possession an old-fashioned range; and whenever we draw hot water the water has the appearance of milk, but after standing a few minutes it regains its regular color. We have been advised not to use the water. A. This is due to the precipitation of the lime contained in the water. Lime is less soluble in hot than in cold water. It is not generally advisable to use water from the hot faucet for culinary purposes, as it may contain poisonous copper and lead salts.

(81) J. A. K. says: 1. I use oxalic acid for preparing pale leather boot work (a teaspoonful of oxalic acid in a pint of water). The mixture sometimes becomes a brownish color. Do you know of any kind of acid which would do instead of oxalic? A. Try moistening the leather first with oxalic acid, as usual, and then with a strong solution of chloride of lime (hypochlorite of lime) in cold water. 2. Do you know of anything to put in ink to give a good gloss? A. Use an alcoholic solution of wax.

(82) J. W. P. asks: What will remove stains of tannic acid from linen and other fabrics? A. Wash well with a little soda, moisten with very dilute sulphuric acid, and then with a strong solution of bleaching powder (chloride of lime) and expose for an hour to bright sunlight. Then wash well in water.

(83) X. Y. Z. asks: Can the skins of birds be tanned with the feathers on? A. Yes, but not without discoloring the feathers.

(84) E. W. W. asks: How can holes be readily pierced, or small holes enlarged, in rubber corks for the fitting of glass tubing? A. Force the stopper into the neck of a flask or large glass tube which it will just fit into, and use a well sharpened cork borer with gentle pressure and even turning. If you desire to enlarge a former hole, first plug it tightly with a piece of glass rod and proceed as before.

Is there any table published of relative chemical affinities by which one may get at the amount of force necessary to dissociate the elements in certain compounds? B. We know of no such table.

(85) W. A. H. says: I have a relay of the box pattern, containing a magnet of about 40 ohms. There is a certain peculiarity I notice, which I would like to have you explain. I notice that whenever the current is broken by opening of the key, a peculiar jump is heard, a kind of kick or hammering. At first I thought the magnet was loose; but after making it as tight as possible, it acted in the same manner. A. The noise is occasioned by a change in the molecular condition of the iron core when magnetized and demagnetized.

(86) S. I. asks: 1. What length and size of insulated wire is required to wind the magnets of a relay, such as is used on ordinary telegraph lines? A. About 1,000 feet of No. 32. 2. What would be the proper dimensions? A. The core can be $1\frac{1}{4}$ inch long and about $\frac{1}{8}$ inch in diameter.

(87) H. L. J. says: Makers of telegraph apparatus use a kind of lacquer or varnish on their brass work which prevents tarnishing, while it is so thin as to avoid muffled the sound. What is it, and how is it prepared? A. Shellac and alcohol are the principal ingredients, colored by gamboge, saffron, turmeric, etc. About 2 gallons alcohol to 1 lb. shellac is the proportion.

(88) G. W. H. says: 1. I am making an induction coil to throw $1\frac{1}{2}$ inches spark, to light gas. Of what diameter and length shall I turn my bobbin? A. Use about 2 miles of No. 36 wire for the secondary. 2. What size of wire shall I use? A. Make the core $\frac{3}{4}$ inch or an inch in diameter and about 8 inches long. 3. I have some tin foil 5 inches wide to make a condenser with; how much in length will it take? A. One hundred feet of the foil will probably be enough.

(89) C. C. S. asks: Can I conduct the smoke and exhaust from a 4 or 6 horse power farm engine through tile laid underground (on a constantly ascending grade; to a stack 100 or 125 feet distant? A. This is frequently done.

(90) A. V. V. says: Two boilers, one 8 feet in diameter and the other 6, each containing the same number of flues and each having a steam gauge indicating apparently the same number of lbs. of steam; which boiler has the most steam in it? A. If the larger boiler has the most steam room, it contains, of course, the greatest weight of steam.

(91) W. H. L. asks: Why is it objectionable to raise the safety valve of a boiler in case of low water and danger of explosion? A. It is not desirable to do anything that may cause the water to rise and come in contact with overheated iron.

(92) R. M. asks: How can I raise a valve by change of temperature? A. There are numerous devices of this kind in common use. By inserting a notice in the "Business and Personal" column, you can probably gain full information.

(93) A. B. says: Please give me the scientific definition of the word "inertia." A. Brande says "This term is used to denote the principle or law of the material world, that all bodies are absolutely passive or indifferent to a state of rest or motion, and would continue for ever at rest, or persevere in the same uniform and rectilinear motion, unless disturbed by the action of some extrinsic force."

(94) A. B. S. asks: Will a pump draw water any easier by having the pipe to the well larger than the connection to the pump, and will an injector lift the water any easier by having the suction pipe in the well larger than the pipe to the boiler? A. By using a larger pipe, the friction is diminished.

(95) J. D. S. asks: What is the best manner of determining when a millstone is in wind? A. Use a red staff, or straight edge covered with red paint, which will show all the high spots.

(96) E. M. P. asks: What are the best methods of reversing motion? A force is used to accumulate or store up a certain amount of power, then that stored-up power is desired to produce or exert its force. By what mechanism can this be effected? A. Sometimes a flywheel is used, a spring may be compressed, a weight may be lifted, or a reservoir may be filled with water. Flywheels, springs, and weights are among the most common means employed.

(97) C. W. asks: What would be a safe steam pressure to carry in a cast iron cylindrical shell of 10 inches inside diameter and $\frac{1}{2}$ inch thick, with heads $\frac{3}{4}$ inch thick? A. You can carry 200 lbs. if the casting is sound; but cast iron boilers frequently have points of weakness that render theoretical calculation of their strength of little value.

(98) W. L. M. says: Astronomers tell us that it has been calculated, from the rapidity of the rotation of the earth, that, if the earth were suddenly intercepted in its motion, sufficient heat would be generated to melt the earth instantaneously. What would be the generator of this heat? A. According to the modern theory of heat, a unit of heat and 772 foot lbs. of work are mutually convertible, motion being the generator of heat.

(99) T. A. asks: Can a turbine or other water wheel be considered an hydraulic power? A. It can, in a general sense, just as much as a steam engine may be spoken of as steam power. Strictly, the term applies to the power furnished by the motor.

(100) Y. M. asks: 1. What is the meaning of the mass of a body, when the weight is divided by the gravity to find it? A. It is a measure of the quantity of matter, and in order to give the same results with the

same body at all places in the earth's surface. 2. What is a circular inch? A. It is the area of a circle having a diameter of 1 inch. 3. What is a cylindrical inch? A. It is the volume of a right cylinder with circular base, diameter of base 1 inch, altitude 1 inch.

(101) C. F. says: When the water in my boiler stands between the two gauges (about 3 inches above top flues) and I start the engine, the water will instantly rise from 6 to 8 inches or nearly up to the dry pipe. As soon as I stop the engine, the water drops back to its original position. We know it is not foaming, as we have blown off the boiler several times, and it is perfectly clean. We use soft water. A. The rise of the water is probably due to insufficient steam room, or possibly because the fire is forced too much. We judge, from your account, that no injurious action takes place. There are several other reasons that might be effective in causing the water to rise, but those given above are the most probable.

(102) I. W. L. says: 1. I have been told that I can make a battery for gold and silver plating as follows: Take a piece of copper $\frac{1}{4}$ inches in diameter and $\frac{1}{2}$ inch thick, and a piece of zinc of the same size. Attach a copper wire to each in a glass vessel $\frac{1}{2}$ full with a piece of bluestone. The zinc is to be on the top. These wires are to go to the bath. Is this right? A. The plates should be much larger to give good results, and the copper need not be so thick. 2. How can I make the bath? A. Make a solution by dissolving cyanide of gold in cyanide of potassium, about $\frac{1}{4}$ oz. of gold per gallon. Connect the article to be plated to the zinc of your battery. 3. How long should the articles be in the bath? A. Until the deposit is of the desired thickness.

(103) W. S. W. says, in answer to M. P., who asks for watch oil: Put 1 oz. pure olive oil in a tumbler, add 2 ozs. of 96 per cent alcohol, stirring well; set it away in a dark place for 24 hours or more, well covered, then pour into a clean bottle containing 10 ozs. distilled or clean rain water. Shake violently for 5 minutes, allow the mixture to stand $\frac{1}{2}$ hour or so, then freeze with salt and ice. You will find a good article of fine limpid watch oil, perfectly fluid, at top. Draw off with a siphon.

(104) L. G. says: A string or cord being attached to a piston rod directly, the engine being of one horse power, what weight must I put on the cord to test the strength of the engine? A. This depends upon the speed of the piston. The measure of a horse power is the work of lifting 1 lb. 33,000 feet high in a minute, or 33,000 foot pounds per minute; so that if you divide 33,000 by the speed of the piston in feet per minute, the quotient will be the required weight.

(105) H. E. W. asks: 1. Why do nearly all manufacturers of electric annunciators and indicators for burglar alarms wind the magnets with wire of No. 28, and finer? Why not use No. 20 to 26? A. In many cases, Nos. 20 or 26 wire would be preferable; but with finer wire the battery does not require so much attention as might be necessary if coarser wire were used. 2. Will cotton covered answer as well as silk covered? A. Any kind of insulation will answer. Silk is better than cotton, as ordinarily put on, as it takes up less room. 3. What size of cores, and how many feet of wire on each core will give the best results? A. Cores are usually made about $1\frac{1}{4}$ inches long and $\frac{3}{8}$ inch thick for annunciators; 250 feet of wire will answer for both cores. 4. Will an electro-magnet ever lose its power or become useless? A. Not with proper care, except that everything wears out with age.

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

G. M. P.—No. 1 is hauselite, sulphide of manganese. No. 2 is idocrase, a silicate of lime, alumina, and iron. No. 3 is tremolite, a silicate of lime and magnesia.—D. A. C.—S is a clay ironstone, containing much sulphide of iron (pyrites). G is graphite mixed with much clay. D appears to contain a small amount of sulphide of lead in a granite matrix. Your letters were insufficiently stamped to the amount of 24 cents.

R. K. says: A friend tells me that a single, a double, a triple, and quadruple thread, either right or left hand, can be cut by one and the same pair of ordinary stocks and dies. Can this possibly be true?—G. S. W. asks: Is there any rule for dividing a circle into 3, 4, or more equal parts by parallel lines?—G. E. C. asks: How can I bend the sides of a guitar? Should they be steamed?—W. H. B. asks: Can you tell me how to bisect a triangle by a straight line passing through any given point within the triangle?

COMMUNICATIONS RECEIVED.

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

On Friction of Slide Valves. By F. G. On Force. By — On Cleopatra's Needle. By J. W. P. On an Old Problem. By B. B. Also inquiries and answers from the following: J. P. B.—T. H. C.—W. C. Y.—R. F.—E. P.—T. S. P.—C. W.—J. B. B.—J. K.—T. H. G.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells blue glass lamp chimneys? Who sells machines for stitching magazines, etc., with wire? Who sells working models of steam engines? Who makes iron chain? Who makes the best medical electric apparatus?" All such personal inquiries are printed, as will be ob-

served, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

February 13, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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