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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 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 drawplate is usually about 10 inches long and 1½ 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 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-

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

Fig 2.

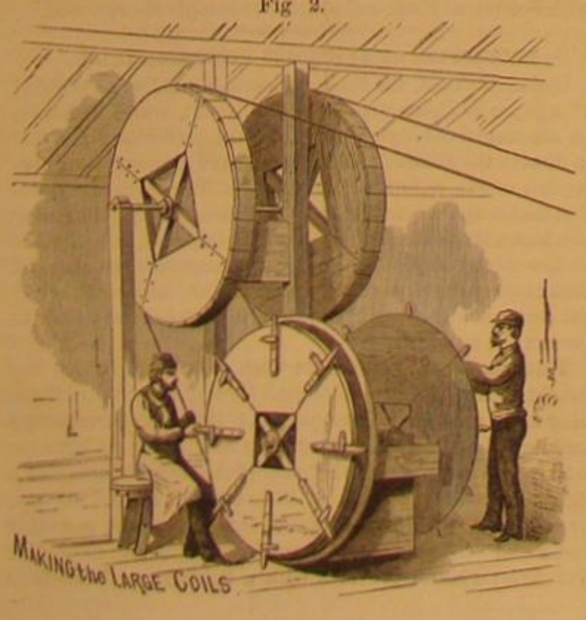

Fig. 3.

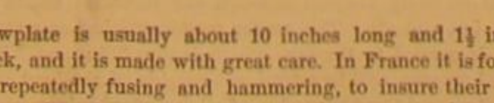

Fig. 4.

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SCIENCE PROPHESIES THE FUTURE OF THE RACE.

M. Alphonse de Candolles 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 archipelagoes, 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 archipelagoes, 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 Candolles 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, who are on the outlook for opportunities for the exercise of their talents. There is no better way to reach such men, 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 isolater, 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 Physic," 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 grapery, 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 suppositious 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 repointed, 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.

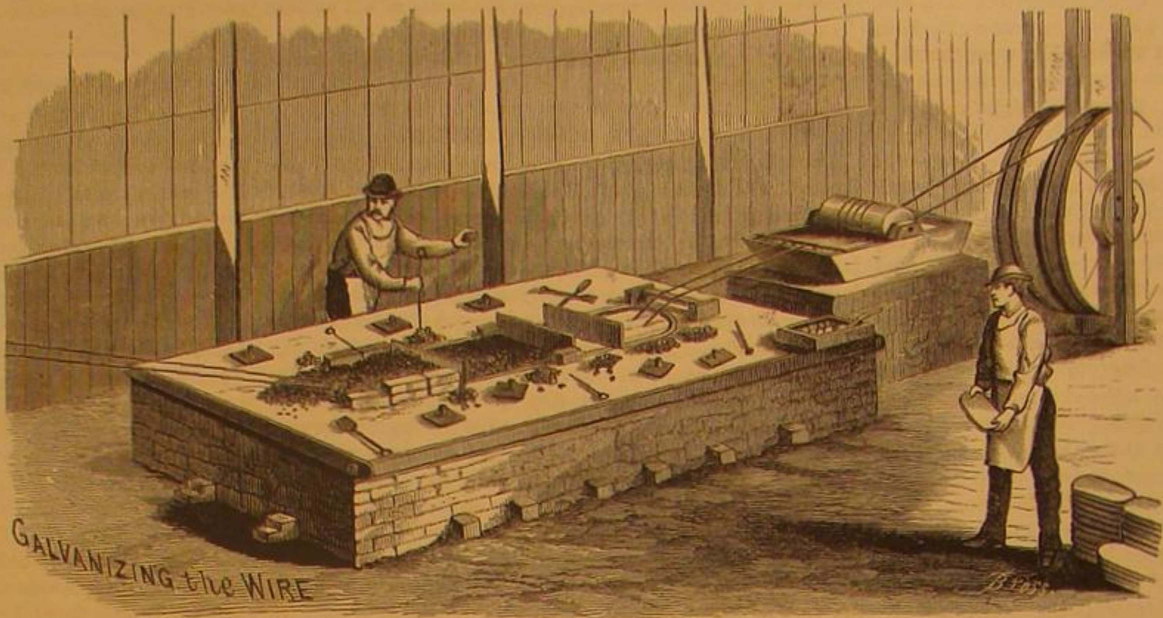
The turning of the drum is represented as being done by hand in Fig. 2; but of course when the manufacture of the wire is further advanced, and when many such drums are necessitated, the work will be done by suitable machines.

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 3½ 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 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.



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

A NEW BOILER CLEANER.

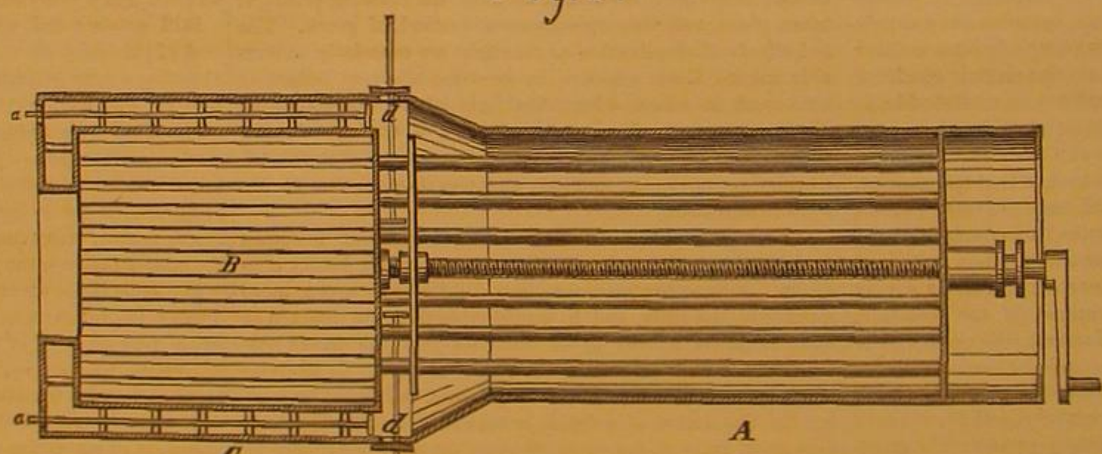
The danger of the explosion of any boiler in which scale is allowed to accumulate is well known; and many compounds to prevent by chemical action the deposition of scale are before the public. But the impurities in water vary so that no chemical preparation can be a panacea; and it is frequently necessary to remove the scale by mechanical means.

Mr. Cornelius J. Cronin, of Barnhart's Mills, Pennsylvania, has patented through the Scientific American Patent Agency, 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 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.

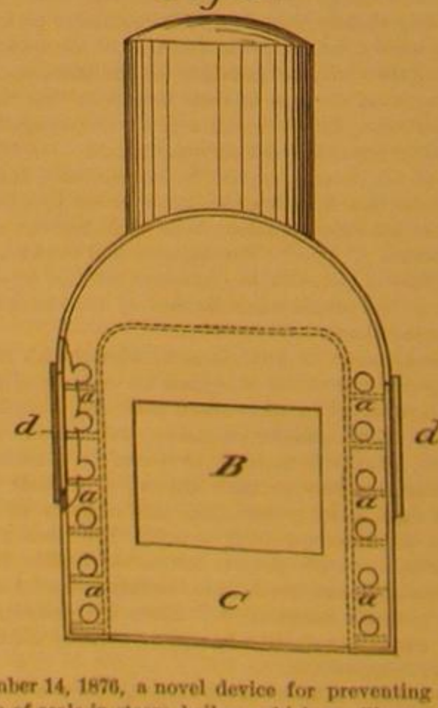
The inside of the rear wall is reached by means of a side opening, *d*, of sufficient length to allow the scraping device to be introduced horizontally between the flues and clear the parts of the rear wall between the same. This opening is closed by a tightly fitting plate attached by stud bolts.

Fig. 1.



CRONIN'S BOILER CLEANER.

Fig 2.



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.	Specific gravity	AMMONIA ALUM.	Specific gravity
1 per cent	1·0065	1 per cent	1·0060
2 " "	1·0110	2 " "	1·0109
3 " "	1·0166	3 " "	1·0156
4 " "	1·0218	4 " "	1·0200
5 " "	1·0269	5 " "	1·0255
6 " "	1·0320	6 " "	[illegible]

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. Schluttig, 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.

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 1858, was the first in New England. Street cars are usually drawn by horses, but many attempts

Fig. 1.

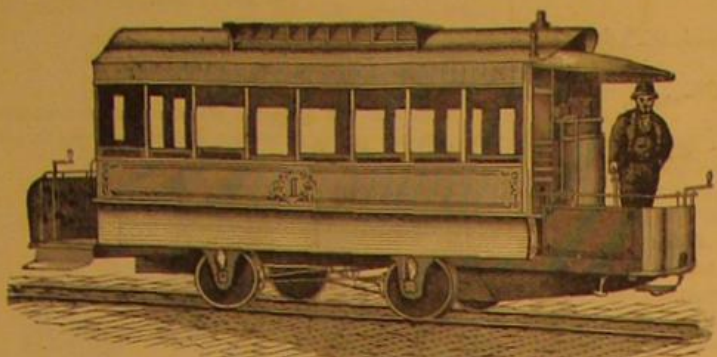


Fig. 2.

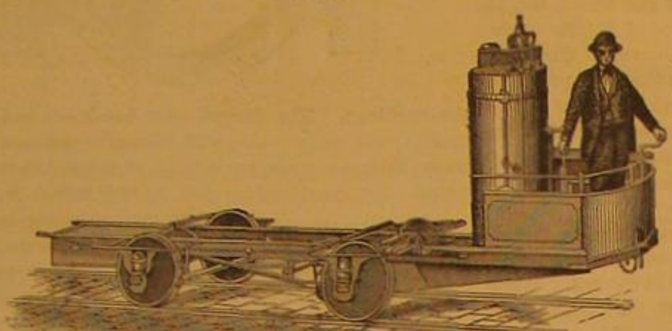
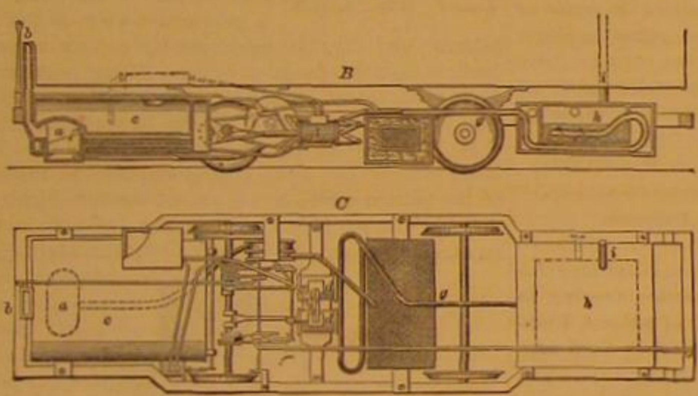


Fig. 3.

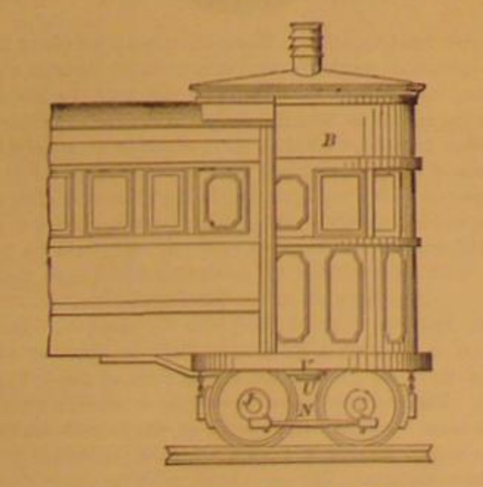


have been made to drive them by machinery. Steam engines, known as dummy engines, have been used with success, but the fire and noise of escaping steam are considered objectionable.

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.



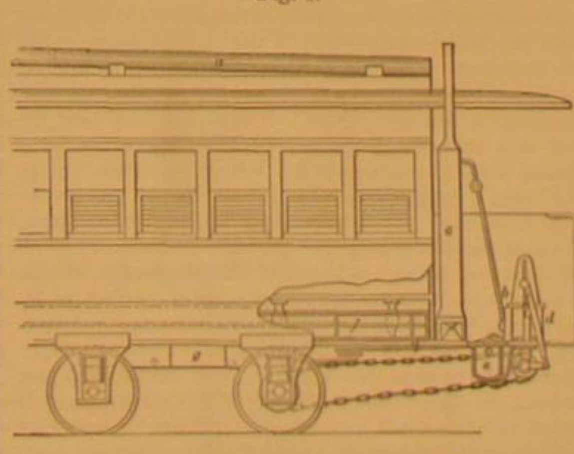
placed on the front platform; a non-conducting partition prevents heat from entering the car. The engine is below the platform. It is compound and double-acting. In ordinary use, the steam from the smaller cylinder exhausts into the larger; but, in ascending grades, the full pressure of the steam may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

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

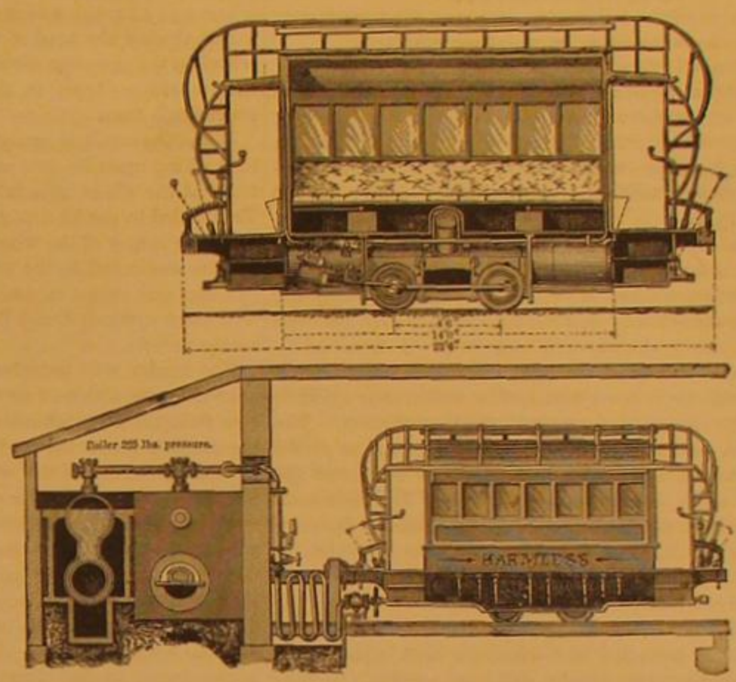
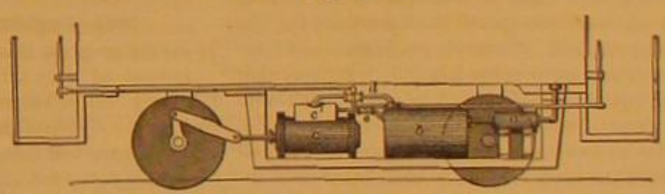


Fig. 7.

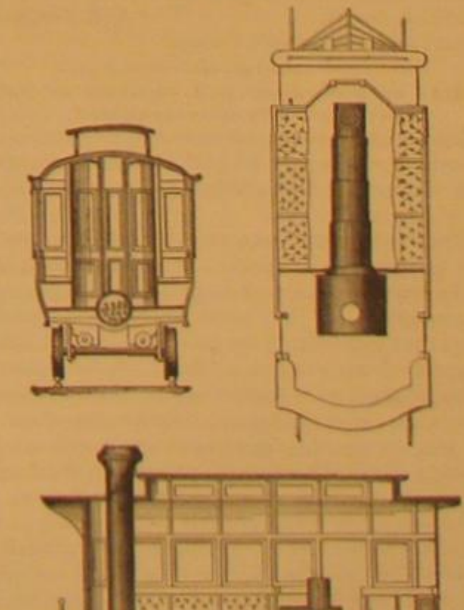


by carbonic acid gas, which is compressed into a liquid and carried in strong cylinders. Another device involves the use of india rubber springs; another of steel springs; another of ammonia vapor: and there are a large number of patented street car engines utilizing compressed air. To this last class 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, *c*, to be pumped back into the auxiliary tank, where it is stored up to assist in starting again. The illustration shows the car bed and lower works.

A car provided with

SMITH AND DE COPPET'S AMMONIA ENGINE

is represented in Fig. 8. Liquid ammonia, stored in a reservoir, *a*, is withdrawn and injected by a pump, *b*, into a vaporizer, *c*, heated by a lamp beneath. The gas is conducted to the engine, *d*, by a pipe, and is exhausted into a condenser, *e*, where it is liquefied by a shower of spray falling through a perforated plate, the water being supplied by tanks, *f*, one at each side of the car, and withdrawn therefrom by a pump. A third pump removes the ammonia from the condenser and forces it into a tank, *g*, beneath the car, where it is retained for further use. Chains communicate motion from pulleys on the engine crank shaft to pulleys on the driving wheel shaft.

In Fig. 9 three views of a dummy engine are given, showing the compact arrangement of boiler necessary to adapt it to the limited space in street cars.

Communications.

A New Method of Projecting Spectra.

To the Editor of the Scientific American:

If the inner coating of a Leyden jar be connected by a wire or a chain to one terminal of an induction coil, and the outer coating to the other terminal, when the battery connection is made or broken, the induced electricity is very much condensed, and shows itself as a much shorter spark; but the intensity of its light is vastly increased, and the passage of the sparks is accompanied with quite a deafening sound, especially if several follow each other in quick succession. Advantage has been taken of this form of spark to study the spectra of the elements by making the spark to pass between terminals of the material to be examined. I have lately found that the intensity of the light from such a spark from one of Ritchie's 10 inch vertical coil is sufficiently great to admit of projection upon a screen in the lecture room. The terminals were arranged one above the other, so as to give a vertical spark. A 1 gallon Leyden jar was used, and the battery had three Bunsen 2 gallon cells. The terminals could be separated about an inch. About a foot in front of the terminals was fixed a double convex lens, 4 inches in diameter and of about 1 foot focus, and a single bottle prism of bisulphide of carbon in front of the lens, where the larger part of the refracted rays would fall upon it at the proper angle, the refracted and dispersed rays falling upon the screen, the focussing being done by moving the lens until a plainly marked spectrum appeared. This spectrum could be very plainly seen when it was eighteen or twenty inches long. In this case, the spark itself answers for the slit in the ordinary method of studying spectra; and inasmuch as the spark is seldom or never straight, it follows that the spectrum will consist of a series of bright lines all with the same zigzag pattern, which gives a very curious and interesting effect, for no two have the same form; and yet all the bright lines hold the same relation to each other as in ordinary spectra.

It is only necessary to affix small pieces of different metals to the terminals of the coil and pass the spark between them to exhibit, to forty or fifty persons at a time, the characteristic spectra of the elements. Those that I used were sodium, copper, zinc, calcium, and brass. There is usually a tolerably plain continuous spectrum, which I take to be due to incandescent dust particles in the path of the spark, but this does not interfere with the bright line spectrum. This method may be usefully employed when the class is not too large, and when neither a fifty cell battery nor an oxyhydrogen lantern are owned.

A. E. DOLBEAR.

Physical Laboratory, Tuft's College.

Are Iodide of Potassium and Chlorate of Potassa Therapeutically Incompatible?

To the Editor of the Scientific American:

In your issue of January 20, 1877, the above question is answered affirmatively in an article copied from the *American Journal of Pharmacy*.

I recollect having once seen a very sick patient treated with iodide of potassium and chlorate of potassa, administered alternately every two hours in large doses, for a number of days in succession, and the patient recovered. I called the attention of the physician to the possible danger of administering the two drugs at the same time; but he averred that he had frequently done it without any bad results following.

His knowledge of chemistry and incompatibles would have allowed him, no doubt, to administer tannic acid and iron, or iodide of potassium and acetate of lead, in the same prescription; yet sometimes from people's blunders we gain practical information. It is possible that the safety in these cases consisted in the fact that the drugs were administered with intervals of two hours between them, the one having been absorbed from the stomach before the other entered.

I am of the opinion that, when these drugs are administered with intervals of two or three hours between them, there is no danger of the formation of iodate of potassium. It would be reckless, however, with our present knowledge, for any practitioner to prescribe the two drugs in the same formula.

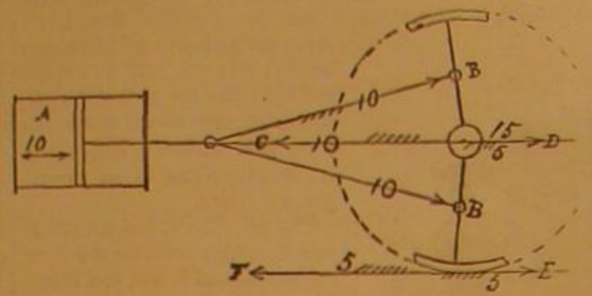
A. C. SIMONTON, M.D.

Mitchellville, Iowa.

Traction of a Locomotive.

To the Editor of the Scientific American:

The inquiry is often made as to the principle upon which a driving wheel draws its load. The annexed simple analysis will, I presume, make the matter clear. An engine with a 16 inch piston, 4 feet driver, and 12 inch crank, working at a maximum cylinder pressure of 100 lbs. to the inch, will exert a force of about 10 tons upon the piston, A, and crank pin, B, and an equal force upon the head of the cylinder, and,



through the medium of the engine frame, upon the center of the driver in the opposite direction. When the crank is below the center of the wheel, the 10 tons acting upon its pin is divided equally, in this case, between the center of the wheel and its tread. 5 tons at each point; but as the 10 tons acting against the head of the cylinder and the center of the wheel in the opposite direction is just double this amount, the impelling force, in the direction of F and C, will of course be 5 tons.

When the crank is above the center of the wheel, the 10 tons acting upon its pin will exert a force of 5 tons at the tread of the wheel, as a fulcrum, in the opposite direction. This added to the 10 tons gives 15 tons as the force of acting upon the center of the wheel in the direction, D; but as this 15 tons is opposed by the 10 tons acting upon the head of the cylinder and center of wheel, we have just 5 tons progressive force towards E and D. The operation is clearly shown by the arrows.

The reader will perceive that the progressive motion is caused by the action of an ever-varying leverage whose effective fulcrum is the adhesion of the wheel to the rail. When the crank is below the center of the wheel, the length of the lever is the radius of the wheel, and the positive agency to locomotion is the pressure of steam against the head of the cylinder, and the negative agency is the pressure of steam against the piston; but when the crank is above the center of the wheel, the case is reversed. The pressure against the piston then becomes positive, and that against the cylinder head negative, and the length of the lever is the radius of driver *plus* the length of crank. I use the term positive because the engine moves in that direction.

Worcester, Mass. F. G. WOODWARD.

State Legislation Concerning Patents.

To the Editor of the Scientific American:

Apropos of your article in the SCIENTIFIC AMERICAN for February 17, in reference to State legislation tending to abridge the rights of patentees and owners of patents, I presume that the bill recently introduced in the New York Legislature is patterned after a law of this State (Pennsylvania), approved April 12, 1872, which enacts substantially as follows: That the words "given for a patent right" shall be prominently and legibly written or printed upon the face of any promissory note or other negotiable instrument, the consideration for which, either in whole or in part, shall consist in the right to make, use, or vend any patent invention or inventions claimed to be patented; and the party taking such note shall, as to any defence which the maker may or might have, stand in the shoes of the original payee or holder. The act proceeds still further, and makes it a misdemeanor, with a maximum penalty of $500 fine and sixty days' imprisonment, for any person to take, sell, or transfer a negotiable instrument not having the words "given for a patent right," as before mentioned, knowing the consideration thereof to be, wholly or partially, an interest or right in a patent or in an invention claimed to be patented.

In a case tried here some months ago, brought to recover on a note given for a patent, and not containing the statutable words, the judge charged that if the plaintiff knew, at the time he took the note, that the consideration was an interest in a patent, he committed a misdemeanor, and the note was, consequently, absolutely void. It has, however, been decided in a later case that a negotiable writing given for a patented thing or machine is not within the statute, as, the latter being a "very extraordinary" act, parties who invoke its aid must bring themselves strictly within its provisions, and the words of the act are a "right," etc., only.

When I first learned, a few days after its passage, of this law—which might better have been entitled "an act to relieve certain fools from the legitimate consequences of their folly," or "a law trap for the unwary"—I unhesitatingly expressed the opinion that it was in direct conflict with that provision of the Constitution wherein plenary power is granted to Congress to legislate upon patents. I have seen no reason to alter this opinion; and if the opportunity occur, professionally or otherwise, I shall seek to test the constitutionality of this absurd and impolitic State enactment in the court of final appellate jurisdiction, as provided by the Constitution of the United States.

Would it not be equally just and reasonable to require that notes given for horses, cattle, grain, etc., should bear across their face the words "given for a mule," or "given for a hog," as the case might be: or that an accommodation note (which, as between maker and payee, represents no value received) should have the words "given for accommodation" apparent on its face? It would not, assuredly, require superior astuteness or invention to discover a plan whereby anti-patent State legislators could, by an extended but similar interpretation of State rights, so legislate as to practically strangle, so to say, a valuable franchise granted by the *whole* United States.

J. PUSEY.

501 Chestnut St., Philadelphia, Pa.

PRACTICAL MECHANISM.

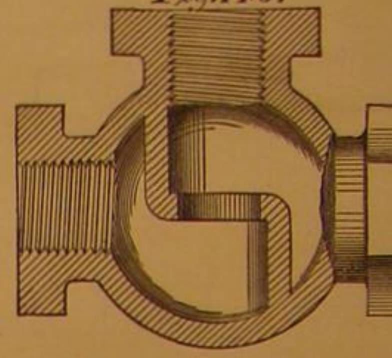
BY JOSHUA ROSE.

NEW SERIES—No. XXI.

PATTERN MAKING.

In Fig. 146, we have for an example a common globe valve, shown partly in section and with a gas thread cut in

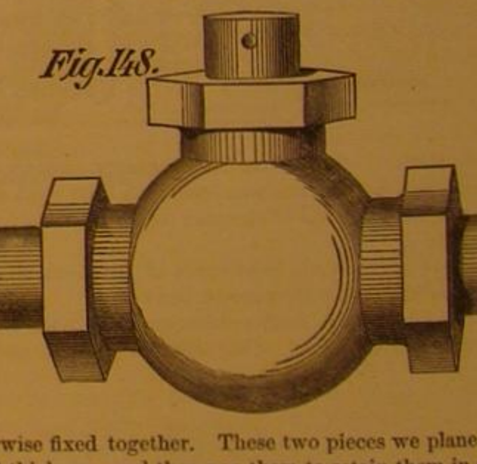
Fig. 146.



the openings. The flanges vary in shape; but as a rule, small valves are provided with hexagons and large ones with round flanges suitable for bolting to similar flanges to make joints. For small valves, say up to 2 inches, the pattern is usually made with the hexagons cut out of the solid, but for sizes above that, they should be made in separate pieces, as shown in Fig. 147, and screwed to the pattern, so that in case of necessity they may be removed, and flanges substituted in their stead. In Fig. 148, we have a perspective view of the finished pattern; and Fig. 149 represents the pattern as prepared, ready to receive a flange or hexagon as may be required. A globe valve pattern should be made in halves, as shown in Fig. 150, the parting line of the two halves being denoted by A B. To make this pattern, we first prepare two pieces of wood so large that, when pegged together, the ball or body of the pattern can be turned out of them, and long enough not only to reach from P to P, in Fig. 149, but also to allow an excess by means of which the two pieces may be glued or

Fig. 147.

Fig. 148.



otherwise fixed together. These two pieces we plane to an equal thickness, and then peg them to retain them in a fixed position, taking care, however, that the pegs do not occur where the screws to hold the flanges will require to be. We also place two pegs within a short distance of what will be the ends of the pattern when the excess in length referred to is turned off. We next prepare, in the same way, two more pieces, to form the two halves of the branch, shown at B, in Fig. 149, for which, however, one peg only will be necessary. These pieces must be somewhat wider than the size of the required hexagon across the corners, that is, supposing the hexagon is to be solid with the branch; otherwise we must make them a little wider than the diameter of the hub of the flange, or of the round part of the hexagonal pieces. Their lengths must be such as to afford a good portion to be let into the ball or body of the pattern (as shown by the dotted lines in Fig. 149), which is necessary to give sufficient strength. The two pieces must be firmly fixed together, and then turned in the lathe.

During the early stages of the turning, or, in other words, during the roughing out, we must occasionally stop the lathe and examine the flat places on the body; for unless these places disappear evenly, the work is not true, and one half will be thicker than the other, so that the joint of the pattern will not be in the middle. It was to insure this that the pieces were directed to be planed of equal thickness, since, if such is the case, and the flat sides disappear equally and simultaneously during the turning, the joint or parting of the pattern is sure to be central. If the lathe centers are not exactly true in the joint of the two pieces, they may be made so by tapping the work on the side having the narrowest flat place, the process being continued and the work being trued with the turning tool at each trial until the flat places become equal. By this means, we insure, without much 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

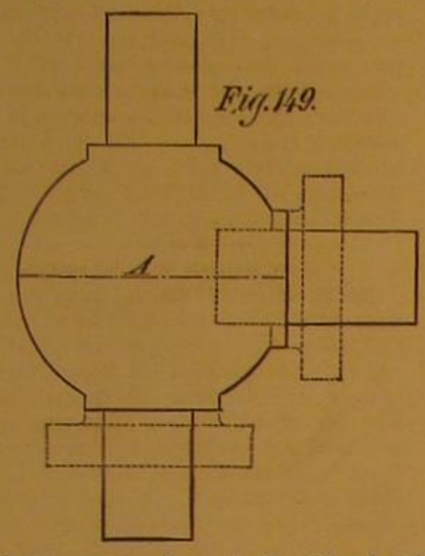


Fig. 149.

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

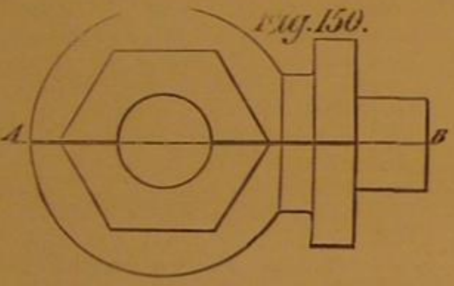


Fig. 150.

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

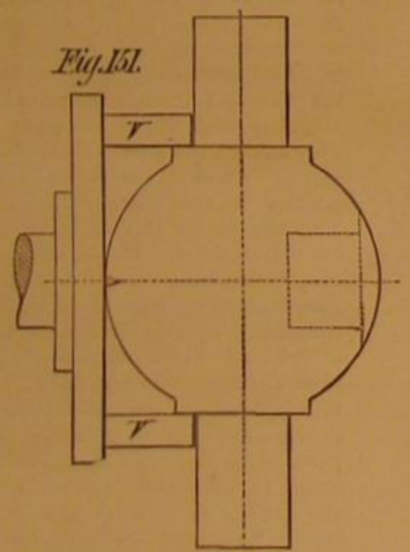


Fig. 151.

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 si:e 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,

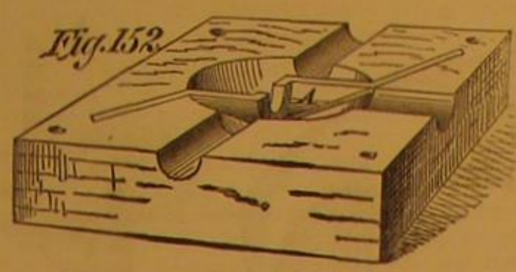


Fig. 152.

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

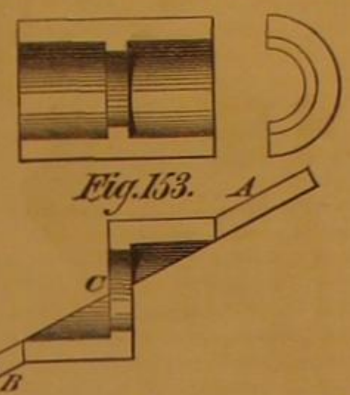


Fig. 153.

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.


Fig. 154.

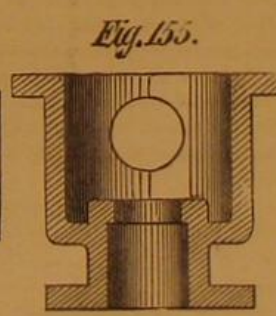


Fig. 155.

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.

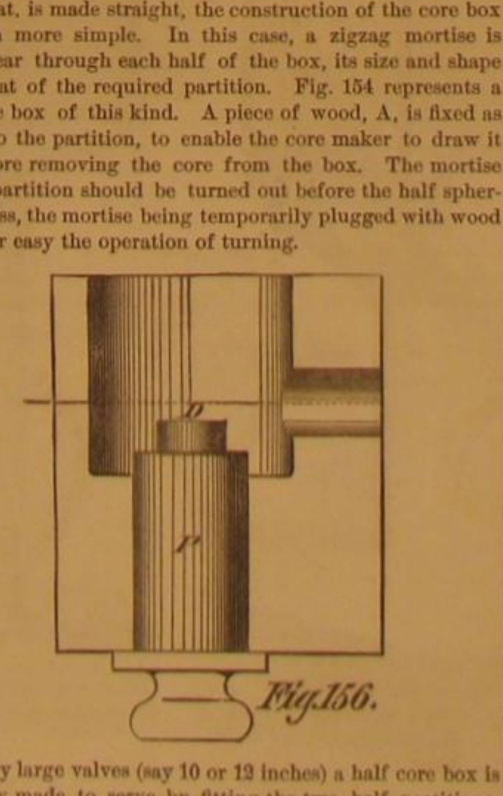


Fig. 156.

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.


Fig. 157.

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, 4½ 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.

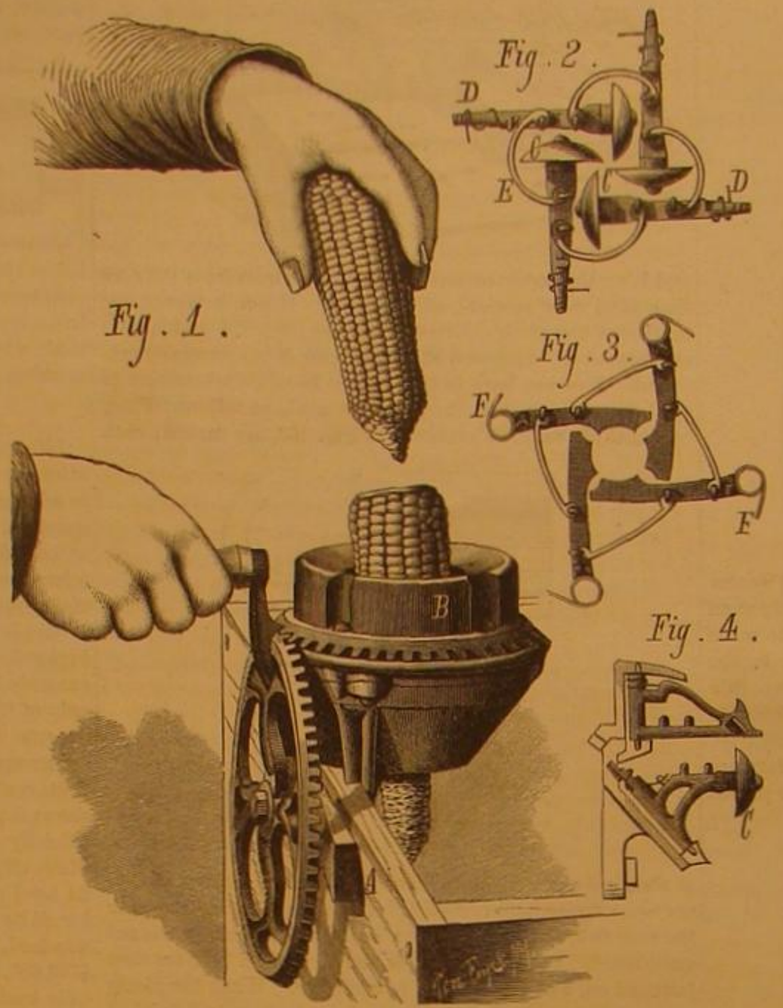
THE "LITTLE SPEEDY" CORN SHELLER.

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 interbraced.

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.



GODDARD'S CORN SHELLER.

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.

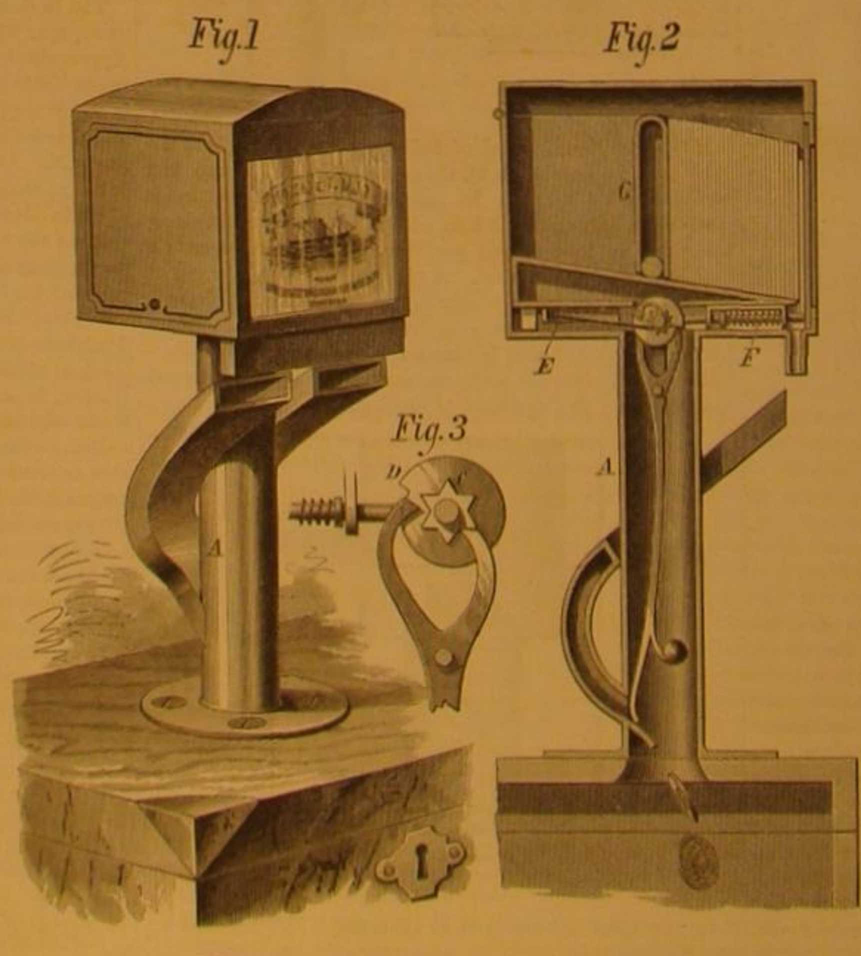
The invention herewith illustrated, while being somewhat on the same principle as the above, is a decided improvement thereon, as it gives the donor of the coins a return for his expenditure in the shape of a photograph card or picture, which is prominently displayed, and which he is induced to purchase 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 spring driven bolt, F; so that, at every revolution of that wheel, the bolt slips from the shoulder, and its forward end is thus retracted sufficiently to allow the front card in the case above to drop out, as said card rests, as will be seen from Fig. 2, upon the bolt. The cards are introduced by lifting the cover of their receptacle, which is afterwards locked. They are placed upon an inclined plane, and they are constantly pushed forward by a movable frame, G, having a 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 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.



BRICE'S ADVERTISING MONEY BOX.

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 14¼ 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. Iles' 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.

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 (*harpya 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 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.

THE HARPY EAGLE.

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. Employers 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 $\frac{3}{8}$ or $\frac{1}{2}$ 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. 6,036, 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 there imperfectly described.

Mere 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. Storrow, 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, Tuft's College. Illustrated. Boston, Mass.: Lee & Shepard.

The book whose title we give 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-lumiere* 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 oxycalcium (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 megascope 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 41 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 fullness 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.I.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 formulæ 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 supersedes the unreliable formulæ 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 hounds, 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 R. 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 Pulaski, 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, Centreville, 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. Cock, 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. Covell, 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 atmosphere 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 pendent 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.

Isham 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. Gilleland, 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 parts 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, Oskaloosa, 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 concussions 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 at 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 Paci, 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 carthorse 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, Curwensville, 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" good, 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 BEVEL.

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 mitering 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 came 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 letters 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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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.

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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Notes & Queries

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 Auchincloss 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. 353, vol. 31.—E. N. T.'s idea of light is the correct one. See p. 308, vol. 30.—J. F. 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. 186, 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 potassa) 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 "Cyclopædia"), 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 heavy 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, 5½ inches in diameter, is made? A. About ⅛ 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 oxycalcium 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 oxycalcium lamp cannot be made to yield as brilliant a light as the oxyhydrogen under any conditions. In the oxycalcium 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 $\frac{1}{16}$ to $\frac{1}{12}$ 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 parting 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 electrotyping 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 waterproof, 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 weft or warp 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 $\frac{3}{16}$ 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 ¼ inch, which will be $\frac{1}{64}$ 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 85,052,000, Neptune 140,000,000. 2. Has our distance from Alcyone 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 ozs. water at 52° Fah. and in 0·6 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 0·5 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 menstruum is warmed. Bromide of potassium is soluble in 1·87 parts of water (by weight) at 32° Fah., in 1·55 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 ¼ 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 tinner 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 ozs., 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 10·06. Its composition may be formulated as follows: $\left.\begin{matrix}(C_2H_3O_2)_2\\ Cu\end{matrix}\right\} O_2 + 3\,(Cu\,O, As_2\,O_3)$.

(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 back 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 ozs., oil rosemary 5 ozs., oil lavender 3 ozs., oil turpentine 9 ozs., and pyroligneous acid 4 ozs. 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 steampipe 100 feet long is connected to a boiler with an ordinary valve at 20 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 20 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 9½ 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 guage, in a few minutes it will run up and fill the glass and all the guages. 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 ¼ of a mile in length, and have three relays, each relay has ¼ 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 percha 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 ¾ 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 plate 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 gages. 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 deers' antlers without scraping near 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 truing 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 ⅛ inch copper, bound at every 4 inches with bands ⅛ inch thick and 1½ inch wide. The heads are $\frac{3}{16}$ inch thick. A. You can make an engine 1½ x 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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9,712, 9,713.—CORSET.—M. Adler, New Haven, Conn.
9,714.—STOVES.—W. A. King, Dayton, Ohio.
9,715.—STOVE.—W. Sanford *et al.*, Brooklyn, N. Y.
9,716.—SKIRT PROTECTOR.—R. Werner, Hoboken, N. J.
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